

## A TOXICOLOGICAL INVESTIGATION OF ALCOHOL CONSUMPTION IN SUBJECTS INVOLVED IN ROAD ACCIDENTS

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### Abstract

**Aim:** Road accidents are one of the main problematic issues in Albania and their number is increased significantly in the last decade. These road accidents are often related to the use of alcohol in the persons involved in them, and presenting an interesting point to start an investigation to see how do different subjects (male, female) with an BAC  $\geq 0.5$  g/l (that is the legal Road Book cut off limit of consumption of alcohol in Albania) relates to their characteristics: age, sex, and vehicle type (if there is one) or pedestrians.

**Materials and methods:** Blood alcohol samples are taken from subjects involved in car accidents and analyzed by GC –HS (Gas-Chromatograph Head Space) Shimadzu QP 2010 in the Laboratory of Forensic Toxicology in the Institute of Forensic Medicine in Tirana which is the only authorized institution to perform the toxicological investigation of road accidents that happen in Albania.

**Results:** In the final cohort of 235 persons involved in traffic accidents, alcohol was found in concentrations above the legal limit in samples from 43% of subjects. BAC exceeded 0.50 g/l mostly in male subjects (99%), in car drivers (57.4%), and pedestrian (28.7%), also in the subjects over 50 years old (29.7%).

**Conclusion:** Men whose blood alcohol concentration exceeds 0.5 g/l have the chance to crash 18% more than females. Car drivers who have positive blood alcohol concentration have the chance to crash 2.4 times more than passengers, while pedestrians who blood alcohol concentration exceeds 0.5 g/l have the chance to crash 6.3 times more than passengers.

**Keywords:** alcohol, road accidents, toxicological investigation.

### Introduction

Traffic accidents cause great human and economic suffering in modern society, and their prevention

has long been a priority issue. Alcohol intoxication is regarded as one of the most important causes of traffic accidents and has been extensively investigated both experimentally and in epidemiological roadside studies [1].

For this reason, the European Union took action to promote road safety by combating driving under the influence of alcohol in program for 1997-2001 [2]. According to the law on Road Traffic Safety in Albania the legal limit of blood alcohol concentration (BAC) for driving in Albania is the value of 0.5 g/l [3].

In many countries it has been demonstrated that alcohol continues to be the most prevalent drug causing traffic crashes [4-7], because subjects with a positive blood alcohol concentration are more likely to be at fault in a collision and more likely to be fatally injured than non drinking drivers [8].

Our objective is to examine how a positive blood alcohol concentration (BAC  $\geq 0.5$  g/l) at the time of crash is associated with the other factors during a road accident.

### Methods

#### Subject

The subjects of this investigation are persons involved in road accidents, whose blood samples were submitted in the Laboratory of Toxicology in order to analyze their BAC. In this report we present results from the toxicological investigation performed for a group of 235 subjects who were involved in road accidents during 2010-2012. These cases represented only a portion of those involved in traffic accidents, not all subjects were included. Only the suspected ones were subjected to alcohol testing, and the decision was made by the police.

#### Sampling and handling

Blood sampling in living people, was done shortly after the accident, venous blood was taken by a physician or registered nurse in the presence of

police officers, using 5ml plastic sterile tubes containing anticoagulants.

In fatal cases, blood samples were collected at autopsy from medico legal doctors, using 30-50 ml sterile plastic tubes. The blood samples were taken from the femoral vein; in the cases where this was not possible, blood was taken from the heart.

Blood samples were kept at 2-4 C from the arrival at Toxicological Laboratory until the analysis had been performed, normally within 1 week, and thereafter frozen at about -20 C for 3 months.

The blood samples were handled using normal routine procedures for forensic toxicology analysis. (Laboratory protocol).

#### *Analysis of alcohol*

Analysis of ethanol in 0.5 ml of the blood was performed by a headspace gas chromatography with a flame ionization detector using t-butanol as the internal standard. Each determination was done in duplicate, and the mean value was reported. BAC of 0.5 g/l was considered as the cut-off concentration. An individual was reported alcohol-positive if he or she exhibited a BAC of 0.5 g/l or higher,

otherwise the case was viewed as alcohol-negative.

