The Prevalence of Illicit Drugs and Alcohol in Road Traffic Accident Fatalities in the Eastern Region of Saudi Arabia

Naglaa F. Mahmoud[1, 2]; Maha K. Al-Mazroua[2]; Mostafa M. Afify[2, 3]

[1]Associate Professor, Forensic Medicine and Clinical Toxicology Department, Faculty of Medicine, Cairo University, Cairo, Egyp, [2]Regional Poison Control Center, MOH, Dammam, Saudi Arabia, [3]Professor, Forensic Medicine and Clinical Toxicology Department, Faculty of Medicine, Beni-Suef University, Beni-Suef, Egypt

Abstract

The study aims to investigate the prevalence of alcohol and illicit drugs in Road Traffic Accident fatalities from January 2015 to December 2019 in Eastern region – Saudi Arabia**.** From a total of 1939 deaths investigated in the Dammam Poison Control Center, only 57 of them were related to Road Traffic Accidents (RTA), of which 96.4% were males, 36.8% were in the age group between 18–30 years. The highest incidence was among Saudi nationals (82.5%). 70.2% of the investigated cases tested positive for ethanol either alone or with other illicit drugs, cannabis ranked the second (38.6%), followed by amphetamine (17%) and heroin (10%). Ethanol was the sole toxicological finding in (57.5%). The single drug–abusing pattern (50.9%) exceeded bi-and triple drug–abusing pattern (31.5 %). None of the investigated samples showed a positive result for illicit cocaine or benzodiazepines. In Conclusion, ethanol identified as a key element, being the highest frequently detected substance in the blood samples of RTA victims which mandates the need for planning appropriate interventions and more strict application of Saudi national program for drug prevention together with wide community action.

Keywords: *Blood Alcohol; illicit drugs; Patterns of Abuse; RTA; Saudi Arabia*

Introduction

Road fatalities in KSA have increased over the last decade from 17.4 to 24 per 100000 individuals compared with 10 in the USA and 5 in the UK, respectively, where road safety rules are being meticulously applied and all primary and secondary preventive measures are being applied strictly [(1)].

Alcohol and illicit drugs have a strong association with the increased incidence of RTA fatalities, which is considered a cause of concern and an alarming problem across the world. Driving under the Influence of Drugs (DUID) and its inhibitory effect on the central nervous system increases the risk of road accidents [(2)].

For instance, alcohol significantly diminishes individuals' capabilities and driving skills due to its effect on coordination, alertness, and reflexes of the user [(3)]. In South Africa and Slovenia, alcohol was the main cause of road accidents causing 58% and 42.4% pedestrian mortalities from 2001 to 2004 and 1999 to 2006, respectively [(4,5)].

This study aims to investigate the prevalence of illicit drugs and alcohol in Road Traffic Accidents (RTA) fatalities from January 2015 to December 2019 in the eastern region of Saudi Arabia**.**

Methods

Collection of Data

Data of RTA deaths was collected by referring to postmortem toxicology and autopsy reports. Data analysis concerning demographics, victim status, state of putrefaction, types of the collected samples, toxicology findings, and pattern of drug abusing were taken into consideration.

Analytical Methods

Blood samples were collected from the femoral vein (being the most reliable sample for toxicology analysis) in containers with sodium fluoride as a preservative (1–

2%, v/v) to determine ethanol level. A vitreous sample (whenever submitted) was used to confirm the level of ethanol in the samples. Urine was initially screened for ethanol and illicit drugs (amphetamine, barbiturates, benzodiazepine, cannabis, cocaine, and opiates) by Fluorescence Polarization Immunoassay (FPIA on ARCHITECT system i1000 SR and c4000, model by Abbott laboratories). Quantification and confirmation of positive screening results were conducted by liquid-chromatography mass-spectrometry after liquid–liquid extraction [6]. Detection of cannabis was based on the presence of Tetrahydrocannabinol (THC) using a method of a solid-phase extraction. [7]. Samples were tested for all volatiles including ethanol using gas chromatography–headspace GC ultra-model K0C33B730000000, Milano, Italy. Other drugs were analyzed by a gas chromatography mass-spectrometer GC– MS–QP2010, Shimadzu.

