

Research Paper: Ethanol Intoxication and Road Accident Trauma Statistics in a Tertiary Hospital Complex of Cotonou City in Benin Republic



Bigot Cedric Egnonwa^{1*}, Chigblo Pascal², Assouto Pamphile¹, Gozo Adjoua Kattia², Goukoudadja Oswald², Hans-Moevi Akoue Aristote²

1. Department of Medicine and Medical Specialty, Faculty of Science and Health, University of Abomey-Calavi, Cotonou, Republic of Benin.

2. Department of Surgery and Surgical Specialty, Faculty of Science and Health, University of Abomey-Calavi, Cotonou, Republic of Benin.



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ABSTRACT

Background: Road traffic accidents are among the leading causes of morbidity and mortality in Benin Republic, in other words, a serious public health problem here. Consumption of alcoholic drinks is known as an important risk factor for road accidents. The aim of this preliminary study was to determine alcohol ingestion and its relationship with victims of road traffic accidents in Cotonou City, Benin.

Methods: It is a descriptive and analytic study which carried out during January-June 2016. In this study, ethanol concentration was measured in the victims of traffic accidents' blood. Information related to the injured people, their social characteristics, circumstances of accident occurrence, and the outcomes were also collected.

Results: In this study, 80 victims of road accidents were included. Most of the victims were men (64%), youth under 40 years (70%), and motorcyclists (83%). The overall prevalence of ethanol ingestion was 55% (64% in motorcyclists and 25% in motorists). Approximately, 16% of them were involved in fatal accidents. There was no association between ethanol ingestion frequency and factors such as the age of the injured, condition of the injured at the time of the accident, time of accident, and road condition on which the accident happened.

Conclusion: This study indicated that a lot of traffic accident victims had consumed alcoholic drinks shortly before the accident in Benin.

* Corresponding Author:

Bigot Cedric Egnonwa, MD

Address: Department of Medicine and Medical Specialty, Faculty of Science and Health, University of Abomey-Calavi, Cotonou, Republic of Benin.

Tel: +229 (9) 7180898

E-mail: bigot.ce@gmail.com

1. Introduction

Road traffic accidents are among the leading causes of morbidity and mortality all over the world. It is a serious public health problem. Every year, 1.3 million people die on roads and 20 to 50 million more people survive from road traffic accidents with serious consequences and disabilities [1]. Road traffic crashes are the leading cause of trauma cases managed in African hospitals [2]. They are responsible for more than 24 deaths out of 100000 inhabitants in Africa [3, 4]. That mortality rate is 2 times higher than Europe [3].

Consumption of alcoholic drinks is one of the main causes of this higher mortality rate [1, 5]. To address that scourge, legislative measures have been taken and a legal limit of Blood Alcohol Concentration (BAC) has been set for motor vehicle drivers. Although the World Health Organization (WHO) recommends setting the limit of BAC level to 0.5 g/L, most countries across the world which passed the law on this issue, have set the said limit to 0.8 g/L [1, 3].

In Benin, such a measure is difficult to be taken. The paucity of local data on the relationship between alcohol consumption and traffic accidents may be one of the obstacles for taking legal action on the matter. Therefore, this study was conducted to address that issue. Its objective was to describe the epidemiological and forensic aspects of alcohol ingestion among traffic accidents' victims in Cotonou City, Benin.

2. Materials and Methods

We carried out this cross-sectional study at the Emergency Care Clinic (CUAU) of the Center National Hospital University Hubert Koutoukou MAGA (CNHU-HKM) of Cotonou from January 2 to June 30, 2016. It focused on all the injured people admitted to the Clinic after a traffic accident. To be eligible, the injured should have been victims of a road accident in the city of Cotonou. Besides, they should have been admitted to the unit within a time limit of not more than 6 hours; they should have not received an infusion or solution of more than 500 mL before admission, and they should be at least 18 years old.

Each injured person was proposed to submit his or her the venous blood sample in order to measure the blood alcohol level. We collected 5 mL of venous blood in sodium fluoride tubes from each injured person who gave his or her consent. The patients whose sampling tubes

did not comply with the required standards or were not sufficiently filled, were excluded from the study.

