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Visual Function of Drivers and its Relation to the Occurrence of Road Traffic Accidents in Saudi Arabia

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Abstract

BACKGROUND: The mortality rate due to road traffic accidents (RTA) is significantly high in Saudi Arabia (SA) compared to other countries. The visual function which includes good visual acuity (VA) and binocular vision are very important factors that can contribute to the incidence of RTA.

AIM: The aim of this study is to investigate the association between refractive errors (REs) and the RTA in SA.

METHODS: A total of 354 participants (mean age 22.67 ± 3.22 years) were recruited randomly to participate in this study from the population of Qassim district. Data collected using the questionnaire included participants' age, sex, and education level, ocular and medical history, driving history as well as history of RTA. Ocular health examination including VA, RE measurements, and binocular vision function vision was measured and analyzed.

RESULTS: The results of this study show that 48.3% of drivers had some form of REs with 3.4% being visually impaired. 217 (61.3%) of participants have had an RTA, and 119 (54.9%) of them have had more than two accidents in the past two years. The findings show no significant association between the occurrence of RTA and uncorrected REs or binocular vision dysfunction.

CONCLUSION: Our data showed significantly higher rate of RTA among Saudi drivers which is much higher than any country in the world. The current Saudi regulations for obtaining driving license need to be modified, with implementing a comprehensive eye examination prior to acquiring or renewing drivers' licenses.

Introduction

Road Traffic accidents (RTA) are a significant public health issue in many countries [1], and a leading cause of death worldwide with an estimated annual death of 1.2 million and 50 million injuries [2]. There is a growing concern about the increase in the number of road traffic injury (RTI) every year [3]. In Saudi Arabia (SA), RTI is considered the third leading cause of death [4], and the World Health Organization (WHO) reported that the mortality rate due to RTA is 24.8/100,000 among Saudi citizens which is significantly greater than other countries [5].

There are many factors that may contribute to the incidence of RTA. These may include poor maintenance of roads, unsafe motor vehicles, and the dangerous behavior of drivers [6], [7]. In addition, excessive speeding, passing a red light, driving without seatbelt are common examples of traffic violations related with higher incidence of RTI worldwide and in SA [8].

Many countries have recognized the necessity of increasing public safety, and have used a number of requirements for obtaining a driver license. Taylor (1982) found that 95% of the sensory requirement for driving was visual ability [9]. The visual function which includes good visual acuity (VA), color vision, and binocular vision are very important factors that can contribute to the incidence of RTA [10], [11], [12]. There are variations in the standards required for driving in different countries. The UK requires a binocular visual field of at least 120 horizontally with no binocular visual field defect of 20° above or below the horizontal meridian [13]. In the USA, for obtaining a driver license the VA has to be 6/12 (20/40) or better (one or both eyes) with or without corrective lenses, whereas the binocular visual field has to be 110° to 140° in most states [13]. Unfortunately, In SA, according to the council of ministers in Act No 36\4, there are no specific visual requirements needed to be met before acquiring a driving license. The ministry of interior represented by the traffic department also did not clarify any details about the visual requirements for driving [14].

Different studies have investigated the relationship between occurrence of RTA and visual function with no equivocal findings. A study examined the association between visual function and the occurrence of RTA in 215 Nigerian drivers (aged between 21 and 75 years old). They found that poor VA is significantly associated with occurrence of RTA [12]. Other studies have also reported an association between occurrence of RTA and visual function[10], [11]. On the other hand, studies from Ghana and elsewhere have reported no association between RTA occurrence and visual function [15], [16], [17], [18], [19]. The reason for the lack of association between occurrence of RTA and visual impairment has been attributed to certain factors. These include the multifactorial causation of RTA and unavailability of drivers with poor vision because of death from RTA or cessation of driving [19].

Recently, the WHO reported that the increasing prevalence of uncorrected refractive errors (REs) is causing a major public health issue in many developing countries [20]. Uncorrected REs have been shown to have a huge negative impact on both prosperity and quality of life [20]. A study found that individuals with uncorrected REs have increased levels of depression and increased risk of accident or death [21].

In SA, many studies have found higher prevalence of REs among Saudi populations [22], [23], [24], [25]. Al-Batanony (2016) conducted a study to determine the prevalence of the REs for 223 students aged between 17 and 23 years old. The results showed that the prevalence of uncorrected REs was 72.2% [22]. Given the high prevalence of uncorrected refracted errors and the significantly higher rates of RTA in SA, there was, therefore, a need to investigate any association between uncorrected RE and RTA. Thus, the aim of this study is to investigate the association between uncorrected REs and the RTA in SA.

