

Central Nervous System Stimulants: effect on visual functions and occurrence of road traffic accidents



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MK Oladehinde*, Bernice O Adegbehingbe**, AO Adeoye*, AO Onakoya**

*Ophthalmology Unit, Department of Surgery, College of Health Sciences Obafemi Awolowo University, Ile-Ife

**Ophthalmology Unit, Department of Surgery, College of Medicine, Lagos University Teaching Hospital, Lagos all in Nigeria

Central Nervous System Stimulants: Effect on visual functions and occurrence of road traffic accidents.

OBJECTIVE: *To determine the influence of the use of central nervous system (CNS) stimulants on visual functions and occurrence of road traffic accidents (RTA) amongst commercial drivers.*

DESIGN: *A cross-sectional study in which two hundred and fifteen consecutive drivers were interviewed and their eyes examined.*

SETTINGS: *Ife Central Local Government Area (LGA) of Osun State, Nigeria.*

MATERIALS AND METHODS: *Out of the estimated 270 commercial drivers registered in the four major parks of the LGA, 215 consecutive drivers participated in the survey. Questionnaires were administered by face – to – face interview and the drivers' eyes examined by the authors.*

RESULTS: *The prevalence of visual impairment (visual acuity < 6/18) in the better eye without correction was 3.3%, and there was a significant association between uncorrected visual acuity impairment in the better eye and RTA ($p = 0.0152$). The prevalence of refractive error was 8.4%, but none of these drivers wear corrective glasses.*

Alcohol consumption is common (57.7%) amongst the drivers, and there was a significant association between alcohol consumption and RTA ($p = 0.00124$). There was also a significant association between the use of CNS stimulants (kolanut, marijuana and cigarette) and RTA ($p = 0.005$).

CONCLUSION: *It was therefore concluded that visual impairment in the better eye, alcohol consumption and the use of other CNS affecting substances contribute to the occurrence of RTA among the drivers.*

KEY WORDS: Alcohol, CNS stimulants, Visual impairment and driving.

Introduction

The estimated annual global death toll from RTA reported¹ was 700,000. On European Union roads alone, an average of 46,000 deaths occurred annually². Also about 972 deaths and 18,936 injuries were reported from RTA in Karachi yearly.³

In Nigeria, between 1980 and 1989, a total of 343,032 RTA was reported, of which there were 98,168 deaths and 244,864 individuals were injured⁴. In Osun state of Nigeria, a total of 1,298 RTA was reported between 2000 and 2002. This comprised 318, 481 and 499 for the years 2000, 2001 and 2002 respectively. The numbers of deaths reported were 232, 345 and 375, whilst injured

persons were 368, 578 and 667 respectively for the years 2000, 2001 and 2002.⁵

The morbidity and mortality from RTA have been on the increase in the developing countries including Nigeria, however, the reverse is the case in the developed countries.⁶⁻⁸

Though 95% of the sensory requirement for driving has been shown to be visual⁹, various workers however found no correlation between visual impairment and the occurrence of RTA⁹⁻¹¹. Rather, other factors, such as the habits of the drivers such as the use of CNS stimulants and the level of compliance to the traffic laws, have been shown to contribute to the occurrence of RTA^{12,13}. There is enough evidence that alcohol, which is a CNS depressant is a major factor in RTA.^{14, 15} Avery¹⁶ found that about 40% of drivers involved in fatal RTA had blood level of alcohol above the legal limit of 0.08% and 0.04% of blood concentration for private and commercial drivers respectively. Alcohol depresses the cerebral centers, thus making the drivers to overestimate their

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For correspondence: Dr Bernice O Adegbehingbe, Ophthalmology Unit, Department of Surgery, College of Health Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria (e-mail: berniceola2003@yahoo.co.uk)

abilities and underestimate their mistakes. Awareness and reaction to stimuli, and muscular coordination are all impaired by alcohol.^{15, 17} The objective measurement of blood alcohol level (BAL) is rarely mentioned in Nigerian studies, due to lack of appropriate instrument of measure.

Tobacco, which is the active ingredient in cigarette is known to reduce vision by reducing oxygen intake.¹⁷ The carbon monoxide produced while smoking also leads to impaired retinal sensitivity.¹⁷ Conjunctiva irritation, divided attention between smoking and driving, and fume deposit on the windscreen can all contribute to the occurrence of RTA. Nicotine in cigarette is also known to cause depression of reflex reactions.¹⁷ Chronic smoking could result in tobacco amblyopia, with its characteristic field defects, reduced central vision and acquired colour vision defect.

