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A retrospective analysis of alcohol in medico-legal autopsied deaths in Pretoria over a 1 year period

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ABSTRACT

The misuse of alcohol has a particularly detrimental effect and is one of the most significant public health problems in South Africa and it also has an impact on the criminal justice system with evidence of association between high levels of alcohol and risk-taking behaviour, committing crimes, or being a victim of crime. A global trend has been set worldwide with alcohol being one of the most common drugs found in post mortem specimens and especially with regard to cases admitted for medico-legal autopsies. The influence of alcohol on the cause of death is either a contributory or an underlying factor in a substantial number of violent deaths. We retrospectively reviewed 1455 cases, in which alcohol was taken, of 2344 medico-legal autopsies done in 2009. We found that 47% of the cases tested positive for alcohol, with the reported blood alcohol concentrations varying from 0.01 to 0.95 g per 100 ml (mean = 0.16 ± 0.11 g per 100 ml) with the highest proportion being in the 0.10–0.19 g per 100 ml range. A breakdown of the results showed that road traffic accidents, assaults and firearm-related deaths predominated the alcohol-positive cases. The results showed that there was a definite correlation between alcohol consumption and the incidence of other that natural deaths.

1. Introduction

The consumption of alcohol is an almost universal phenomenon and its abuse often leads to drunkenness and violence [1,2]. It is well known that the use of alcohol increases the risk of dying from unnatural or violent causes, as acute intoxication may compromise rational thinking and decreases motor and sensory function, whilst also leading to increased risk taking behaviour, aggression and self-destructive tendencies [1,3].

The misuse of alcohol has a particularly detrimental effect and is one of the most significant public health problems in South Africa and it also has an impact on the criminal justice system, with evidence of association between high levels of alcohol and risk-taking behaviour, committing crimes, or being a victim of crime [4–6]. Studies have shown that alcohol is also the preferred substance of abuse [4,7].

In a country with a population in excess of 45 million people, it is estimated that well over 6 billion litres of alcoholic beverages are consumed by South Africans per year [2,8]. It is well documented that a high level of alcohol misuse exists among residents of disadvantaged communities with binge drinking among young males being exceptionally high. South Africa is also known to be one of the higher alcohol-consumption nations with absolute alcohol consumption for adults ranging between 9 and 10 L per year [9]. The widespread misuse and abuse of alcohol in South Africa is likely to have a profound impact on the economy, with alcohol abuse estimated to cost South Africa well over R9 billion per year (approximately $840 million USD) [2].

Risky drinking patterns are common in South Africa, but the biggest concern remains the high level of heavy episodic drinking (binge drinking) linked to many countries with middle to high per capita consumption, such as Brazil and South Africa. In some European countries, such as France with high adult per capita consumption (APC) (13.7 L per year), heavy episodic drinking is relatively low, indicating that APC can be driven by more regular but moderate drinking patterns [10].

A global trend has been set worldwide, with alcohol being one of the most common drugs found in post mortem specimens and especially with regard to cases admitted for medico-legal autopsy [11,12]. The influence of alcohol on the cause of death is either a contributory or an underlying factor in a substantial number of

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violent deaths [13]. It is of utmost importance to continue to raise the community's awareness of the harmful and potentially fatal effects of alcohol, in order to prevent future fatalities [14].

A thorough literature review indicates that there is minimal statistical data pertaining to alcohol and non-natural deaths in South Africa, and none were found for any part of the Gauteng province, as opposed to the abundance of data available from other countries. We compared our results to two studies done locally, both done in the Western Cape. We also made comparisons against studies done in Sweden, Ireland, Slovenia, Brazil and Jordan.

The aim of this study was to review the alcohol levels in medico-legal investigations of unnatural deaths in Pretoria from 01/01/2009 to 31/12/2009. Emphasis was placed on the alcohol level obtained in blood/fluid samples harvested at autopsy and the relevance thereof to the cause of death. Concurrently comparisons were drawn to the parameters at hand (demographics, cause of death, and laboratory analysis) and to find trends in alcohol consumption and other drug or poison usage.

2. Materials and methods

The Pretoria Medico-Legal Laboratory (PMLL) serves the greatest part of the City of Tshwane Metropolitan Municipality, which had a population of about 2.4 million people in 2007, and is located in the administrative capital of South Africa, Pretoria [15].

At the PMLL, alcohol is routinely taken during the post mortem examination on all other than natural deaths admitted to this facility if the deceased is 14 years or older and the autopsy takes place, preferably, within 24 h of the external cause/circumstance of the death.

A retrospective descriptive study was carried out on all case files of non-natural deaths, in which samples were taken for alcohol analysis, on which autopsies have been done at the PMLL from 01/01/2009 to 31/12/2009.

