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Prevalence of drugs in oral fluid from truck drivers in Brazilian highways

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ABSTRACT

Traffic accidents are responsible for 1.25 million deaths worldwide and are the most common cause of death among those aged 15–29 years. In Brazil, traffic accidents caused more than 44,000 deaths in 2014. The use of psychoactive drugs is an important risk factor for being involved in traffic accidents. Previous studies have found that psychoactive substances are commonly used by truck drivers in Brazil to maintain their extensive work schedule and stay awake while driving during nighttime hours. The state of Sao Paulo is one of the most important states regarding goods transportation. Important highways cross through Sao Paulo to other regions from Brazil and to other countries in Latin America. This study aims to determine the prevalence of illicit drug use by truck drivers in the state of Sao Paulo through toxicological analyses of oral fluid. Truck drivers were randomly stopped by police officers on federal roads during morning hours. Oral fluid samples were collected using the Quantisal™ device. In addition, a questionnaire concerning sociodemographic characteristics and health information was administered. Oral fluid samples were screened for amphetamine, cocaine, and tetrahydrocannabinol (Δ9-THC) by ELISA and the confirmation was performed using ultra performance liquid chromatography with tandem mass spectrometry detection (UPLC–MS/MS). Of the 764 drivers stopped, 762 agreed to participate. The participants were driving an average of 614 km and 9.4 h a day. Of the total samples, 5.2% (n = 40) tested positive for drugs. Cocaine was the most frequently found drug (n = 21), followed by amphetamine (n = 16) and Δ9-THC (n = 8). All drivers were men with an average age of 42.5 years. With these results we were able to verify that many truck drivers were still consuming psychoactive drugs while driving, and cocaine was the most prevalent one. This reinforces the need for preventive measures aimed at controlling the use of illicit drugs by truck drivers in Brazil.

1. Introduction

Traffic accidents have reached alarming heights around the world and are causing about 1.25 million deaths per year worldwide. Traffic accidents are the most common cause of death among those aged 15–29 years. The World Health Organization estimates that by 2050 it will be responsible for 2.4 million deaths if no measures are taken [1]. In 2010, the United Nations declared the decade from 2011 to 2020 as the Decade of Action for Road Safety as an attempt to reduce in half the number of traffic accidents and saving millions of lives [1].

More than 170,000 traffic accidents were recorded on federal highways in Brazil in 2014, causing more than 8000 deaths and 100,000 injuries, generating a cost of more than US$ 4 billion for society. Considering all the Brazilian highways, the number of deaths was 44,000 and the cost more than US$ 10 billion [2,3].

The state of Sao Paulo has the highest gross domestic product among the Brazilian states. Therefore, it is one of states with most goods transportation. Important highways to other regions from

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Brazil and other Latin American countries are crossing the state. It has one of the biggest highway networks in the country, but also the highest number of deaths caused by traffic accidents, which is annually more than 7000 [3].

Truck drivers were involved in 33.4% of all traffic accidents on federal highways in 2014. Moreover, trucks were involved in 43% of all deaths due traffic accidents [3].

There are many causes for traffic accidents, such as mechanical failure on vehicles, human failure, and problems on the roads, besides the use of psychoactive substances that decreases the driver's capability to drive safely [4,5]. The deleterious effects of alcohol and psychoactive drugs on drivers are well described in the literature [4–7]. Alcohol decreases the motor coordination, concentration, time of reaction, increasing the chances of involvement in traffic accidents [8,9]. In addition, it is the most found substance in drivers who are victims of traffic accidents [10,11]. The use of psychoactive substances is not only responsible for decreasing the driver's attention, but also for increasing the odds for a dangerous driving which increases the probability for crashes [12]. In a recent Brazilian study, blood samples from 230 traffic accidents victims were analysed. Illicit drugs were found in 21.7% of the samples and cocaine was the most found substance, 15.1% [13].

Stoduto et al. found that self-reported collision involvement within the past year was 18.9% among those who used cocaine in the past year compared to 7.4% of non-users [4].

Previous Brazilian studies have demonstrated frequent use of the three main illicit drugs among truck drivers: cocaine, amphetamine and cannabis. Silva et al. [14] collected 728 urine samples of truck drivers and found that 5.6% of those were positive for psychoactive drugs. Leyton et al. [15] found 9.3% of urine samples were positive for illicit drugs with amphetamine as the most prevalent drug.

