



Prevalence of Color Blindness Among Medical Students

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To find out the prevalence of color blindness among medical students.

Study Design: Descriptive cross-sectional.

Place and Duration of Study: Study was conducted at Chaudry Mohammad Akram teaching and research hospital, Superior university during December 2020 to May 2021.

Methodology: All the medical students having age range between 21-25 years were included in the study. An ophthalmologist did ocular examination, after that color vision was checked by putting Ishihara plates. The score less than 12 out of 14 red-green test plates were labelled as color blind. Data was analyzed by using the SPSS version 20. Chi-square was used to find out the association of color blindness with age groups and gender. p-value less than 0.05 was considered as significant.

Results: The mean age with standard deviation of study participants was 23.27 ± 0.87 years. The prevalence of color blindness among medical students was 2% out of which 1.7% were having strong red-green deficiency while only 0.3% were with mild red-green deficiency. Majority of participants with color blindness were noted in the age group of 22 years while very few were in the

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other age groups of medical students but these results were non-significant. On the other hand, all the color blind was male but no association was found as the p-value was more than 0.05.

Conclusion: Current study reported that about 2% of medical students are affected by color vision deficiency. So there is a need of proper visual screening program among medical undergraduates for early detection of color blindness and counselling session for them.

Keywords: Color blindness; color vision deficiency; ishihara plates.

1. INTRODUCTION

Human being have the capability to see around 150 different colors and can differentiate one color from another one. The term color blindness is used for the color vision deficiency and is the most prevalent and unnoticed abnormality among the general population [1]. It is classified into two categories including congenital and the acquired defect. In Congenital defect there is X-linked recessive trait in which the defected gene is located on Xq28 band of X-chromosome while the acquired defect occurs as a result of multiple diseases like eye diseases, diseases of nervous system or the drug induced. The prevalence of color blindness among Jordanian male is 8.7% while 0.3% has been reported among females [2] while among British physician it is 8% [3]. The prevalence of color blindness among medical students is about 5.8% [4].

To study the histopathological findings different stains are used over the slide so that normal can easily be differentiated from the abnormal one, but the medical students with color blindness are unable to identify these slides, which is a major concern in medical profession [5] as Campbell et.al found in his study that the color blind students were unable to identify the slide of bacilli stained with Ziehl-Nelson method [6]. To improve this deficiency initially the affected students, use the contact lenses to overcome the particular color deficiency, but currently gray scale is used in computers as well as in photomicrographs for laboratory examination. Use of grayscale is very helpful in studying the structure of cells and tissues by focusing on their architecture instead of colors on slide [5].

Campbell et.al also noticed that those physician who were color blind, unable to identify the picture of either vomitus or stool showing fresh blood or skin rashes so it is again a major issue in the clinical practice for the color blind physicians [6]. Very few of the studies have been done to find out the prevalence of color blindness among medical students. So the aim of the current study is to find out the prevalence of color

blindness among medical students in current setup.

2. METHODOLOGY

A descriptive cross-sectional study was conducted at Chaudry Mohammad Akram teaching and research hospital, Superior university during December 2020 to May 2021 in Lahore. The study got approval from the concerned institute. Sample size was calculated by using OpenEpi calculator and was 295. All the medical students having age range between 21-25 years were included in the study. Informed consent was taken from all students. Those students were excluded who were diagnosed cases of either ocular abnormality or eye infections or refused to give consent.

An ophthalmologist did ocular examination, after that color vision was checked by putting Ishihara plates at a distance of 75cm from the study participants. For reading the plates, participants were given 5 seconds. If the score was less than 12 out of 14 red-green test plates, the participants were labelled as color blind while the score more than 12 was considered as the normal color vision. All the demographic data, visual acuity and score of color vision were noted on a proforma.

Data was analyzed by using the Statistical Package for Social Sciences (SPSS) version 20. Mean and standard deviation was calculated for numerical variables while frequency and percentages for categorical variables. Chi-square was used to find out the association of color blindness with age groups and gender. p-value less than 0.05 was considered as significant.

3. RESULTS

The mean age and standard deviation of study participants were 23.27 ± 0.87 years, while the age range of medical students were between 21-25 years. Majority of study participants were male (63.1%) as compare to their female counterparts. Visual acuity of study participants was noted with and without glasses and it had

been found that about 75% of participants were having visual acuity of 6/6 with glasses in both right and left eyes. Looking over the visual acuity without glasses 91.3% and 90.5% of the participants were having 6/6 visual acuity in right and left eye respectively as mentioned in Table 1.

As presented in Fig. 1 the prevalence of color blindness among medical students was 2% out of which 1.7% were having strong red-green

deficiency while only 0.3% were with mild red-green deficiency.

Majority of participants with color blindness were noted in the age group of 22 years while very few were in the other age groups of medical students but these results were non-significant. On the other hand, all the color blind was male but no association was found as the p-value was more than 0.05 as mentioned in Table 2.

