Alcoholism markers in their relation to prevention and rehabilitation

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Alcohol consumption and participation in traffic under influence of alcohol are worldwide problems. In Germany 2 of 3 males and 1 of 3 females drink more than 20 g alcohol daily and even 1 of 3 males and about 10% of females more than 40 g. Among these peoples are occasional and chronic drinkers. Many of them take part in traffic as car drivers also after consumption of alcoholic beverages. Alcoholics participate in road traffics to the same extent as corresponding groups of occasional drinkers but 4 times more frequent under the influence of alcohol. Therefore they are found also to a higher degree for drunk driving and involving in accidents. The group of "driving drinkers accounts for a considerably high proportion of all alcoholic delinquencies.

It is one proposition of police to detect people driving cars under the influence of alcohol. This may be done by the determination of ethanol in blood or breath. Car drivers licence is generally confiscated in Germany if a blood alcohol level of more than 1.1 g ethanol/kg blood is reached during driving. Usually the licence will be returned by the road traffic authorities after about one year. But the authorities are also instructed not to return confiscated licences to persons who have obvious problems with their relations to alcohol. The problem is to detect "driving drinkers" among the alcoholized car drivers. Till now the blood alcohol level and sometimes the behaviour during the punishable offence are the only criterion to select "driving drinkers". A blood alcohol concentration of more than 2.0 g/kg in former years but nowadays of 1.6 g/kg is seen as a critical limit to require a medical psychological examination before licence is returned.

The main question is: Is a blood alcohol level a sufficient criterion to detect "driving drinkers". If we consider only the blood alcohol concentration there is no difference between chronic and occasional drinker. Also a drinker may have blood alcohol concentrations of 0.8 g/kg participating in traffic as car driver. "Driving drinkers" differ from "drunken drivers" in their frequency drinking alcoholic beverages. This leads to alterations in organism detectable by elevated levels of so-called alcoholism markers. Some of these markers are only in increased concentrations detectable during phases of drinking and in the presence of ethanol like methanol, acetone or isopropanol. Others like GGT, MCV, deficient transferrines are also present in non alcoholized times between two phases of heavy drinking. These markers are only measurable in blood but not in breath.
Blood alcohol alone is a weak marker to detect alcoholics and a great danger that people drinking occasional are signed unjustifiably as alcoholics (IFFLAND 1992, STAAK and IFFLAND 1992). Most of the above mentioned markers can be measured in blood samples taken by police after a car was driven under influence of alcohol. This is a great advantage of blood samples in contrary to breath alcohol measurements.

GGT possesses great significance in the diagnosis of alcoholism. In approximately 1,000 blood samples taken from traffic offenders suspected of alcohol consumption GGT was measured. Cases with a GGT over 100 U/l were selected. This justifies in each case the diagnosis alcoholism. In all cases blood alcohol concentrations higher than 1.6 or 2.0 g/kg would be expected if blood alcohol level is a suited criterion for alcoholics. Fig. 1 shows the limit of 2.0 g/kg is exceeded in only 40% and 1.6 g/kg in 55% of all cases. This demonstrates that the blood alcohol level is an insufficient criterion for the diagnosis of alcoholism - and does not prevent further car driving of drinkers.

![Graph](image)

**Fig. 1:** Blood alcohol concentration (BAC) and GGT >100 U/L of alcoholized culprits (45 cases of 960 blood samples)

The methodological improvement of the gaschromatographic detection enables the measurement of the concentration profile of the so called cogeners and biochemical markers like acetone and isopropanol which are associated with chronic alcoholism.

Investigations carried out in our institute by IFFLAND et al. (1984) demonstrated that methanol is a suitable parameter of establishing alcohol addiction and blood methanol levels higher than 10 mg/kg are typical for alcoholics. Measurements of blood samples from traffic offenders under the influence of alcohol showed a remarkable correlation of high methanol levels and increased GGT activities. These original findings have been confirmed by other investigators. In Fig. 2 the importance of methanol as a
marker becomes obvious. The patients of an addiction clinic were all known to be alcoholics. Methanol levels higher than 10 mg/kg were found in considerably more cases than an increased GGT and are thus in cases of proven drunkenness a significant indicator for the diagnosis of drunkenness. In the light of these experiences methanol has established its validity as an significant marker of alcoholism.