Blood and urine samples were tested for Ethyl Glucuronide and Ethyl Sulphate (EtG and EtS) by liquid chromatography-tandem mass spectrometry by using the methodology approved by Helander et al. [8].To distinguish between antemortem and postmortem blood alcohol source, only cases with EtG levels ≥ 0.5 µg/mL (positive cut-off for EtG) and EtS ≥ 0.1 µg /mL (positive cut-off for EtS) were included in the study.

Statistical Analysis

Data of the investigated cases were submitted for statistical evaluation by SPSS version 25 and the results were compared with other similar studies.

Results

From a total of 1939 deaths investigated in Dammam Poison Control Center, only 57 RTA–related deaths were identified. As shown in table 1, the highest number of RTA fatalities was found in males (96.4%) and the commonly affected age group was 18–30 years old. Saudi nationals represented the dominant nationality 82.5% while non-Saudi people represented 17.5 %.

70.2% of the studied samples yielded ethanol in their analytical results. Cannabis ranked second (38.6%), followed by amphetamine (17%) and heroin (10%); samples were reported positive for heroin after the detection of 6-mono acetyl morphine in the urine samples as shown in figure 1.

The analytical findings showed that 82.4% (n=47) of the investigated fatally injured RTA victims had one or more substances detected in their specimens. While 17.5 % had negative analytical results. The pattern of abusing single drugs predominated (n=29 ,50.8 %) over those of bi-and triple drug abusing (n= 18,31.5 %) (figure 2).

Of the total ethanol positive samples (n = 40), ethanol was the sole toxicological finding in 57.5% and combined with other substances in 42.9 %. The combination of ethanol with cannabis was the most commonly detected combination (4.8 %) (figure 3).

Distribution of BAC means showed that the highest mean (270 mg/dl) was found in the 18–30 years old age group, while the lowest mean (114 mg/dl) was observed in the 51–60 years old age group (Figure4).

Most of the victims were drivers (56%), others were pedestrians and car passengers (21% and 14%). However, the categorization of other RTA fatalities (8.7%) was not evident due to the lack required data. Variable ranges of alcohol concentration were detected among different victim categories tested positive for ethanol (Table 2).

Table (1): Socio-demographic characteristics of RTA victims included in the study.

Age group	Sex		Total No (%)
	Males No (%)	Females No (%)	
< 18 yrs	1 (100%)	0(0.00%)	1 (1.8%)
18-30 yrs	21(100%)	0. (0.00%)	21(36.8%)
31-40 yrs	14 (93.33%)	1(6.67%)	15 (26.3%)
41-50 yrs	16 (94.12%)	1(5.88%)	17(29.8%)
51-60 yrs	2(100%)	0.0(0.0%)	2 (3.5%)

Cont... **Table (1): Socio-demographic characteristics of RTA victims included in the study.**

>60 yrs		1(100%)	0.0(0.0%)	1(1.8%)
Total		55(96.4%)	2 (3.5%)	57 (100%)
Nationality	Saudi	45 (95.74%)	2(4.26%)	47(82.5%)
	Non-Saudi	10(100%)	0(0.00%)	10(17.5%)

Table (2): Summary of alcohol results in blood and urine showing the range of concentrations and the percentage number above the current KSA legal driving limit among different victim categories

		Alcohol concentration ranges mg/dl					**Overall ranges mg/dl**	**% No above legal driving limit**
Victim Category	Samples no	< 50	51-100	101-200	201-300	>300		a Blood > 0.00 mg/dl
Drivers= 23	Blood 35 Urine 11	4 1	8 3	15 5	5 2	3 0	30-410 15–290	100%
Pedestrians=7	Blood 9 Urine 5	1 2	2 0	4 3	0 0	2 0	13-516 40-165	100%
Car passengers=5	Blood 7 Urine 3	1 1	3 0	2 2	1 0	0 0	24-282 28-166	100%
Unknown =5	Blood 8 Urine 2	1 0	1 1	5 1	1 0	0 0	42-287 78-160	100%