Commercial vehicle drivers were chosen for this study because they spend longer hours on the roads than all other categories of road users. This had been shown to increase by 12 folds the risk of RTA, when compared to private motorists⁹.

Ife Central LGA is suitable for this study in Osun State of Nigeria, being the largest and most populated LGA in Osun State of Nigeria as reported in the National population diary of the year 2000, with a population of 96,580 people comprising 48,560 males and 48,020 females. This population is serviced by commercial vehicles distributed over four (4) major motor parks where this study was carried out.

Methods

Approval of the protocol for this survey was obtained from the Research and Ethical Committee of the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife.

A cross-sectional study in which two hundred and fifteen consecutive drivers seen in all the 4 major motor parks (Ilesa, Lagere, Mayfair and Campus gate motor parks) in Ife central LGA was conducted. There were 180 vehicles registered in all the garages. The total estimate of all the drivers was thus put at 270 because about 50% of the vehicles have two drivers each.

The minimum sample size was estimated using the formula:

$$N = \frac{pqZ^2}{d^2}$$

where:

N = Minimum sample size required for the study;

p = Estimated prevalence of drivers with impaired vision¹¹;

q = 1 - p ;

d = Precision level acceptable;

Z = Constant for 95 % probability of not exceeding the maximum sampling error, i.e. confidence level.

Estimates

p = 12.9 % (i.e. 0.129). Which is the highest prevalence value obtained in various studies conducted amongst different categories of drivers in Nigeria¹¹.

q = 1 - 0.129 = 0.871

d = 0.05

z = 1.96 → Z² = (1.96)² = 3.842

$$N = \frac{0.129 \times 0.871 \times (1.96)^2}{(0.05)^2}$$

N = 172.65 Approximate 173.

Minimum Sample Size = 173.

The minimum sample size calculated from the above was 173. However, 215 drivers participated fully in the study. Collective education of the drivers was done on each visit, after which Verbal consent was sought from consecutive drivers that presented for examination.

Two assistants were trained to assess the visual acuity of the subjects after an initial pretest on the degree of agreement. A questionnaire was administered to each driver by the ophthalmologist after explaining the need to conduct the study. The interview was conducted in English language, with language translation in Yoruba when necessary.

Information collected included demographic data, driving history, social history, ophthalmic history and history of previous eye examination.

Detailed eye examination was done on all the respondents by the one consultant ophthalmologist while administration of questionnaires and visual acuity assessment were done by two previously trained assistants.

Visual acuity was assessed in the open field during the day using the Snellen's chart (or illiterate E chart) placed at 6 meters from the respondents. Each eye was tested separately unaided and with pinhole where visual acuity was less than 6/6. Visual acuity of 6/6 - 6/18 was considered to be normal, < 6/18 - 6/60 was classified as visual impairment, and < 6/60 - 3/60 was classified as severe visual impairment while visual acuity less than 3/60 was classified as blindness.¹⁸

Colour vision was tested using the Ishihara pseudoisochromatic plates while stereopsis was assessed using the TNO test chart. Visual field test was done using the Humphrey automated perimeter. Extra-ocular muscle activity was tested in all directions of gaze, seeking for any paresis or paralysis of the extra-ocular muscles. Diplopia was sought for in all directions of gaze.

Pen torch examination of the anterior segment was done in each eye and findings recorded.

Funduscopy was done without dilatation on all the respondents using the Keeler professional direct ophthalmoscope, in a relatively darkened common room at

the motor parks. Dilated funduscopy was done when necessary, for instance when the ocular media is hazy precluding detailed view of the fundus, after which such drivers were advised not to drive for the day. Intra-ocular pressure was measured on all respondents using a Perkins applanation tonometer.

Respondents who required further evaluation or medical/surgical attention were referred to the eye clinic of the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) Ile-Ife, with a designed referral form.

Data obtained was analyzed using EPI-INFO statistical software. Odds ratios, 95 percent confidence intervals, and tests of trend were calculated using logistic regression. The relationships between categorical data were analyzed using Chi square (X^2) test. Yates's corrected chi square and the appropriate Fisher's exact p value were used where the value of any cell was less than 5.

Results

A total of 215 drivers participated in the survey representing about 80% of the estimated 270 drivers in the parks. Their ages ranged between 21 and 75 years (mean age was 41.5 ± 6.7 years).

Table I shows the age distribution of the drivers. Majority (34.9%) were between the age group 31-40 years, another 33.0% were between 41-50 years. Most of the respondents (83.6%) had no eye test before they were issued their driver's licenses. A significant proportion (22%) got their licenses without undergoing any form of driving test. Majority (92.1 %) of the respondents could read and comprehend the road signs; 91.2% had formal education, 54.9% of these had some sort of post- primary education. . Majority (84.2%) of the drivers did not start driving or obtain a driver's license (94.0%) until the approved age of 18 years or more, while 15.8% of the drivers started driving before the approved age. An unlicensed driver was however seen at one of the motor parks.