Blood alcohol concentration was measured after the elimination of proteins from the collected blood through defecation by using DiaSys Ethanol Standard FS kit. Enzyme reaction with Alcohol Dehydrogenase (ADH) was the method used. In the presence of ADH, ethylic alcohol reduces NAD. The resulting NADH was then measured through colorimetric estimation using a soluble chromogen [6]. The tests were performed on Flexor-Selectra automated biochemistry analyzer. We used 0.8 g/L threshold as legal BAC.

In addition to blood alcohol level, the information related to the injured social characteristics, circumstances of accident as well as the outcomes were directly collected from the injured people or their relatives. The results were encrypted and then analyzed in Epi Info version 7. We used Fisher's exact test and the Chi-square tests to analyze the obtained data. We considered $P < 0.05$ as significant for all statistical tests. All the injured who participated in the survey did it voluntarily and gave us their written consent. This study has been approved by the Ethics Committee of the Faculty of Health Sciences of Cotonou.

3. Results

Characteristics of the injured

During the study course, a total of 867 injured people were admitted to the Emergency Care Clinic of CNHU-HKM after road traffic accidents. Of them, 233 met the inclusion criteria. Only 148 injured gave their consent. In the laboratory, 68 blood samples were excluded. Finally, the blood alcohol level was measured for 80 injured i.e. a final recruitment rate of 34.3%.

About 80% of the study population consisted of men so M:F ratio was 4 to 1. Mean age of the injured was 37 years ranged from 18 to 72 years. Sixty percent of those injured were less than 40 years old. About 53.8% of the injured people did not start or complete the primary study procedure. A total of 64 (80%) of the injured had no paid job on a regular basis. Six (7.5%) injured people claimed to have a history of alcohol addiction.

Circumstances of occurrence of accidents

The injured people traveled with two-wheel vehicles in 83.8% of cases. The rest consisted of light (3) or heavy (5) vehicle drivers and five were pedestrians. Car drivers accounted for 76.3% of the injured persons. Fifty (62.5%)

Table 1. The frequency of illegal blood alcohol level

Groups	Total Number of Cases in the Group	Number of Cases With Illegal Blood Alcohol Level	%
Two-wheel driver	50	32	64.0
Four-wheel driver	8	2	25.0
Passenger	17	9	52.9
Pedestrian	5	1	20.0
Total	80	44	55.0

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cases of the accident happened between 12 AM and 12 PM, and 40 (50.0%) accidents happened during the weekend. Those which happened on asphalted roads accounted for 51 (63.8%) cases. One injured person out of 4 (21 out of 80) admitted having ingested an alcoholic drink an hour before the accident or crash. Nine (42.9%) of them drank some beer. Thirteen accidents resulted in deaths.

Ethanol ingestion and associated factors

Among the study population, the average blood alcohol level was estimated at 1.19 g/L with a range from

0.027 to 4.1 g/L. A total of 44 (55.0%) injured people had blood alcohol level higher than 0.8 g/L. The most impacted group was the motorcyclists (Table 1). The frequency of ethanol ingestion in men was higher than women ($P=0.032$) (Table 2). Bi-variate analyses do not indicate an association between ethanol ingestion frequency and factors such as the age of the injured, condition of the injured at the time of the accident, time of the accident, and type of the road on which the accident happened.

Table 2. The prevalence of casualties with BAC* above recommended legal (0.8 g/L) in relation to the characteristics and circumstances of the accident

Characteristics	Groups	BAC<0.8 g/L (n=36)	BAC≥0.8 g/L (n=44)	Total (N=80)	%	P
Gender	Male	25	39	64	80.0	0.033
	Female	11	5	16	20.0	
Age group, y	18-29	12	12	24	30.0	0.66
	30-39	15	17	32	40.0	
	≥40	9	15	24	30.0	
Day of the accident	Weekday	19	21	40	50.0	0.65
	Weekend	17	23	40	50.0	
Time of accident	Day	12	21	33	41.3	0.19
	Night	24	23	47	58.7	
Driving license	Yes	20	33	53	66.3	0.67
	No	16	11	27	33.8	
Medium and high speed road	Yes	24	27	51	63.8	0.62
	No	12	17	29	36.3	

* BAC: Blood Alcohol Concentration

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Table 3. The consequences of the accident with BAC above recommended level

Characteristics	BAC<0.8 g/L		BAC≥à 0.8 g/L		Total		p
	n=36	(%)	n=44	(%)	N=80	(%)	
Multiple traumas	5	(13.9)	7	(15.9)	12	(15.0)	0.80
>5 days hospitalization	28	(77.8)	35	(79.5)	63	(78.8)	0.85