[a] Saudi Arabia has a strict, zero-tolerance policy for alcohol

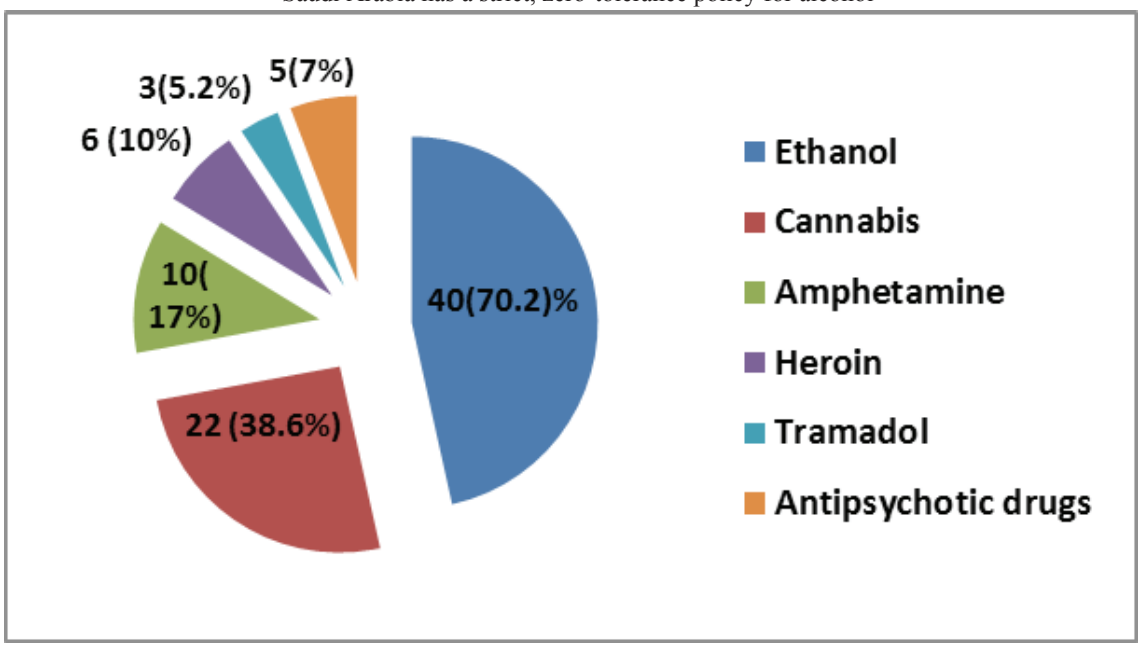

Figure (1): Identified drugs in the studied postmortem samples

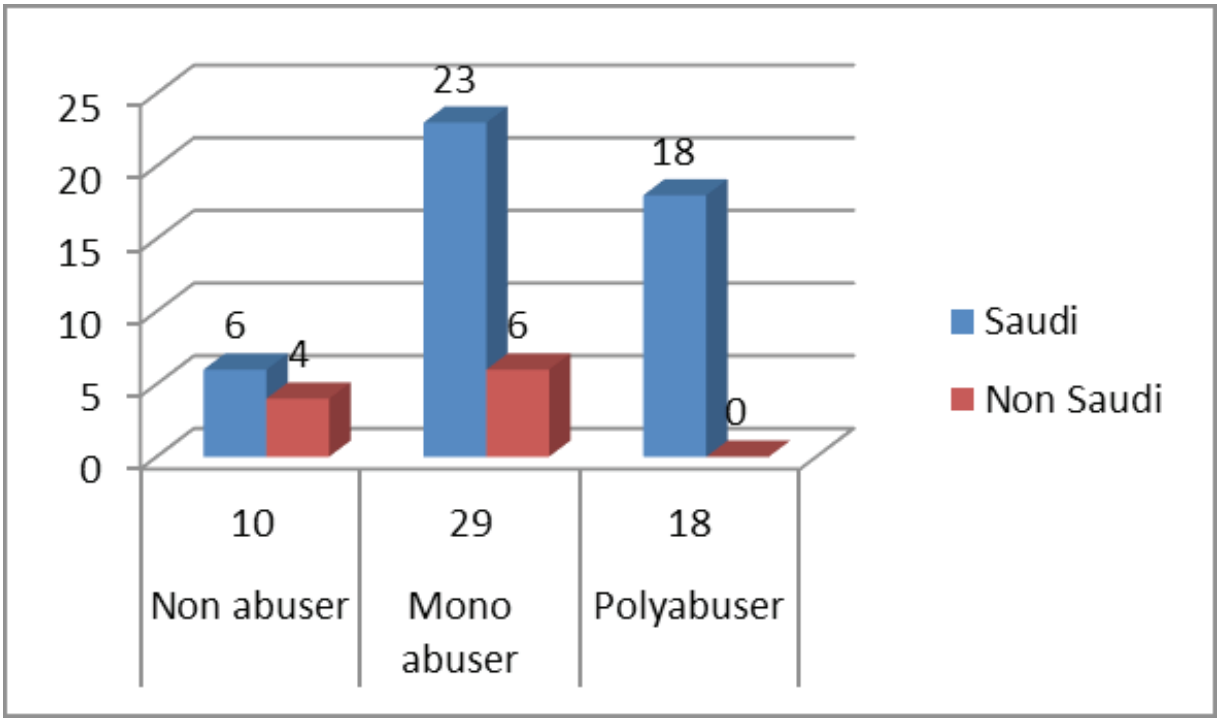

Figure (2): pattern of drug and substance abusing according to victim's nationality