#### *Statistical analysis*

Binary logistic regression was used to assess the association road traffic accidents with alcohol positivity. The odds ratios (OR) and 95% confidence intervals (95% CI), and p values were also calculated. P values  $p < 0.05$  were considered statistically significant. Statistical analyses were performed running the SPSS version 11.0 (statistical package for the social science version 11.0, Inc. Chicago, IL, USA) on a personal computer.

#### **Results and Conclusions**

In the final cohort of 235 persons involved in traffic accidents, 43% of subjects (n=101) were found to be alcohol-positive at the time of crash. Subjects with positive BAC were more frequently men 94.5 % of total (n=222) [ $p=0.027$ ] statistically significant. There was only one female whose blood alcohol concentration exceeds 0.5 g/l have, and 99% of drunk drivers were men. Males have the possibility to crash 18% more than females. [OD: 1.18; CI95%: 1.01-7.76] (Table nr.1).

**Table nr.1 Cases with positive ( $\geq 0.50$  g/l) blood alcohol concentration (BAC) in relation to baseline characteristics**

<i>Variables</i>	<b>Total (n=235, %)</b>	<b>BAC<math>\geq 0.5</math>g/l (n=101, %)</b>	<b>P value</b>	<b>OR</b>	<b>CI95%</b>	
					<b>Lower</b>	<b>Upper</b>
<b>Age</b>			.038			
> 50 years	86 (36.6)	30 (29.7)	.645	.835	.388	1.796
40-50 years	49 (29.9)	22 (21.8)	.088	.466	.193	1.121
30-40 years	39 (16.6)	26 (25.7)	.197	1.720	.754	3.924
17- 30 years	61 (26.0)	23 (22.8)			reference	
<b>Sex</b>						
Male	222 (94.5)	100 (99.0)	.027	1.176	1.009	7.755
Female	13 (5.5)	1 (1.0)			reference	

The studied subjects aged from 17 to 81 years old, the prevalence of a positive BAC increased from 22.8 % in persons aged 17-29 to a maximum 29.7%

in patient over 50 years, and then declined at the group of 40-50 years old at 21.8% (Table nr.2).

**Table nr.2 Cases with positive ( $\geq 0.50$  g/l) blood alcohol concentration (BAC) in relation to road users**

<i>Variables</i>	<b>Total (n=235, %)</b>	<b>BAC<math>\geq 0.5</math>g/l (n=101, %)</b>	<b>P value</b>	<b>OD</b>	<b>CI95%</b>	
					<b>Lower</b>	<b>Upper</b>
<b>Road users</b>			.013			
Car drivers	107 (45.5)	58 (57.4)	.029	2.413	1.611	9.527
Pedestrians +Bicyclists	97 (41.3)	29 (28.7)	.014	6.337	1.458	17.548
Motorcyclists	17 (7.2)	7 (6.9)	.083	4.344	1.827	22.827
Passengers	14 (6.0)	7 (6.9)			reference	

Data about road users were presented according to four main categories: car drivers, passengers, motorcyclists and pedestrian (bicyclists included, only 3).

It was found that car represented the highest proportion of vehicles in both alcohol-negative crashes and alcohol-positive crashes. 45.3% of total accidents included cars followed closely behind by pedestrians (41.5%). 54.7% of the alcohol positive cases involved cars, pedestrians (28.7%), motorcyclist equal to passengers (6.9%) followed behind.

It is statistically significant the association between persons with positive BAC ( $\geq 0.5$  g/l) and the type of motor vehicle ( $p=0.013$ ). Car drivers who have positive blood alcohol concentration have the possibility to crash 2.4 times more than passengers [OD:2.41; CI95%: 1.61-9.53], while pedestrians who blood alcohol concentration exceeds 0.5 g/l have the possibility to crash 6.3 times more than passengers [OD:6.34; CI95%: 1.46-17.55].