The presenting visual acuity in the better eye of the drivers was as shown in Table II. Majority (96.7%) had normal vision while a few (3.3%) had mild to moderate degree of visual impairment. None of the driver had severe visual impairment.

Table IV shows the relationship between alcohol consumption just before driving and occurrence of RTA. Twenty-four (55.8%) out of the 43 drivers who admitted to consumption of alcohol while at work i.e. just before driving were involved in road traffic accident while 33 (19.2%) of those who did not consume alcohol were involved in RTA. The risk of been involved in road traffic accident is higher in those with moderate alcohol consumption (Risk ratio 2.90, Odds ratio 5.32, 95% confidence interval 2.63 to 10.78, $X^2 = 23.7$). There is a statistically significant relationship between alcohol con-

TABLE I – Age distribution of the drivers

Age (Years)	Number	Percentage (%)
21 – 30	34	15.8
31 – 40	75	34.9
41 – 50	71	33.0
51 – 60	28	13.0
61 – 70	6	2.8
71 – 80	1	0.5
Total	215	100

TABLE II – Presenting visual acuity in the better eye of drivers

Visual Acuity	Number	Percentage (%)
6/6 – 6/18 normal	208	96.7
<6/18 – 6/60 visual impairment	7	3.3
<6/60 – 3/60 severe visual Impairment	0	0.0
<3/60 blindness	0	0.0
Total	215	100

sumption prior to driving and involvement in road traffic accident.

Table V shows the relationship between smoking and the involvement in RTA. Out of the 74 drivers who indulged in the habit of smoking, 27(36.5%) were involved in RTA. whilst of the 141 non-smokers only 30 (21.3%) were involved in RTA. There was a statistically significant association between cigarette smoking and involvement in RTA. (Risk ratio 1.72, Odds ratio 2.13, 95% confidence interval 1.15 to 3.94, $X^2 = 1.11$).

Ninety (41%) drivers used central nervous system stimulants. 125 (58.1%) did not use any of the stimulants. kola nut and marijuana were the substances more commonly abused, 84 drivers (39.1%) and 6 (2.8%) regularly consumed kola nut and marijuana respectively. Table 6 shows that 35 (38. 9%) of the 90 drivers who used CNS stimulating were involved in RTA while 22 (17.6%) of the 125 drivers who did not use CNS stimulating drugs were involved in RTA. There is a statistically significant association between the intake of CNS stimulant and involvement in RTA. (Risk ratio 2.21, Odds ratio 2.98, 95 % confidence interval 1.60 to 5.55, $X^2 = 1.40$)

The perceived causes of accident among drivers were over speeding 20 (35.1%), faulty vehicles including burst tyres in 19 (33.3%) and others {bad road and drunkenness (10.5% each and tiredness/fatigue and unknown causes 3 (5.3% each)} (Table VI). None of the drivers thought that road accident could be attributed to poor vision. Majority, 208 (96.7%) have normal visual acuity, while 7 (3.3%) have visual impairment in the better eyes. Among those with normal visual acuity in their better eyes, 51 (24.5%) had been involved in road traffic accident, while 157 (75.5%) were never involved in road

TABLE III – Relationship between alcohol consumption before driving and road accidents

Alcohol consumed prior driving	Road traffic accident		Total
	Yes	No	
Yes	24	19	43
No	33	139	172
Total	57	158	215

$X^2 = 23.69$ $df = 1$ $P = 0.000002$ Risk ratio 2.91

TABLE IV Relationships between smoking and road traffic accidents

Smoking	Road traffic accident		Total
	Yes	No	
Yes	27	47	74
No	30	111	141
Total	57	158	215

$X^2 = 5.76$, $df = 1$ $P \text{ value} = 0.010$, Risk ratio 0.37

TABLE V – Relationships between the use of CNS stimulants and road traffic accidents

Stimulant	Road traffic accident		Total
	Yes	No	
Yes	35	55	90
No	22	103	125
Total	57	158	215

$X^2 = 11.31$ $df = 1$ $P \text{ value is} = 0.005$ Risk ratio 2.21

TABLE VI – Drivers' perceived causes of road traffic accidents

Causes	Frequency	Percentage (%)
Bad road	6	10.5
Drunkenness	6	10.5
Faulty vehicle	19	33.3
Overspeeding	20	35.1
Tiredness/fatigue	3	5.3
Unknow causes	3	5.3
Total	57	100

traffic accident. The p value = 0.015, hence there is a statistically significant association between visual impairment in the better eye and RTA involvement.

