

Colour Blindness Among Male Professional Drivers: A Cross-sectional Study In Karachi

Samira Faiz, Sehrish Zehra, Farhan Qureshi, Seema Mumtaz

ABSTRACT:

Objective: To determine the frequency of color blindness among male professional drivers of Karachi- Pakistan and the difficulties they experience while driving.

Study Design and Setting: A cross-sectional study was conducted among 300 male drivers with valid driving licenses operating on local and long routes in Karachi.

Methodology: The study was done at various locations in the city of Karachi from September to November 2017. The subjects were tested for vision and color blindness with the help of Snellen's chart and Ishihara chart respectively. A pre-ciséd questionnaire was developed keeping in view the study objectives. SPSS version 21.0 was used for data entry and its analysis. Each questionnaire was thoroughly studied and seen for missing data or information before entry. A written informed consent about the study was provided to the subjects in the form of a plain language statement attached to the questionnaire. This study was approved by the ethical review board of Karachi Institute of Medical Sciences (KIMS).

Results: Amongst the 300 participants 7 (2.33 %) of the drivers were found to have complete color blindness while 2 (0.66%) were partially colour blind. They preferred day time driving and experience difficulties in recognizing traffic signals and vehicle lights.

Conclusion: The frequency of colour blindness was found to be low but it was observed that colour blind drivers face a lot of difficulties while driving. Therefore, easy and practical changes should be made, like shape-coding of signals, and continuous research-based modifications are required to aid these drivers.

Keywords: *Colour Vision Deficiency (CVD)/Colour blindness, professional drivers*

INTRODUCTION

Commercial transport businesses have a colossal lucrative effects on the country's transportation industry and on the overall economy.¹ Most governments invest a lot in every sector to make it advance further through continuous monitoring and evaluation that emanates better policies for improvements.² The most common problem being observed in this profession is the poor physical and mental health of professional drivers.³⁻⁵ Long working hours, difficult and stressful driving conditions, monotonous and repetitive work, lack of education and low socio-economic status all contribute to deteriorate their mental and physical health.⁶

While talking about physical health of drivers, colour blindness is an important health related issue that is under consideration to be solved appropriately.

Colour blindness or colour vision deficiency (CVD) is the deficiency to detect certain colors from what is seen with normal vision. Colour vision deficiency is a condition that affects the perception of colours that are specifically associated with electromagnetic radiations of specific wavelengths which a human eye can visualize.⁷ The retina is lined by red, blue and green cone cells which perceive the colours and the signals are generated and send to the brain to create a wide spectrum of colours that we see. Genetic CVD is due to defected photopigments in these three different kinds of cones that respond to red, blue and green light.⁸ Mostly colour blind people are not aware of their deficiency specially those who do not have severe type of colour vision impairment unless tested in clinic or lab. Colour blindness is mostly hereditary but, it can also be caused by chemical or physical damage to the eye, to the optic nerve or to the part of brain that process colour information. Men are more affected by genetic CVD than women due to the mutation of X chromosome. Sometimes aging or cataract may lead to decline in colour vision.⁹

The most common type of colour blindness is red-green followed by blue-yellow while complete colour blindness is rare.^{10,11} There are three main types of color blindness, that is entailed by the photopigment defects in the three different kinds of cones. The commonest being the red-green color blindness that is followed by blue-yellow type of color blindness. Total color blindness is rare which is the complete absence of colour vision.

Samira Faiz
Sr Lecturer, Department of CHS
Karachi Institute of Management Sciences
Email: samirafaiz@ymail.com

Sehrish Zehra
Lecturer Department of CHS
Karachi Institute of Management Sciences

Farhan Qureshi
Assistant Professor, Department of CHS
Karachi Institute of Management Sciences

Seema Mumtaz
Professor and HOD, Department of CHS
Karachi Institute of Management Sciences

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Worldwide colour blindness approximately affects 1 in 12 (8%) of men while 1 in every 200 women is affected by CVD.¹² Similarly, among European Caucasians of Chinese and Japanese ethnicity, it is around 8% in men while 0.4% in women.^{11,12} Although, different studies are being carried out throughout the world to observe the health status of drivers^{13,14} but, It is commonly assumed that drivers with colour identification problems drive as safely as other drivers with normal eyesight.¹⁵ This is owing to the reasons that colour blind drivers hardly complaint, no accident records are kept and above all no policies have been developed regarding CVD for the vehicle licensing system therefore, it is assumed that colour impaired drivers easily compensate.