Methods

This is a cross-sectional study involving 354 participants who were recruited randomly to participate in this study from the population of Qassim district. A structured questionnaire was used for data collection as well as clinical examination. Data collected using the questionnaire included participants' age, sex, and education level, ocular and medical history, driving history as well as history of RTA in the last 2 years. Ocular health examination including measurements of VA, RE measurements, and binocular vision function vision were measured in the clinic of optometry department.

The uncorrected distance VA was measured using an Auto chart Projector with the Snellen's chart at 6 m. Binocular vision function was assessed using a cover–uncover test at both distance (3 m) and near (40 cm), while participants were fully corrected with the distance vision correction. RE for all participants was measured using autorefractor (Nidek AR-310 a) and 3 static measurements of RE were averaged for each eye. These measurements were averaged and calculated as the mean spherical equivalent (MSE).

This study was approved by the university ethical committee and all study participants gave informed consent to participate. The study was carried out according to the tenets of the Helsinki Declaration for the conduct of medical research with human participants.

Data analysis

In this study, emmetropia was defined as a MSE RE between -0.50 D and +0.50 D; myopia as MSE > −0.50D; and hyperopia as MSE > +0.50 D; astigmatism was defined as −0.50D cylinder or worse in the better eye [26]. VA greater than 0.2 logMAR is classified as normal vision, whereas VA of less than 0.2 logMAR is considered as poor vision [15]. Data were collected from both eyes, however, only data from the right eye is presented and analyzed [27].

Data were analyzed using the (SPSS) version 21.0. Appropriate descriptive and inferential statistics were performed to report the findings of the study. For statistical significance, a p = 0.05 or less was considered to be significant. The associations between categorical data were analyzed using Chi square (χ^2) test.

Results

Study participants

A total of 354 male drivers were recruited for this study. The participants were aged 20–43 years with a mean age of 22.67 ± 3.22 years. About 91% of the respondents were aged 25 years and below. The participants who reported their ages indicated that they have been driving for between 2 and 25 years (mean = 4.78 ± 3.39), (Figure 1).

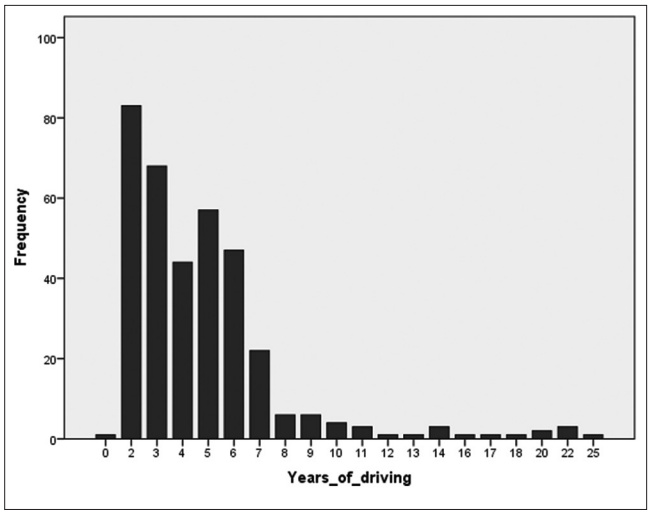

Figure 1: The distribution of number of years that the participants have been driving

RE and history of RTA

Of the 354 participants, 141 (39.8%) had myopia, 30 (8.5%) had hyperopia while the remaining 183 (51.7%) had no significant RE (emmetropia). Of the 354 who reported whether they have had an RTA in the past 2 years, 217 (61.3%) have had an RTA while 137 (38.7%) have not. About 196 (90.32%) of these numbers have had less than five RTA in the past 2 years, whereas 21 (9.68%) have had more than five RTA (Table 1). The occurrence of RTA in the last 2 years among the study participants was not significantly associated with the number of years for which they have been driving (p = 0.501) and the refractive status of the respondents (p = 0.72), (Table 2)

The spherical equivalent of the participant ranged between - 2.75 to + 2.75 D with a mean of - 0.31 ± 0.72 D (Figure 2). There was no significant association between the occurrence of RTAs in the past 2 years and the spherical equivalent RE (p = 0.73) (Table 2).