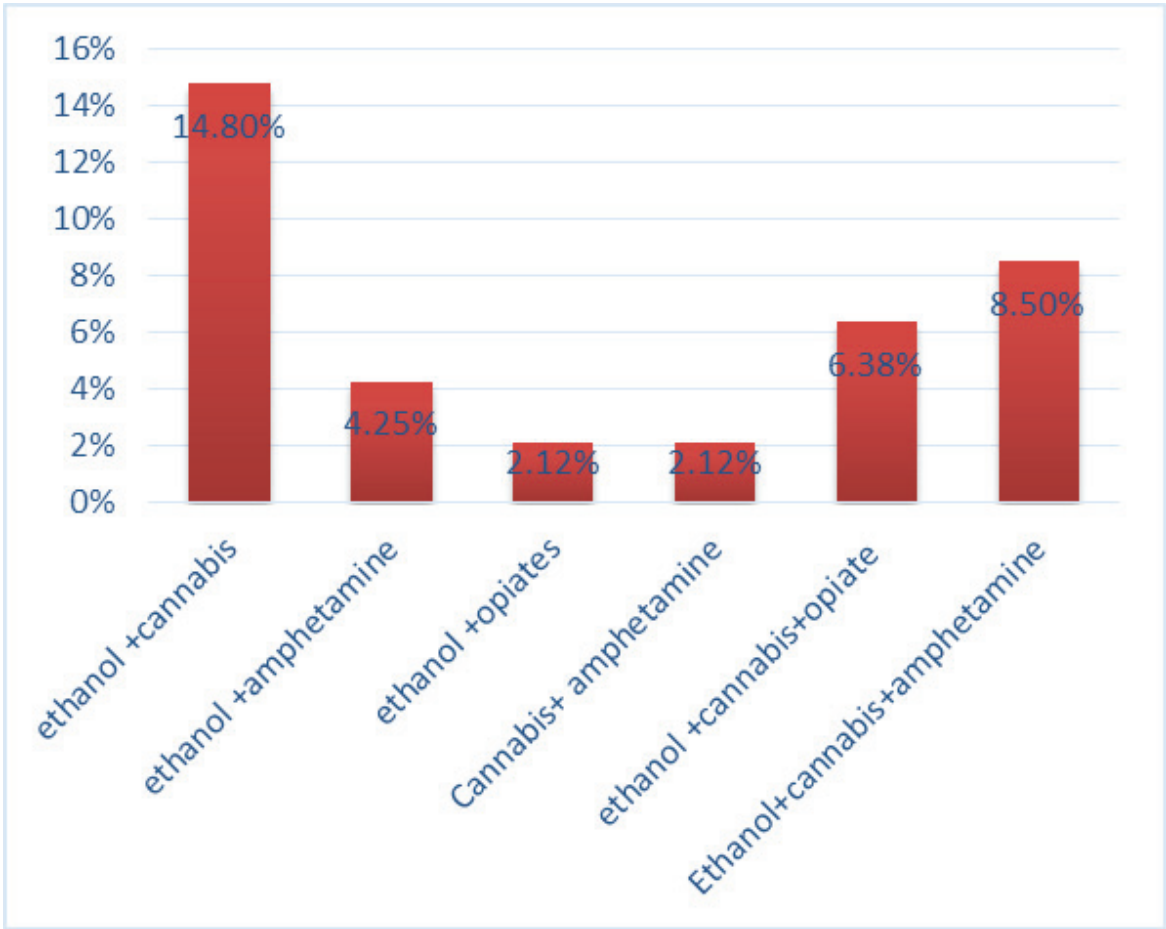

Figure (3): incidence of drug combinations detected in postmortem samples.