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Human consequences of ethanol ingestion

Thirteen (16.3%) injured people were admitted at the emergency care unit in a state of shock and 10 (12.5%) were presented with multiple traumas. The parts of the body most affected by traumatic injuries were pelvic limbs (31.5%), skull (25.8%), front (16.1%), thoracic limbs (12.9%), and trunk (9.6%). A total of 63 (78.8%) injured people were admitted to hospital for more than 5 days (Table 3). Two of those hospitalizations resulted in deaths. Bi-variate analyses did not reveal an association between BAC and the injury profile of the victim. Those accidents affected on average +3/-2 people with a range from 1 to 12 injured persons. Five (15.2%) car drivers involved in fatal accidents were under the influence of alcohol ingestion.

4. Discussion

This research work focused on the blood alcohol level of road accidents' victims admitted to CNHU-HKM. The method used for measuring blood alcohol level was the enzymatic method. Although gas chromatography is the standard method in that field, measurements through the enzymatic method with ADH has remained reliable for clinical uses [7].

Our study comprised 80 patients. The injured were mostly men (64%) and young under 40 years old (70%) who traveled by motorcycle (83%). Madougou et al. (2016) [8] already made the same observation during an epidemiological study on road accidents in the city of Cotonou. Similar trends were observed in most African countries, especially in Nigeria [2], Congo [9], and Tanzania [10]. The authors of those studies also put forward and emphasize the role of lighting and road condition in accidents. The fact that road accidents mostly happen at night and during the weekend is a well-known worldwide [11].

In our study, we observed that 55% of the injured people were confirmed with ethylic alcohol ingestion. That prevalence is three times higher than the one found out

in injured people who had confessed that they consumed alcohol before the accident. That difference reflects a sense of guilt and fear of sanction. Derry et al. (2017) found that 86% of motor vehicle drivers were aware of the fact that driving a motor vehicle after consuming alcohol was a dangerous behavior [12].

Motorcyclists were particularly involved with a prevalence of 64%. Among the injured car drivers, the prevalence of ethanol ingestion was estimated at 25%. The frequencies of ethanol ingestion noted in our cohort study are similar to those identified by Diakite et al. (2014) in Côte d'Ivoire [13]. In European countries, the prevalence of alcohol ingestion is lower. The prevalence was estimated at 35% in Portugal [14], 12% in Italy [15], 21% in Sweden [16] in car drivers and 45% among motorcyclists in Norway [17].

In those countries, car driving under the influence of alcohol was punished by law. The judicial system and police regular controls and penalties imposed on offenders are severe in general. In African countries where legal BAC are imposed, the controls are not frequent. In Ghana, only 8% of road users were aware of BAC legal limit and only 2% had undergone at least one police control [18]. In the United States, nearly 30% of the respondents interviewed during a study asserted that downward reevaluation of legal blood alcohol level for motorbike and car drivers would not affect their habits [19]. Thus prevention through sensitization must play an important role ahead of repression [1].

Alcohol ingestion affects road users' alertness and capabilities of driving [20]. A study conducted on car driving simulator by Wiedemann et al. (2018) had pointed out that vehicle drivers with a BAC higher than 0.08 g/L had longer reaction time and lower quality road holding [21]. Alcohol effect on drivers may be exacerbated by drug use. Association of alcohol and licit or illicit psychoactive substances, is increasingly higher among road users [15, 22, 23]. In Abidjan (Côte d'Ivoire), the frequency of simultaneous ingestion of ethanol and psy-

chotropic substances was estimated at 6.7% in road accident victims [13].

The findings of our study do not support an association between the severity of injuries and ethanol ingestion. Actually, in our study, the frequency of multiple traumas and long stays in hospital in the injured people under the influence of ethanol ingestions was similar to the injured people with a BAC less than 0.5 g/L. A study carried out in Hyderabad (India) highlights that injured people under the influence of alcohol ingestion are more often presented with severe injuries. That difference may be due to the small number of the injured people recruited in our study.

The accidents involving drivers under the influence of alcohol ingestion have been registered with more injured people and more deaths. Beydoun et al. (2014) [24] conducted a case-control study in the United States on 1057 injured people. They observed the same trends we have witnessed.