Discussion

Various habits of the drivers before and while driving have been shown to be of importance in the occurrence of RTA. Habits such as alcohol consumption and the use of central nervous system stimulants such as mari-

juana, kolanut and cigarette smoking, have been implicated in the occurrence of RTA^{12, 17}. They affect the cognitive and motor functions, with a negative consequence on road safety.

Drivers in the age range 31 – 50 years were responsible for majority of road traffic accidents in this study. This is similar to the finding in Enugu, where Effiong¹² reported that 72.45% of the prevalence of RTA was contributed by the age bracket 31 – 50 years. The finding in this study agreed with the result of other workers,^{12, 19, 20} that the working class, made up of young adults and early middle age groups were mostly involved in RTA.

The prevalence of visual impairment of 3.3% found in this study is higher than those found in drivers of similar categories from previous studies.^{12, 21, 22} This can be explained partly by the fact that these other studies used the best or pinhole corrected visual acuity for their analysis, while the presenting visual acuity was used in this study; this was because all of the drivers whose vision could have been improved with optical devices had none. This is consistent with the results of other researchers that a number of drivers in Nigeria operate on the roads with vision below the legal requirement^{12, 23}. However, Nwosu²³ in Ibadan reported a prevalence of 3.1% amongst government drivers which is in agreement with the finding in this study.

Various habits of the drivers before and while driving have been shown to be of importance in the occurrence of RTA. Habits such as alcohol consumption and the use of central nervous system stimulants e.g. marijuana, kolanut and cigarette smoking, have been implicated in the occurrence of RTA.^{12, 14-17} They affect the cognitive and motor functions, with a negative consequence on road safety.

This study revealed that alcohol consumption was common amongst the drivers and that a high proportion (20.0%) consumed alcohol just before driving. One should also note that a statistically significant proportion of the drivers who had been involved in RTA consumed alcohol just before commencement of driving. This is in agreement with the results in other studies^{12, 14-17, 24}. This further highlights the need for intense education against driving when under the influence of alcohol. Non availability of equipment for assessing the blood alcohol levels in the country for now warrants an outright blanket ban on driving under the influence of alcohol. Stiff penalty should also be attached to the violation of this law and the traffic law enforcement agents should be properly educated on the need to enforce the law to the letter.

Cigarette smoking has also been implicated in the occurrence of RTA.²² The divided interest caused by smoking while driving and the fume deposit on wind screen have been adduced as likely causes of RTA.²². Nicotine which is the active ingredient in cigarette is known to reduce vision by causing impairment in retinal sensitiv-

ity, through the effect of carbon monoxide produced during smoking. It is also known that nicotine suppresses the reflex reaction, which may be vital in prompt reaction to situations on the roads. Tobacco amblyopia and acquired colour defect have also been noted in chronic tobacco consumption¹⁷.

In this study, there was a significant association between cigarette smoking and RTA, ($P= 0.0095$). This result should however be interpreted with caution because it does not take into consideration the duration of smoking and whether the drivers were smoking at the time they had the accidents. The other CNS stimulants used by the drivers in this study were marijuana and kolanut. Majority of the drivers however were not forthcoming with information on the use of CNS affecting substances, hence the data presented may be an underestimation of the true situation. However, there was a statistically significant association between the consumption of CNS affecting substances and the occurrence of RTA ($p= 0.005$). This result is in agreement with what was found in Effiong's study amongst commercial drivers in Enugu¹². Nwosu²³ however did not find any statistically significant association between use of stimulants and RTA amongst government drivers in Ibadan.

Though majority of drivers had driving test before obtaining their licenses, but the finding of an unlicensed driver amongst commercial vehicle operators is an indictment on the activities of the appropriate law enforcement agencies.

The prevalence of RTA of 26.5% as seen in this study is lower than 43.6% found in similar study in Enugu¹². Enugu is a bigger and more industrialized city than Ife, people in such big cities tend to be in a hurry in pursuit of their economic activities and this may predispose to increase in the occurrence of RTA. The prevalence of RTA found amongst government drivers in Ibadan by Nwosu²³ was 3.5%. This is lower than the prevalence in this study because government drivers are possibly more careful because many government agencies often give incentives for accident free driving, also it's assumed that they spend lesser hours on the roads than the commercial drivers.