In the context of law's application, blood is the matrix that must be collected to determine if a driver is under the influence of any drug. However, the collection of blood is very invasive, and the refusal rates are high in studies where participation is voluntary [16]. Urine can also be used to verify drug intake; however, a drug can be detected several days or weeks after drug consumption. Therefore, a positive drug finding does not indicate that driver was under influence while driving [17]. Instead of using samples of blood or urine, oral fluid may be collected, because a positive drug finding in oral fluid indicates in most cases that the drugs is also present in blood [17,18]. The salivary glands are highly perfused, which guarantee a rapid transfer of a substance from blood to oral fluid. Besides, the collection of oral fluid is fast, easy, and not invasive, and it is difficult to adulterate because the collection occurs in the presence of the researcher [19].

The aim of this work was to estimate the prevalence of recent use of cocaine, amphetamine and tetrahydrocannabinol among truck drivers in the state of Sao Paulo using oral fluid as biological matrix for the toxicological analysis.

2. Methods

2.1. Sample collection

The collection of oral fluid samples was performed on federal highways in the state of Sao Paulo, between 9 a.m. and 4 p.m. on selected days during March 2014 and March 2015. In addition, a questionnaire concerning sociodemographic characteristics and health information was administered. The location and date of sample collection were previously chosen by the Federal Highway Police. Police officers randomly stopped truck drivers and invited them to participate in the project "Health Commands on the Roads", which provided free health services to truck drivers. This event was not a police control of truck drivers. Participants were informed about the study and those who agreed to participate signed an informed consent form. All drivers who agreed to participate were included in the study. Age, gender, education level, and marital status were recorded in addition to information about the place of departure, destination, travel length and working hours per day. Self-reported data on drug use was also recorded. Oral fluid samples were collected using the Quantisal™ device (Immunalysis, Pomona, CA, USA). The samples were labelled with a number linking the sample to the questionnaire. The collected samples were kept under refrigeration and transported to the laboratory during the day of collection where they were frozen at −20 °C.

2.2. Screening tests

Oral fluid samples were analysed at the Faculty of Medicine of the University of Sao Paulo. Drug screening for amphetamine, cocaine, and Δ9-THC was performed using Enzyme-Linked Immunosorbent Assay (ELISA— Immunalysis, Pomona, CA, USA). We used a specific ELISA plate for each drug and the following cut-off values were used: amphetamine — 50 ng/mL; cocaine — 20 ng/mL and Δ9-THC — 4 ng/mL. All the calibrators and reagents used were from the commercial kits acquired. All samples were analysed in duplicate.

2.3. Confirmatory tests

The samples that were found to be positive by the screening analysis were confirmed at the Norwegian Institute of Public Health (NIPH). The confirmation analysis was performed using ultra performance liquid chromatography with tandem mass spectrometry detection (UPLC–MS/MS) [20]. The following cut-offs were used: amphetamine — 25 ng/mL; cocaine — 10 ng/mL; and Δ9-THC — 1 ng/mL.

2.4. Statistical tests

All the statistical tests were performed using the STATA software version 13 (StataCorp LP, College Station, Texas). The data were analysed through regression tests Tobit and Probit.

2.5. Ethics

This work was approved by the Ethics Committee of the Faculty of Medicine from the University of Sao Paulo, #135/14.

3. Results

Sample collection was performed during 5 days. A total of 764 drivers were invited to participate, and of those, only two (0.2%) refused, claiming lack of time.

All included drivers were men, with an average age of 42.5 years. The majority was married (71.1%) and many had studied for 8 years in school (41%). Regarding the employment, most of them worked for a company (67.7%) for an average of 15.6 years as truck drivers. The average daily work routine was 9.4 h and the average distance they were travelling was 614 km.

Of the total samples, 40 (5.2%) were considered positive for one or more substances. Cocaine was found in 21 samples (2.7%), followed by amphetamine in 16 samples (2.1%) and Δ9-THC in 8 samples (1.0%). Among the positive samples, we detected multiple use of illicit drugs in five cases: three samples were positive for cocaine and Δ9-THC, one sample was positive for cocaine and amphetamine, and another one sample positive for amphetamine and Δ9-THC (Table 1).