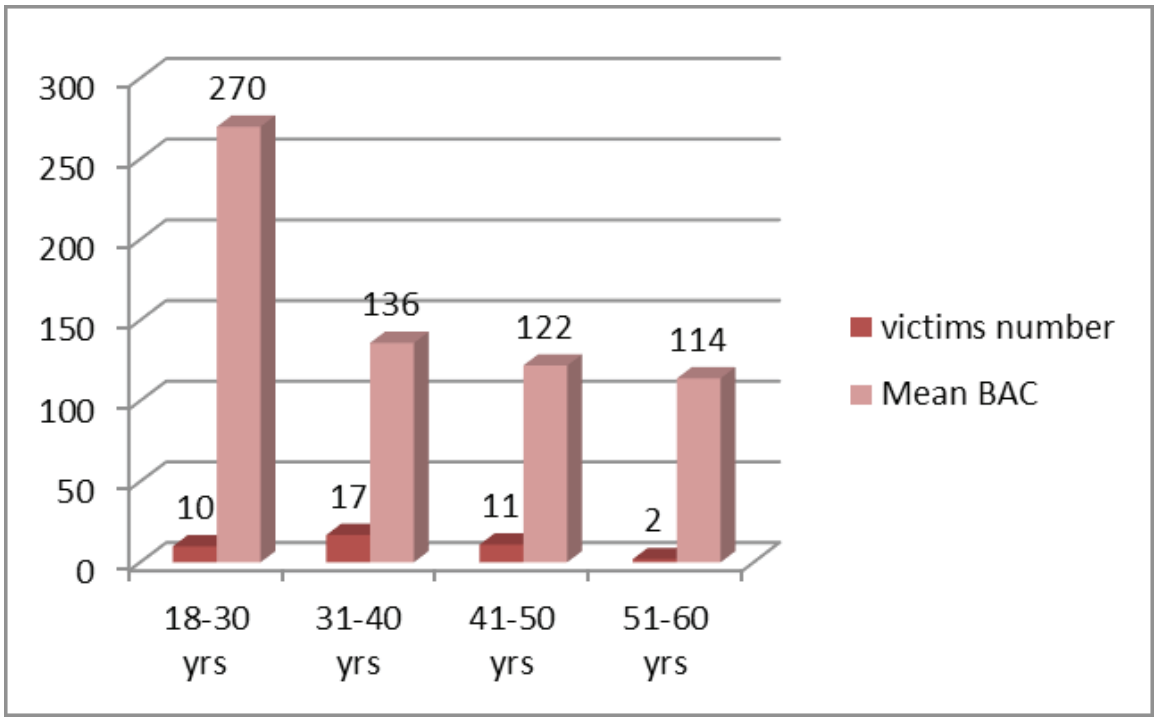

Figure (4): Distribution of BAC means in relation to age groups.