Various reasons were attributed to RTA in this study, but it is however surprising that none of the drivers attributed the cause of RTA to poor vision. It implies that most drivers do not yet appreciate the importance of good vision in road safety. Hence those with RTA caused by visual impairment may not be aware of their visual status because they develop this problem over time and may just be used to their poor sight. Effiong¹² found that 3.39% of the cases of road accidents in her study were caused by poor vision.

In conclusion, this study revealed that the use of CNS stimulants and alcohol consumption was common amongst the drivers and there is a significant association between RTA and alcohol consumption, CNS stimulants and visual impairment. Majority of commercial drivers

with visual impairment and refractive errors never had an eye test before. Driving under the influence of alcohol and stimulants should be absolutely banned. Regular education of the populace especially drivers on the adverse effects of these agents is strongly recommended.

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Commento e Commentary

PROF. PIER ENRICO GALLENGA
Direttore Clinica Oculistica
dell'Università di Chieti - Chieti

Rientra nella routine ospedaliera ricoverare il trauma da incidente stradale con contusione cranica in reparto chirurgico di osservazione breve.

È dunque opportuno prendere coscienza dei dati riportati nella ricerca pubblicata per una corretta indagine anamnestica e per la comprensione olistica del traumatizzato: nei paesi industrializzati è comune "la strage del sabato sera", picco assurdo di incidenti correlati a libertà dal lavoro, a disponibilità di denaro settimanale e di tempo per il 'morning after the night before', occasione di incontri occasionali o prenotati, occasione di eccessi.

La visione analitica di un'area urbana subsahariana qui offerta, dimostra come i comportamenti perversi coincidano con la tendenza ad uno sviluppo omologabile, da includere dunque nei criteri di adeguamento a una civiltà 'di mercati' piuttosto che ad una civiltà 'dei consumi' o meglio ad una "civiltà" tout court.

Lo studio è stato condotto su autisti professionali e conferma come in generale gli stimolanti del CNS possano interagire con la performance dell'apparato visivo e del comportamento su strada. "Alcohol consumption is common (57.7%) amongst the drivers, and there was a significant association between alcohol consumption and RTA (p = 0.00124). There was also a significant association between the use of CNS stimulants (kolanut, marijuana and cigarettes) and RTA (p = 0.005)."

Ciò che è ovviamente tanto più vero per i privati che affrontano la guida sotto carico acuto e occasionale di farmaci da abuso. La cultura della prevenzione, la diffusione dell'informazione sugli effetti avversi dei farmaci che interagiscono sul CNS sembra essere l'unico – per quanto blando e disatteso e inascoltato – mezzo per arginare e contenere gli inutili drammi conseguenti agli abusi, in un mondo che cerchi di liberarsi dalle guerre e di dare alle generazioni motivi di crescita e non di autodistruzione. È merito degli Annali aprire uno spiraglio su queste problematiche tutt'altro che collaterali benché apparentemente estranee, pubblicando questo report-denuncia sociale che focalizza l'aspetto oftalmico ma si presta appunto a ben più ampie considerazioni.

It is a consolidated praxis to admit in short observation surgical wards the victims of road accidents with cranial contusion. Therefore it is opportune to know the data of this study for a correct inquiry history and to have a complete comprehension of the injured patient: in industrialized countries it is nowadays frequent the "Saturday night massacre", absurd peak of road accidents correlated to time free from work, free weekly money and enough time for the 'morning after the night before', occasion for occasion or programmed encounters, when the transgression is easy.

The offered analytical description of a subsaharian urbane area demonstrates as the wicked behaviours coincide with an inclination toward an homologous development, to be comprised in the actual equalization criteria to a market civilization instead than to a consumer civility, or better to a "civility" tout court. The study has been made of professional drivers and confirms as in general the stimulating drugs for CNS can interact with the performance of the sight apparatus and of the behaviour on the road. "Alcohol consumption is common (57.7%) amongst the drivers, and there was a significant association between alcohol consumption and RTA (p = 0.00124). There was also a significant association between the use of CNS stimulants (kolanut, marijuana and cigarettes) and RTA (p = 0.005)."

With evidence this is also more true for private drivers that undertake the guide under an acute and occasional misuse of drugs. The culture of prevention, the diffusion of information on the adverse effects of the drugs that interact with CNS seems to be the only mean – though mild and not followed because not listen – to dam and restrain the avoidable dramas that can follow to the abuse, in a world which attempts to be free from wars and to give the new generations the aim of growing and not the self destruction. Annali Italiani di Chirurgia must be credited to open at least a glance on these problems, that are not of second value although seemingly extraneous, in publishing this social report-denunciation, that highlights the ophtalmic aspect, but opens the minds to wider considerations.