Table 1: Descriptive characteristics of the study population by prior history of traffic accidents

Variable	No history of RTA n = 137	History of RTA n = 217	Total n = 354	p-value
Age, mean (SD) 22.9 (3.9)		22 (2.6)	22.6 (3.2)	0.15
Educational level, count (%)				
Higher education	17(12.41%)	19 (8.67%)	36 (10.17%)	0.26
High school	120 (87.59%)	198 (91.24%)	318 (89.83%)	
Comorbidity, count (%)				
Healthy	127 (92.70%)	210 (96.77%)	337 (95.20)	0.08
Comorbidity	10 (7.30%)	7 (3.23%)	17 (4.80%)	
Ocular history, count (%)				
Healthy	135 (98.35%)	211 (97.24%)	346 (97.74%)	0.49
Ocular comorbidity	2 (1.46%)	6 (2.76%)	8 (2.26%)	
Driving history, mean(SD)	5.1 (4)	4.5 (2.8)	4.7 (3.3)	0.13
Accident frequency, count (%)				
One accident	-	98 (45.16%)	-	
2–4 accidents	-	98 (45.16%)	-	
≥5 accidents	-	21 (9.68%)	-	

The VA of the participants ranged from 0.00 logMAR (6/6) to 0.60 logMAR (6/24). As much as 342 (96.6%) had a VA of 0.2 logMAR (6/9.5) or better, while the remaining 12 (3.4%) had a VA of 0.3

Table 2: The association between history of RTC and VA and refractive errors

Variable	No history of RTA n = 137	History of RTA n = 217	Total n = 354	p-value
Refractive error (right eye), count (%)				
Having refractive error (Right eye)	68 (39.76%)	103 (60.23%)	171 (100%)	0.72
No refractive error (Right eye)	69 (37.7%)	114 (62.29%)	183 (100%)	
Mean (SD) refractive error (Right eye)	1.31 (1.60)	1.37 (1.72)	1.34 (1.65)	0.73
Visual acuity (right eye), count (%)				
Normal VA	131 (38.31%)	211 (61.69%)	342 (100%)	0.22
Abnormal VA (visually impaired)	6 (50%)	6 (50%)	12 (100%)	
Binocular vision, count (%)				
Normal binocular vision	125 (39.06%)	195 (60.93%)	320 (100%)	0.68
Abnormal binocular vision	12 (35.29%)	22 (64.71%)	34 (100%)	

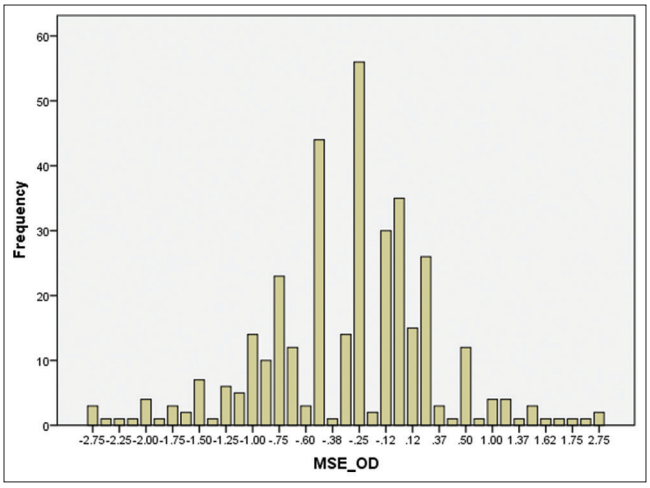

Figure 2: The distribution of the mean spherical equivalent of the participant

logMAR (6/12) or worse. Occurrence of RTA in the past two years among the respondents was not significantly associated with VA (p = 0.22), (Figure 3).