An old study showed that in Canada only, around 500,000 drivers were having difficulty in recognizing some colors specially red and green.¹⁶ Similarly, a study of 1992 shows that at least seven million drivers in North America had difficulty in identifying red and green lights.¹⁵ Some three million drivers were suffering from colour blindness in British Columbia in addition to those with hereditary colour blindness.¹⁷

Individuals having colour blindness experience a lot of difficulties in everyday life and at work. They take a longer time to judge certain colours than normal individuals.¹⁸ A study revealed that the chances of rear-end collision is doubled in colour blind people.¹⁹ The traffic lights seem satisfactory and are easy to follow for a normal person but for the color impaired person they are difficult to judge. For instance, red blind drivers have difficulty in critical stops due to poor recognition of red lights on signals and car brake lights.¹⁷

Keeping this in view a cross-sectional study was conducted in 2017 in Karachi, Pakistan, among 300 male drivers. This study observed the frequency of colour blindness among male drivers. These drivers were also tested for their eyesight and specifically tested for colour blindness using Ishihara's chart.

METHODOLOGY:

To study the frequency of colour blindness amongst male drivers, a cross-sectional survey was conducted from September to November 2017. Data was collected from 300 participants. The age limit was from 18-60 years as visual acuity lowers with increasing age while CVD may also occur. Data was collected from various sites within Karachi city through convenient sampling. The subjects included male drivers with permanent and valid driving license, either driving on local routes or long routes. In our society, professional driving is solely dominated by males therefore, the study does not include any female drivers. Participants who had history of severe head injury or neurological or ocular surgeries were excluded from the study. Drivers using antituberculosis drugs at the time of survey were also excluded.²⁰ They were briefed about the purpose and procedure of the study. Those who volunteered signed a

written informed consent and filled a small proforma regarding personal information including age, education, years of driving, type of vehicle and route of driving. The participants were also inquired about their eyesight (with or without glasses; if applicable) and if they know that they had colour vision deficiency. Those who were found to have or were aware of their CVD were also inquired if any of their family members have the same problem.

The drivers' visual acuity was measured through Snellen's Chart while colour blindness was investigated through Ishihara's Chart. Those who could not read the numbers (never attended school) on Ishihara's Chart were asked to draw on paper using a pencil, what they saw. The participants who found to be having any of the above deficiencies were advised to consult eye clinics for further evaluation.

This study was approved by the ethical review board of Karachi Institute of Medical Sciences (KIMS). Data was compiled for analysis using IBM SPSS statistics version 21.0 (IBM Corp., Armonk, N.Y., USA). Frequency was calculated as simple percentages.

RESULTS:

Table 1 summarizes the characteristics of the study population and CVD frequency among them. The cross-sectional survey included 300 male professional drivers amongst whom 37% (n=111) were between 31-40 years of age followed by 31% (n=93) who were between 41-50 years. CVD frequency was found in the same age groups (n=5, n=4 respectively). 21% (n=63) were unable to read or write however, majority of the CVD positive individual (n=6) had received 6 to 10 years of education (n=108, 36%). Complete CVD was found amongst drivers who had 6 to 10 years of driving experience.

The study included both long and local route vehicles (n=120 and n=180 respectively) among which mostly were minibus and coach drivers but, most of the CVD was seen in truck drivers of both, long and local routes (Table 2).

Table 3 enumerates the frequency of visual impairment and CVD amongst professional drivers. Out of 300 individuals, 26 were found to be having impaired vision and only 3 used to wear glasses among them and needed reevaluation. All of the 26 drivers were somewhat aware of their visual in-acuity. Partial CVD was observed in 2 (0.66%) participants who showed difficulty in recognizing red and green colours while, 7 out of 300 (2.33%) were suffering from complete CVD. None of them were aware of their deficiency nor did they know if anyone in their family had the same problem.

DISCUSSION:

This study was done to determine the frequency of partial and complete colour blindness in professional drivers. For the detection of CVD, Ishihara's Chart was chosen because of its validity for accurate assessment in mass screenings.⁷ Moreover, it is easy and quick to perform as the individuals had to identify numbers rather than the colours.