During autopsy, blood samples are collected into sealed post mortem blood alcohol kits which includes a McCartney bottle that contains 0.32 mg sodium fluoride (as preservative) and potassium oxalate (as anticoagulant) in a ratio of 4.3:1. The McCartney bottles are resealed in their polystyrene containers and sent to the laboratory for blood alcohol analysis.

All the samples were analysed by the Pretoria Forensic Chemistry Laboratory. Ethanol concentrations were determined by headspace gas chromatography with flame ionisation detector. All results presented in this study were the average of duplicate analyses. An Agilent 6890 gas chromatograph (GC) system with flame ionisation detector and an Agilent G1888 headspace auto sampler was used throughout this study. The GC operates under a detector temperature of 220 °C and oven temperature of 80 °C while the auto sampler operates under a detector temperature of 300 °C and oven temperature of 145 °C. The chromatographic columns were a Porapak-type HP-ALC (7 m and 0.32 mm internal diameter, with a film thickness of 20 μm) and a Polyethylene glycol-type DB-ALC1 (30 m and 0.53 mm internal diameter, with a film thickness of 3 μm) respectively. Nitrogen was used as carrier gas with a flow rate of 3.6 ml per min (GC) and 31.7 ml per min (auto sampler).

The internal standard solution was prepared from 1 ml t-butanol prepared in deionised water to give a concentration of 0.1% (v/v). Certified reference ethanol standards at concentrations of 0.01, 0.02, 0.05, 0.1, 0.2, 0.3, 0.5 g per 100 ml were used as calibrators. All standards were purchased from the National Metrology Institute of South Africa (NMISA).

The total number of cases (caseload) admitted to the PMLL was recorded as well as the total number of cases from which samples for alcohol analysis were taken. Information was collected on the blood alcohol concentration (BAC); demographic details of the deceased including age, gender and race; any additional noteworthy details on the history; the scope of the post mortem examination and the cause of death.

The data was collected on a data sheet and transferred to a Microsoft® Office Excel® 2007 (Microsoft, Redmond, Washington, US) spread sheet. The data was then transferred to the STATA 10® (StataCorp LP, Texas, USA) program and analysed in conjunction with a statistician.

Ethics Committee approval was obtained from the Research Ethics Committee of the Faculty of Health Sciences at the University of Pretoria prior to the commencement of the study.

Unless otherwise stated, alcohol levels refer to blood alcohol levels and are expressed in grams per 100 millilitres of blood. A blood alcohol concentration of 0.01 g per 100 ml is considered to be positive.

3. Results

A total caseload of 2344 was admitted to the PMLL for 2009. From this number, 1455 samples were taken for alcohol analysis. This constitutes 62% of the total caseload. Alcohol results were available in 1431 of the 1455 cases analysed, 24 cases still had pending results at the time of data collection and positive values were obtained in 686 (47%) of the cases, which constitutes 29% of the total caseload. The average blood alcohol concentration (BAC) was 0.16 ± 0.11 g per 100 ml which ranged from 0.01 to 0.95 g per 100 ml (Fig. 1).

3.1. Age distribution (Fig. 2)

Of the 1455 cases, the largest single group was 18–29 years old, although the mean age was found to be 36 years (range = 4–89 years). For age groups <18, 40–49 and 60+ years old, more negative than positive cases were found, while the converse was true for the 30–39 year group. In the case of the 18–29 and 50–59 groups, there were equal numbers of positive and negative cases.

3.2. Gender distribution

Most of the decedents examined (81%, $n = 1173$) were male and just over half of them were positive (51%, $n = 595$) with a mean BAC of 0.16 g per 100 ml. In contrast, only 32% ($n = 91$) of the female decedents were positive with a mean BAC of 0.14 g per 100 ml.

3.3. Racial distribution

One-thousand-and-forty-seven (72%) of the deceased individuals were found to be black, 355 (24%) were white, 33 (2%) were coloured, 9 (1%) were Asian/Indian and in 11 (1%) the race was

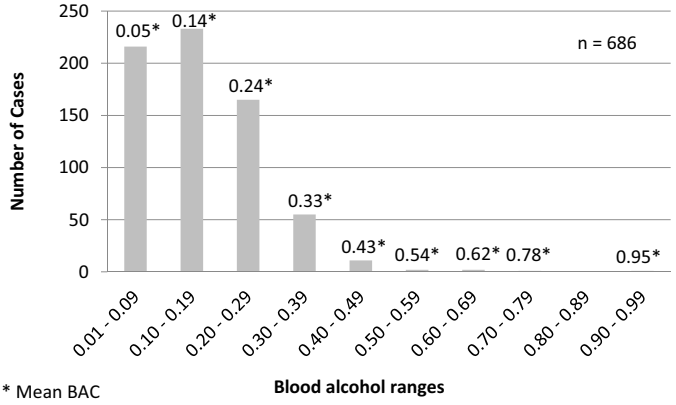

Fig. 1. Distribution of positive alcohol levels (in g per 100 ml).