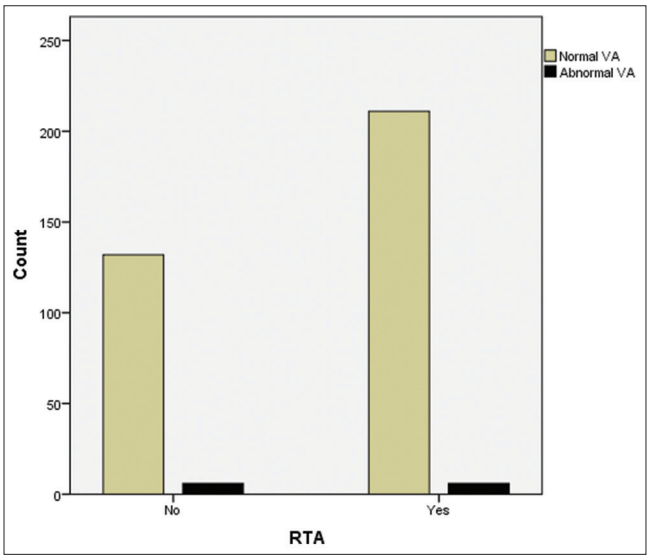

Figure 3: The distribution of visual acuity with the occurrence of road traffic accident (No; means no accident and Yes: means they had an accident)

The results of binocular vision function also showed that 320 (90.4%) had normal binocular vision, whereas 34 (9.6%) of them had an abnormal binocular vision. RTA of participants was not significantly associated with binocular vision dysfunctions (p = 0.68), (Table 2).

Discussion

The results of this study show that the prevalence of uncorrected REs is 171 (48.3%), almost similar to the prevalence reported in previous studies amongst Saudi populations [22], [23], [24], [25]. result

also agrees with the data presented in Ghana, where they found 312 (60.0%) of commercial vehicle drivers had some form of REs [15] but higher than the 32% reported in another Ghanaian study [16] and 16.7% among drivers of public institutions in Nigeria [28]. For the road safety, these drivers could have their vision improved by wearing corrective lenses which could have minimized the possibility of road accidents.

The results further showed that the participants who had vision less than 0.2 logMAR (moderate visual impairment or worse) were 12 (3.4%). These findings are in agreement with previous work found in Nigerian drivers (3.3%) [12] and in Ghana 13 (2.5%) [15] but less than 6.8% reported in another Ghanaian study [16]. Our results found 12 (3.4%) of participants were visually impaired, however, it is unsafe for them to drive their vehicles in the road with such vision.

Our results indicated that the majority of participants (95.2%) were in good general health with no chronic diseases while only 4.8% of the participants had systemic disease (4 diabetes mellitus, 11 asthma, and 2 hypertension). The age group of the present study shows that the majority of participants (91%) were aged 25 years and below. This is lower than those examined in Nigeria where almost 2/3 of drivers were aged between 31 and 50 years old, or in Ghana study [15], where 267 (51.3%) of drivers were adults aged (36-59) years old. The relative younger age group in the study may reflect the sociocultural behavior in SA. Until August 2018, women were barred from driving thus families relied on the male members of the family to commute from one point to another. This had the attendant effect of having male members engage in driving activity relatively earlier than other countries.

Interestingly, there were 217 (61.3%) participants who had an RTA in the last 2 years, and 119 (54.9%) of them have had more than two accidents in the past 2 years. This high rate of RTA is significantly greater than in Nigeria where only 57 (26.5%) drivers had been involved in RTA [12]. It is also higher than the number in Ghana which had reported a history of RTA 117 (22.5%) [15]. These findings support the previous report of the WHO which has found that the mortality rate due to traffic accidents is significantly higher in SA compared to other countries [5].

The findings of the present study show no significant association between the occurrence of RTA and uncorrected REs. Our results are comparable with the previous studies [15], [16], [17], [18], [19], [29] where they did not find any association between the occurrence of RTA and REs. The lack of association between the occurrence of RTA and visual function in this study and previous studies may be due to the small sample size of drivers in these studies. Furthermore, relying on subjective report of a history of RTA may have led to under reporting of RTA among drivers. As Adekoya *et al*. [19] have pointed out, the lack of association may reflect the non-availability of drivers who may have had RTA for survey. These limitations should potentially be taken into account when applying the results of this study. The lack of the association may have also been due to the absence of visual field and color vision data, although several studies did not find a strong association between these data and the RTA [12], [29]. However, other studies indicated that there was a significant association between the RE and the RTA [10], [11], [12]. These controversial views in the literature lead to the high demand of a study that investigates several components of the visual function at a same protocol of testing in order to accurately assess the association between the RTA and the visual function.

Conclusion

The current study found that 48.3% of drivers had some form of REs with 3.4% being visually impaired. Our data showed significant high rate of RTA among Saudi drivers which is much higher than any country in the world. This indicates that the current Saudi regulations for obtaining driving license need to be modified, with implementing a comprehensive eye examination prior to acquiring or renewing drivers' licenses.

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