Approximately, 16% of drivers under the influence of alcohol ingestion were involved in fatal accidents. Those drivers thus ran the risk of charges on criminal proceedings. They were likely to get sued for “unintentional assault and battery that led to death” or for “negligence manslaughter”. Those criminal offenses may qualify for severe prison sentences. In practice, that type of prosecution is not common in Benin. However, it is not specific to Benin only. The drivers under the influence of alcohol ingestion, who arrive at the hospital as injured, are rarely prosecuted for criminal affairs for drunk driving [25] although it is permitted by laws. Only their civil liability is regularly incurred.

5. Conclusion

The findings of this preliminary study confirm that a lot of traffic accident victims had consumed alcoholic drinks shortly before the accident. Further research studies with larger samples and test performed with gas chromatography methods will help pinpoint the factors associated with that alcohol consumption and make sure if there is also a relationship between psychotropic substances and alcohol use among road users in Benin.

Ethical Considerations

Compliance with ethical guidelines

This study has been approved by the Ethics Committee of the Faculty of Health Sciences of Cotonou. All the

injured who participated in the survey did it voluntarily and gave us their written consent.

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Authors contributions

All authors contributed in preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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References

- [1] Goniewicz K, Goniewicz M, Pawłowski W, Fiedor P. Road accident rates: Strategies and programmes for improving road traffic safety. *European Journal of Trauma and Emergency Surgery*. 2016; 42(4):433-8. [DOI:10.1007/s00068-015-0544-6]
- [2] Onyemaechi NO, Nwankwo OE, Ezeadawi RA. Epidemiology of injuries seen in a Nigerian tertiary hospital. *Nigerian Journal of Clinical Practice*. 2018; 21(6):752-7. [DOI:10.4103/njcp.njcp_263_17]
- [3] World Health Organization. *Global status report on road safety 2015: Supporting a decade of action*. Geneva: World Health Organization; 2015.
- [4] Adelaye D, Thompson JY, Akanbi MA, Azuh D, Samuel V, Omoregbe N, et al. The burden of road traffic crashes, injuries and deaths in Africa: A systematic review and meta-analysis. *Bulletin of the World Health Organization*. 2016; 94(7):510-21A. [DOI:10.2471/BLT.15.163121]
- [5] Eby DW, Molnar LJ, Kostyniuk LP, Louis RM, Zanier N, Lepkowski JM, et al. Perceptions of alcohol-impaired driving and the blood alcohol concentration standard in the United States. *Journal of Safety Research*. 2017; 63:73-81. [DOI:10.1016/j.jsr.2017.08.013]
- [6] Léric H, Kaplan JC, Broun G. [Enzymatic assay of blood alcohol by colorimetric micromethod (French)]. *Clinica Chimica Acta*. 1970; 29(3):523-8. [DOI:10.1016/0009-8981(70)90024-0]
- [7] Kristoffersen L, Skuterud B, Larssen BR, Skurtveit S, Smith-Kielland A. Fast quantification of ethanol in whole blood specimens by the enzymatic alcohol dehydrogenase method:

