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Drugs and chronic alcohol abuse in drivers

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Abstract

Blood specimens from 210 drivers (179 male and 31 female) apprehended in Luxembourg from autumn 2001 to spring 2002 and requested for the determination of their blood alcohol concentration (BAC) were tested for medicinal drugs, illicit drugs, and chronic alcohol abuse (by quantification of the carbohydrate-deficient transferrin: CDT). These additional analyses were performed anonymously and with permission of state prosecutor. The 22.8% had consumed medicinal drugs, with benzodiazepines and antidepressants (10.9 and 7.6%, respectively) as main psychoactive classes. Cannabis was the most detected illicit drug (9.5%) but only one in three had THC detectable in their blood. Association of two or more psychoactive substances (poly-drug use) was observed in 27.6% of drivers (90.6% of drug consumers). On the basis of CDT values, 29.5% of drivers investigated were assumed to be chronic alcohol abusers. Statistical analysis revealed that chronic alcohol abuse and medicinal psychoactive drugs were associated with significantly higher BAC. Medicinal psychoactive drugs were clearly associated with poly-drug use, and were furthermore detected at supra-therapeutic levels in 34.9%.

Keywords: Driving under the influence; Blood alcohol concentration; Medicinal drugs; Illicit drugs; Poly-drug use; Chronic alcohol abuse

1. Introduction

Driving ability may be altered by the consumption of various psychoactive substances. The most frequently reported is alcohol, from either occasional (social drinkers) or chronic users. A blood alcohol concentration (BAC) is therefore often measured in drivers. Although BAC has been for a long time monitored by authorities in cases of impaired driving or during traffic control, the relevance of detecting chronic alcohol abuse among drivers is becoming increasingly relevant [1,2]. Alcohol abusers are indeed recognized as particularly hazardous drivers with significantly increased risk of involvement in road traffic accident [3–5]. The Council Directive 91/439/CEE (1991) establishes that driving licences cannot be issued or renewed to people suffering from alcohol-related problems [6].

The consumption of illicit drugs is also a problem of growing interest, since there are increasingly observed in impaired drivers [7–10]. The intake of medicinal drugs, especially psychoactive medications, such as sedatives, anxiolytics, hypnotics, antidepressants, either by themselves or in association with alcohol or other substances, may lead to a decreased fitness to drive safely [11–13]. These sub-

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stances are frequently reported to be associated with fatal and non-fatal accidents [10,14–17] and their consumption is associated with an increased crash risk [18].

Trends in use of psychoactive substances in drivers are of particular interest in the current context of driver safety. Many European countries are therefore tending to develop or reinforce their juridical position with regard to drivers consuming drugs. Recent studies aimed at accumulating data to further understand this problem have reported highly varying patterns of consumption of psychoactive substances in the different countries investigated [9,15,16,19–28]. The lifestyle patterns of subjects, such as regional alcohol consumption habits [29–31], level and accessibility of their health care system [32], availability of illicit drugs [27], and social status of subjects [33,34], are directly responsible for the exposure to drug and their abuse, and hence to driver impairment.

In 1997, Luxembourg occupied the second place in Europe with regard to traffic accident-related death rate [35]. Moreover, despite its small size, the closeness of many countries (France, Germany, Belgium and The Netherlands) with differing traditions, habits, legislation and tolerance has made Luxembourg a European centre for trade of goods and smuggling of illicit drugs. Central Europe and particularly Luxembourg, France, and Germany are particularly concerned for alcohol abuse problems [36]. A Luxembourg Health Ministry report estimated that in 1994 about 3% of the population aged 15 years and over were excessive drinkers [37]. These different factors lead to an acute exposure of the population and make Luxembourg a relevant country for investigating the overlap of alcohol abuse, drugs consumption and traffic safety.

In this study, blood samples from drivers apprehended in Luxembourg and requested for determination of their BAC were used to perform further analysis. In order to assess involvement of drugs to driver behavior that would have been often missed by authorities due to a positive BAC, illicit drugs (cannabinoids, opioids, amphetamine derivates and cocaine metabolites), medicinal drugs (benzodiazepines, antidepressants, neuroleptics, etc.) and chronic alcohol abuse (by quantification of the carbohydrate-deficient transferrin: CDT) were measured in these drivers. This study was aimed at providing an indication of the extent of psychoactive substance use by gender and age.

2. Materials and methods

2.1. Population

The population investigated consisted of drivers apprehended in Luxembourg and requested by authorities for the determination of alcohol in blood. All additional analyses were performed for scientific purpose only, anonymously, with permission of state prosecutor, and had no administrative and/or legal consequence.

The reasons of being submitted by authorities to blood alcohol analysis were: a positive previous breath alcohol test, inability to provide a breath test (physically unable or no breath test available) or refusing to perform breath alcohol test while suspected of being impaired. Systematic controls and being involved in a traffic accident as driver were other reasons for taking a blood specimen.

The population consisted of 210 subjects (179 males, 31 females) randomly selected from drivers apprehended in Luxembourg from autumn 2001 to spring 2002. This represented one third of the approximately 630 cases per year requested by the police for alcohol analysis in blood. Subjects were mostly middle-aged with a mean of 39 years old for both males and females, and median of 37 and 41 years old for males and females, respectively.

2.2. Drugs and alcohol analysis

Illicit drugs and methadone were detected by routine GC–MS methods used in the laboratory. Following solid phase extraction, measurements were performed in the selected ion monitoring (SIM) mode, based on a selection of most common illicit drugs and metabolites (THC, THC-OH, THC-COOH, amphetamine, methamphetamine, MDA, MDMA, MDEA, MBDB, cocaine, benzoylecgonine, ecgonine methylester, cocaethylene, EDDP, methadone, morphine, dihydrocodeine, codeine, 6-acetylmorphine).

Medicinal drugs were screened using HPLC. Each substance detected was identified by retention time and UV spectra compared with an in-house library. Drugs are detailed in Fig. 1, with the number of positive subjects, limits of detection, and blood concentration ranges observed in the population investigated.

As requested by Luxembourg law, BAC was measured by two independent methods: gas chromatography head space coupled with a flame ionization detector (GC-HS/FID), and enzyme immunoassay (EIA) technique.

2.3. Carbohydrate-deficient transferrin quantification

Percentage of carbohydrate-deficient transferrin (CDT) in blood was determined as described by Legros et al. [38], using capillary electrophoresis (Beckman, P/ACE 5500), and CDT kit from ANALIS (Namur, Belgium). As recommended by the kit manufacturer, sample with CDT concentration equal to or above 2% of total transferrin was considered to originate from chronic alcohol abusers.

2.4. Statistical analysis

The hypothesis of independence was tested for any pair of variables: age, gender, alcohol, CDT, medicinal psychoactive drugs and cannabinoids. To this end, the χ^2-test or Fisher's exact test of independence, the Wilcoxon–Mann–Whitney test (WMW) and the Spearman rank correlation coefficient (r_s) were used according to whether there was a