Discussion

There is a growing concern regarding the correlation between driving under the influence and RTA, where alcohol and abused drugs can affect the behavior and cause perception alteration for those who consume it [9]. The results of the study showed that males were dominantly present in fatal road traffic accidents and represented 96.4%, which concurs with statements by other authors [10].This prominent sex factor could be attributed to the Saudi culture of limited social and professional activities of females with no permission for driving license during the study period.

The majority of involved males were in the age group from 18 to 30 years old, whether being directly related to the accident as in driving or indirectly as in being car passengers or pedestrians. These results were similar to those obtained from the studies conducted in Amman and The Center of Portugal [11,12] and could be explained by the risk-taking attitude of young males; thereby, it affects the driving behavior besides their lack of driving experience. However, young drivers, contrary to their older peers, maintain better reaction response and reflexes.

As stated by other authors and in consistency with our results, the majorities of the victims were drivers followed by pedestrians [13]. On the contrary, pedestrians were the most frequently affected category as reported by other authors [11].

In many countries such as Australia and Slovenia [13,14] and consistent with our results, ethanol was the most frequently detected component either solely or combined with other substances. Our findings were also in line with other relevant studies conducted on Saudi population and revealed that ethanol was the main analytical finding detected in 49% of postmortem specimens and considered the most common substance linked to road accident deaths (41%) [15].

Many studies are confirming that alcohol level as low as < 0.02 g/100 ml can impair driving performance [16]. However, currently, there is no clear approved threshold ethanol level below which impairment could be excluded and there is no agreed definition of the victim who will be excluded from being under alcohol influence [17]. Considering the transgression of driving under the influence, alcohol is completely banned in Saudi Arabia with a strict zero-tolerance policy for alcohol and drugs [18].

It is vital to consider the factors contributing to the interpretation of postmortem and antemortem BAC or drug levels and its effect on the state of conscious impairment at the time of death due to its crucial role for legal and insurance purposes such as putrefaction degree, postmortem interval time, types of the collected samples for analysis, and the environmental conditions. However, in our study, bodies showed signs of putrefaction or postmortem changes were excluded [19].

An important issue is to differentiate between postmortem ethanol synthesis and antemortem ingestion. This could be avoided by extracting the blood samples from the femoral vein, which is the least prone to postmortem changes. Also, Ethyl Sulphate (EtS) and Ethyl Glucuronide (EtG) were utilized to eliminate the potential of false-positive or negative results, as it is not vulnerable to the Escherichia coli bacteria by creation or degradation. EtS has proven to be more accurate and a reliable biomarker of ethanol exposure that is quickly replacing EtG as the gold standard for alcohol [8].

The consumption of recreational drugs varies among countries which reflected in the postmortem toxicology findings of victims killed in road-traffic crashes [20-21]. This study illustrated that cannabinoids were the most frequently found illegal drug, followed by amphetamine and heroin. However, one notable result is the absence of cocaine in all investigated postmortem samples due to its relative scarcity and high cost. In line with our results, previous studies documented that the pertinence of illegal drugs was variable: in an Australian study, cannabinoids were found in 13.5% of postmortem samples, opioids ranked second with a percentage of 4.9% and stimulants were observed in a percentage of 4.1% [13].

Another recent Swedish study confirmed that illegal drugs were found in 7.2% of all victims with the predominance of amphetamine and cannabis and rare frequency of cocaine [22].

Conclusion

The results of the present study strongly prove the relation between driving under the influence and the increasing incidence of fatal RTA. Ethanol was identified as a key factor in traffic accidents' fatalities, being the most commonly detected substance in the blood samples. Furthermore, cannabis ranked the second, necessitating the enforcement of specific legislations, and a stricter application of the Saudi National Program for Drug Prevention alongside community-wide action to increase the public awareness about the negative effect of these substances and their contribution for the surging incidence of RTA fatalities.

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Conflict of Interest: None.

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