![Fig. 2: Methanol concentration and GGT in blood samples of a clinical hospital for addicts. n=33, BAC between 0.38-3.80 g/l](image)

The validity of the blood alcohol level alone in diagnosis for alcoholism can also be seen in Fig. 3. Limits for the suspicion to be a "driving drinker" are a GGT of 40 U/l and methanol levels above 10 mg/kg. In somewhat more than 50% of alcoholized road users with blood alcohol levels > 2 g/kg and aged between 35 and 60 years (points outside the marked areas) the suspicion is justified and a medicopsychological treatment necessary. In a comparative group of younger persons from 16 to 25 years and the same high blood alcohol concentrations, only 15 to 20% showed these markers of alcoholism. In 50% of the older persons and 80% of the younger ones we have no objective proof for alcoholism. It is also remarkable that in a group of road users aged between 35 and 65 years with blood alcohol levels between 0.5 and 1.2 g/kg more than 20% had GGT and/or methanol levels above critical ranges but they would not be tested by a medical psychological examination.

As a further marker though of lower validity than methanol isopropanol was established (IFFLAND et al., 1988). Methanol and isopropanol are formed mainly endogenously and increase in presence of ethanol. No explanation has been found so far for their metabolic generation.

Isopropanol levels of 1.0 mg/kg are to be regarded as an indication of alcohol induced metabolic disturbances which are significant in the case of alcoholics. In blood samples taken from alcoholized men of ages between 45 and 55 years methanol and isopropanol concentrations were measured (Fig. 4). Outside the shaded area the suspicion of alcoholism would be
Fig. 3.: Methanol concentration and GGT in blood samples of alcoholized car drivers. n=66, age 35-60 years, BAC between

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Fig. 4: Distribution of methanol and isopropanol concentrations in blood samples of alcoholized men of age between 45 and 55 years with blood alcohol concentrations between 0.7 and 1.3 g/l ( ) n=32 and above 2.2 g/l ( ) n=32

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Outside the shaded area the suspicion of alcoholism would be justified by the results of these markers. In 60% of these cases with high blood alcohol levels the suspicion is warranted but also in about 40% of drivers with blood alcohol levels lower than 1.3 g/kg.

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W = Withdrawal Treatment  
MPI = Medical Psychological Institution  
TEP = Traffic Education Program

Fig. 5: Consequences for alcoholized drivers depending on determination of alcoholism markers in blood samples

CONCLUSIONS

1.) The blood alcohol level established after a traffic offence is not a suitable criterion for distinguishing between alcoholics and occasional drinkers. Investigations have shown that there are equally many alcoholics to be found in road traffic with low blood alcohol levels.

2.) Suitable parameters in place of blood alcohol concentrations are alcoholism markers such as GGT, methanol, and isopropanol. But GGT has to be measured immediately after blood alcohol determination. Analytically it is no problem. Methanol and isopropanol may be determined also after a storage of months.

3.) To improve safety in road traffic it is essential not to return confiscated driving licences to alcoholics until they have undergone thorough medicopsychological examination or reeducation. This decision should not depend on blood alcohol level but on the levels of alcoholism markers. Fig. 5 shows the proposed consequences.

4.) Alcoholism markers like GGT are also a control for a successful withdrawal treatment or an altered behaviour to alcohol if they are determined in the first blood sample ordered by police and a later one for example during the examination by the Medical Psychological Institution (MPI).
References


Iffland R (1992) Alcoholism markers in blood samples of alcoholized car drivers in view of the restitution of the driving licence. 12th Int Conf Alcohol, Drugs and Traffic Safety, 28.09.-02.10.1992, Köln/Germany