- Optimization by Experimental Design. *Journal of Analytical Toxicology*. 2005; 29(1):66-70. [DOI:10.1093/jat/29.1.66]
- [8] Madougou S, Chigblo PS, Tchomtchoua AS, Lawson E, Yetognon L, Hans-MoeviAkue A. [Incidence and impacts of road traffic accidents among motorcycle taxi drivers in tropical areas (French)]. *Revue de Chirurgie Orthopédique et Traumatologique*. 2016; 102(2):211-4. [DOI:10.1016/j.rcot.2016.01.005]
- [9] Kandolo SI, Matungulu CM, Mukanya PK, Umba IK, Kabamba JN, Numbi OL, et al. [Factors associated with road accidents in the city of Lubumbashi (French)]. *Santé Publique*. 2014; 26(6):889. [DOI:10.3917/spub.146.0889]
- [10] Boniface R, Museru L, Kiloloma O, Munthali V. Factors associated with road traffic injuries in Tanzania. *Pan African Medical Journal*. 2016; 23:46. [DOI:10.11604/pamj.2016.23.46.7487]
- [11] du Plessis M, Hlase KK, Blumenthal R. Ethanol-related death in Ga-Rankuwa road-users, South Africa: A five-year analysis. *Journal of Forensic and Legal Medicine*. 2016; 44:5-9. [DOI:10.1016/j.jflm.2016.08.006] [PMID]
- [12] Damsere-Derry J, Palk G, King M. Motorists' knowledge, attitudes and practices toward alcohol-impaired driving/riding in Ghana. *Traffic Injury Prevention*. 2017; 18(1):28-34. [DOI:10.1080/15389588.2016.1193172]
- [13] Diakite A, Gadegbeku B, Dano DS, Yapotte H, Botti K, Malan AK, et al. Road traffic injuries involving illegal blood alcohol levels and psychoactive drug use in Côte d'Ivoire: A hospital-based study. *Universal Journal of Public Health*. 2014; 2:154-62. [DOI:10.13189/ujph.2014.020503]
- [14] Costa N, Silva R, Mendonça MC, Real FC, Vieira DN, Teixeira HM. Prevalence of ethanol and illicit drugs in road traffic accidents in the centre of Portugal: An eighteen-year update. *Forensic Science International*. 2012; 216(1-3):37-43. [DOI:10.1016/j.forsciint.2011.08.013]
- [15] Carfora A, Campobasso CP, Cassandro P, Petrella R, Borriello R. Alcohol and drugs use among drivers injured in road accidents in Campania (Italy): A 8-years retrospective analysis. *Forensic Science International*. 2018; 288:291-6. [DOI:10.1016/j.forsciint.2018.05.003]
- [16] Ahlner J, Holmgren A, Jones AW. Prevalence of alcohol and other drugs and the concentrations in blood of drivers killed in road traffic crashes in Sweden. *Scandinavian Journal of Public Health*. 2014; 42(2):177-83. [DOI:10.1177/1403494813510792]
- [17] Christophersen AS, Gjerde H. Prevalence of alcohol and drugs among motorcycle riders killed in road crashes in Norway during 2001-2010. *Accident Analysis & Prevention*. 2015; 80:236-42. [DOI:10.1016/j.aap.2015.04.017]
- [18] Damsere-Derry J, Afukaar F, Palk G, King M. Determinants of drink-driving and association between drink-driving and road traffic fatalities in Ghana. *The International Journal of Alcohol and Drug Research*. 2014; 3(2):135-41. [DOI:10.7895/ijadr.v3i2.135]
- [19] Eby DW, Molnar LJ, Kostyniuk LP, St Louis RM, Zanier N, Lepkowski JM, et al. Perceptions of alcohol-impaired driving and the blood alcohol concentration standard in the United States. *Journal of Safety Research*. 2017; 63:73-81. [DOI:10.1016/j.jsr.2017.08.013]
- [20] Martin TL, Solbeck PAM, Mayers DJ, Langille RM, Buczek Y, Pelletier MR. A review of alcohol-impaired driving: The role of blood alcohol concentration and complexity of the driving task. *Journal of Forensic Sciences*. 2013; 58(5):1238-50. [DOI:10.1111/1556-4029.12227]
- [21] Wiedemann K, Naujoks F, Wörle J, Kenntner-Mabiala R, Kaussner Y, Neukum A. Effect of different alcohol levels on take-over performance in conditionally automated driving. *Accident Analysis & Prevention*. 2018; 115:89-97. [DOI:10.1016/j.aap.2018.03.001]
- [22] AL-Abdallat IM, Al Ali R, Hudaib AA, Salameh GAM, Salameh RJM, Idhair AKF. The prevalence of alcohol and psychotropic drugs in fatalities of road-traffic accidents in Jordan during 2008-2014. *Journal of Forensic and Legal Medicine*. 2016; 39:130-4. [DOI:10.1016/j.jflm.2016.01.018]
- [23] Das A, Gjerde H, Gopalan SS, Normann PT. Alcohol, drugs, and road traffic crashes in India: A systematic review. *Traffic Injury Prevention*. 2012; 13(6):544-53. [DOI:10.1080/15389588.2012.663518]
- [24] Beydoun H, Teel A, Crowder C, Khanal S, Lo BM. Past blood alcohol concentration and injury in trauma center: Propensity scoring. *The Journal of Emergency Medicine*. 2014; 47(4):387-94. [DOI:10.1016/j.jemermed.2014.06.024]
- [25] Green RS, Kureshi N, Erdogan M. Legal consequences for alcohol-impaired drivers injured in motor vehicle collisions: A systematic review. *Accident Analysis & Prevention*. 2015; 80:106-16. [DOI:10.1016/j.aap.2015.04.005]