Table 1. Demographic characteristics of study participants

| Variables | n= 295 (%) |
|--|-------------|
| Gender | |
| Male | 186 (63.1%) |
| Female | 109 (36.9%) |
| Visual acuity with Glasses (n= 64) | |
| Right eye | |
| 6/6 | 48 (75%) |
| 6/9 | 13 (20.3) |
| 6/24 | 1 (1.6%) |
| 6/36 | 2 (3.1%) |
| Left eye | |
| 6/6 | 48 (75%) |
| 6/9 | 15 (23.4%) |
| 6/24 | 1 (1.6%) |
| 6/36 | -- |
| Visual acuity without Glasses (n= 231) | |
| Right eye | |
| 6/6 | 211 (91.3%) |
| 6/9 | 13 (5.6%) |
| 6/12 | 2 (0.9%) |
| 6/18 | 1 (0.4%) |
| 6/24 | 4 (1.7%) |
| 6/36 | -- |
| Left eye | |
| 6/6 | 209 (90.5%) |
| 6/9 | 13 (5.6%) |
| 6/12 | 2 (0.9%) |
| 6/18 | 2 (0.9%) |
| 6/24 | 4 (1.7%) |
| 6/36 | 1 (0.4) |

Table 2. Association of Color blindness with age and gender

| Variables | Color blindness | | p-value |
|-------------|-----------------|-------------|---------|
| | Yes (n= 6) | No (n= 289) | |
| Age (years) | | | 0.070 |
| 21 years | 0 | 1 | |
| 22 years | 4 | 54 | |
| 23 years | 1 | 117 | |
| 24 years | 1 | 96 | |
| 25 years | 0 | 21 | |
| Gender | | | 0.058 |
| Male | 6 | 180 | |
| Female | 0 | 109 | |

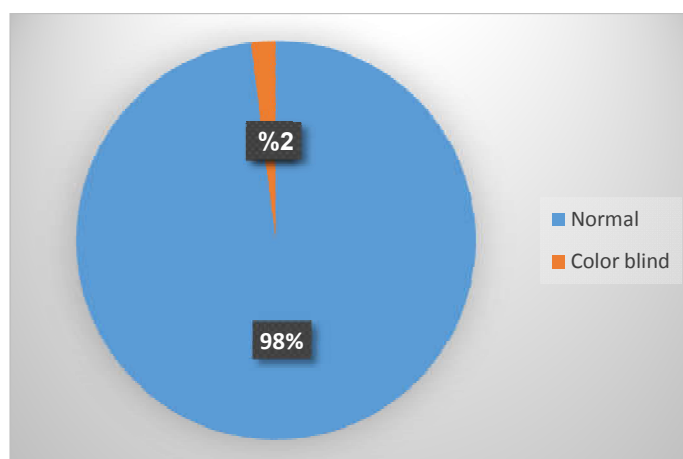


Fig. 1. Prevalence of color blindness among medical students

4. DISCUSSION

The current study reported that medical students are facing the problem of color blindness but is unnoticed which both the medical students when studying the colorful charts or identifying the normal histology or pathological findings in a slide. They also get difficulty during learning of clinical skills including surgical procedures as well as later on in professional carrier when identifying the patient with cyanosis, jaundice, pallor or rashes. They also have difficulty in identification of blood in sputum, vomitus, urine or feces [7]. Due to this color blindness, physician fails to diagnose and treat the disease which lead to worsening of symptoms as reported by Spalding et.al in his study [8].

Current study reported 2% prevalence of color blindness among medical students while in Nepal Praminik et.al found 5.8% of the medical students with color vision deficiency [4] while the prevalence is higher in United states where 12.8% of medical students while 7.8% of dental students are facing the color vision deficiency [9,10]. Another study done in United Kingdom noted a higher prevalence rate among the histology students than the students of other specialties and it was 8.7% [5]. Sangeeta et.al found 8.9% prevalence of color blindness in Odisha [11]. The variations in prevalence might be because of differences in study population, geographical location, ethnicity or the techniques used for testing color vision [12].

Current study reported higher prevalence of color blindness among male and is favored by multiple studies conducted in different geographical

regions [13-15]. This male predominance is because of the X-linked recessive trait of the disease [16]. But no significant association was found between color blindness and gender while same is manifested by Aziz et.al, who found p-value greater than 0.07 [12]. Due to poor differentiation between congenital and acquired cases there is inappropriate estimation of prevalence rate so the multiple studies reported non-significant association with the gender. Literature review also revealed a strong association of color vision defect with the age, as the age increases the exposure to environmental factors also increases which lead to acquired color blindness in old age [17,18], but the current study contradicted this finding by reporting non-significant p-value. This variation is because of the selection of study population, as all are the young medical undergraduates so no effect of old age can be detected.

There are some of the study limitations like it was a single centered study, no differentiation between congenital and acquired color blindness was done and a small sample size. There is a need to conduct the study on large scale by involving the multiple tertiary care hospitals and using a large sample size.

5. CONCLUSION

Current study reported that about 2% of medical students are affected by color vision deficiency. So there is a need of proper visual screening program among medical undergraduates for early detection of color blindness and counselling session for awareness of their limitations and the way to overcome that in future clinical practice.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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