Age in years	Frequency	Percent %	CVD frequency
20-30	69	23.0	0
31-40	111	37.0	5*
41-50	93	31.0	4*
51-60 years	27	9.0	0
Education			
Not educated at all	63	21.0	0
Primary, up to 5 yrs	84	28.0	1
Secondary, up to 10 yrs	108	36.0	6*
Higher education, above 10 yrs	45	15.0	2*
Years of driving			
1-5 Years	39	13.0	3*
6-10 years	57	19.0	5
11-20	120	40.0	0
> 20	84	28.0	1*

Table 1: CVD frequency related to characteristics of drivers N=300
*Partial CVD included

Types of vehicles	Frequency	Percent %	CVD Frequency
(a) Long route vehicles			
Bus (coach)	61	50.83	3*
Truck	35	29.16	2
Trailer	24	20.00	0
(b) Local route vehicles			
Bus (mini/coach)	93	51.66	0
Taxi	56	31.11	1
Truck	31	17.22	3

Table 2: CV frequency related to types of vehicles and driving routes (N=300)
*Partial CVD included

	Frequency	Percent
Visual impairment	26	8.66
Partial CVD (red-green CVD)	2	0.66
Complete CVD	7	2.33
Visual impairment with CVD	0	0.00

Table 3: Visual impairment and Colour vision deficiency (N=300)

The prevalence of complete CVD was found to be 2.33% while partial CVD came out to be 0.66%. Our results are comparable with the results of a study by Siddiqui et al.²¹ That showed 3.1% CVD amongst male students of Pakistan.²¹ In 2017, another similar frequency was given during a pre-employment screening in a tertiary care health centre of Pakistan. It reported a 0.9% overall prevalence of CVD (32/3437) with 1.4% males and 0.4% females.¹¹ These frequencies are much less than the results of earlier studies done in various countries. A study done among Indian Muslims in 2013, showed 8.73% of CVD in males but, their results differed in various Muslim ethnicities of India.²² Another 10 year study was done in 2016 among science students of ASC Rahuri College India, showed 0.303% of

colour Blindness in male students.¹⁰ A Turkish research also observed 3.2% red-green and 6.7% CVD in males. In 2006, Balasundaram et al. revealed a prevalence rate of 6.7 colour blindness in male health professionals of Seremban, Malaysia.⁷ The differences in frequencies in all the above studies might be due to the race, ethnicity and/or geographical locations.

It is commonly believed that colour blindness hardly create any trouble while driving. It is mostly due to the fact that drivers often identify lights according to their arrangements on the signal. However, several studies have shown that drivers do face difficulties while driving.^{9,24} Therefore, those who had partial or complete CVD were further interviewed about their driving issues.

In this study, individuals with impaired vision acuity were fully aware however, seemed careless about it. Vision impairment due to refractive errors is easier to self-detect and can be overcome by wearing glasses but, colour blindness is difficult to detect unless tested in clinic or labs especially, when congenital.²⁵ All of the CVD positive individuals in the study were also not aware of their deficiency although, most of them were middle aged and had more than 5 years of education. Previous researches have revealed that these people develop some strategies and clues about certain colours since their childhood.^{11,18} Despite the colour identification strategies, our colour blind participants were facing particular problems while driving that they never realized before then. Sudden inversion of signal lights from red to green specially when there is no yellow light in between, were difficult to detect for most of them. This is a common difficulty found in most of the colour blind drivers.²⁴ Similarly, almost all of them accepted that they could not recognize brake lights which delays brake time while critical stops.

Drivers declared that they had faced RTAs in their early driving years. Among them were mostly bus and truck drivers who had difficulty to identify car brake lights that were at lower level compared to their own vehicles. The small sample size of our study restricted us to infer CVD as a risk factor of RTAs. These results are in agreement with some previous studies.^{26,27} As CVD positive drivers were not aware of their deficiencies, they did not know if any of their family members had the same problem.

It was recommended that research based modifications, like shape-coding of traffic signs, should take place involving all the stakeholders including traffic engineers and medical and public health practitioners to counter the driving issues of CVD positive drivers. A complete eye checkup will be helpful, before the issuance of driving license and at renewals, in order to get recent statistics and information.

CONCLUSION:

It was concluded that the frequency of colour blindness amongst male drivers was found to low but, most of them

remain unaware throughout their life. They, themselves, not only face a lot of difficulty while driving but are a huge risk for others as well.

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