The prevalence of positive BAC cases was significantly higher in car drivers (57.4% of cases,  $p=0.029$ ), and then in pedestrians (28.7 % of cases,  $p=0.014$ ). The prevalence of positive BAC cases was lower in motorcyclists and passengers.

## Discussion

In this study, alcohol-positive rate is defined as the portion of individual who has a BAC above the legal limit set by the government. The legal limits for driving range from 0.2 g/l to 0.8 g/l in different nations; the legal BAC in Albania is 0.5g/l. When compared with the data from other countries which have the same limit, the value of total drinkers involved in accidents obtained in this study (43%) was higher than that in Italy (18.1%) [8]. In this study, 57.4% of car drivers had a BAC  $\geq 0.5$  g/l showing that alcohol consumption was a contributing factor in these fatal crashes, much higher than in Italy (11%) and in Greece (37%, reduced in other four years to 29%). The higher BAC of car driver obtained in this study was 3.49 g/l, and the highest BAC of motorcyclists was 3.08 g/l.

Drivers involved in fatal crashes were predominately male (94.5%). It was estimated that, males dominated the picture largely because they accounted for the majority of the drivers. The involvement rate of female drivers (5.5%) was lower compared with some country. In Australia, in different age groups, females account for 16.5-

29.5% of fatal drivers [11], and these numbers were 13-16% in five northern European countries (Denmark, Finland, Iceland, Norway and Sweden) [12]. In this study also was found that, males were much more likely to drive under the influence of alcohol (alcohol positive rate was 99 % for male and 1 % for females). It is a high difference from reported studies performed in Greece [10] (70 % vs 30%) and Italy (80% vs 20%) [8]. Men are supposed to drink more in social activities, while women drink less often and less amount of alcohol than men in alcohol-related social activities.

In this study the age group most frequently involved was drivers aged over 50 years old (36.6%) and also alcohol-positive cases (29.7%). Studies from other countries show that, the proportion of fatally injured drivers was highest in quite young age group (20-29 years old in Italy, 21-30 years in Greece). However, as reviewed by Waller, after about age 55, crash risk per mile driven begins to increase with age at an accelerating rate alcohol was found to further increase the crash risk of older drivers [13]. Thus, it is suggested that elderly people should be very careful when driving, and should avoid driving after drinking.

In this study cars were the majority type of vehicles in total crashes (45.5%) and alcohol-positive crashes (57.4%). Pedestrians ranking the second highest group in total crashes (41.3%) and alcohol-positive crashes (28.7%). Because of very small number (only 3), bicycles are included into the pedestrians group. Bicycles are not used quite often as a means of transportation and work in Albania. It is usually supposed that, it is safer to walk than to drive after drinking, however in this study it is shown that approximately 30% of pedestrian involved in road accidents were drunk, and the highest BACs among the pedestrians was 3.78 g/l. For surprise, the contribution of motorcycles to the fatal traffic accidents was very low (7.2% in total) and motorcyclists represented only 6.9% of drunk drivers. Studies in many countries have shown that driving after alcohol consumption is primarily a nighttime, weekend phenomena [13,14,15], but no data were available in our investigation.

We expect that sampling was in some cases not performed if the police considered that the probability of finding alcohol was low, or long distances to obtain an autopsy may also have contributed to a low frequency of toxicological testing. Alcohol concentration in autopsy samples may not reflect the concentration at the time of death

because of post-mortal changes [16,17]. BAC positive subjects have been shown to have difficulties in keeping their motorcycle under control, because of the effects of alcohol on motor skills and reaction times [18]. Many of alcohol related accidents would probably not have happened if the drivers were not drunk.

What needs to be mentioned is that, in Albania illegal drug use of drivers is rarely tested. Maybe some accidents in this study were actually caused by the usage of illicit drugs or the interaction of alcohol and drugs. So the data presented in this study had

some limitation, and what is the relationship between drug use and crashes needs to be clarified in further studies.

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