



THE PREVALENCE OF COLOUR VISION DEFICIENCY AMONG SCHOOL CHILDREN IN TELANGANA STATE

Ophthalmology

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ABSTRACT

Colour vision is the ability to distinguish objects based on the wavelength of light they emit, reflect or transmit. Inability to distinguish different colours is colour vision deficiency. The aim of the study is to determine the prevalence of colour vision deficiency among school children in Hyderabad district. The present study was conducted under National School Eye Screening Programme. Total 13,149 school children were screened consisting of 6484 (49.31%) girls and 6665 (50.68%) boys. Among them 118 (0.89%) students were found to have colour vision deficiency. Prevalence rate for CVD was found to be higher in males 88.93% than girls 11.04%. Diagnosis of congenital colour vision deficiency in school children helps in adaptation of children to their dysfunction and better planning of their professional future.

KEYWORDS

Colour Vision Screening, Colour Blindness, Prevalence.

INTRODUCTION

Colour sense is the faculty by which one can distinguish between different colours and colour tones as excited by light of different wavelength¹. The trichromatic theory of colour vision was given by Thomas Young in 1801-1802 postulated the existence of three principal colours (red, green and blue) from which all colours can be obtained.²

This theory is modified by Von Helmholtz in 1866 postulated the existence of three kinds of cones, each containing a different photopigment and maximally sensitive to one of the three primary colours (red, green, blue)³.

Cones, the photoreceptors in the retina of the eye are responsible for the colour vision. These photoreceptors have light sensitive pigments that enable us to recognize colour.⁴ An individual with normal colour vision is known as Trichromate.

Molecular studies showed that defects in colour vision result from the absence, malfunction or alteration of one (dichromatism), two (monochromatism) or all (achromatism) of the photopigments. The class of dichromats characterized by the entire absence of blue, green and red are called tritanopia, deuteranopia and protanopia respectively while those characterized by a relatively mild form of defective colour vision for blue, green and red are called as tritanomaly, deuteranomaly and protanomaly respectively.^{5,6}

Colour vision deficiency is usually inherited and affects upto 8% of males and less than 1% of females.⁷ Colour blindness is a X-linked disorder. Most of the colour blinds remain undetected in general population due to lack of proper screening.⁸ The severity of colour vision deficiency range from mild to severe depending on the cause. It affects both the eyes if it is inherited and usually one eye if the cause for the deficiency is injury or illness.^{9,10} Acquired colour deficiency can result from certain diseases, trauma or as a side effect of certain medications.

The Ishihara Pseudoisochromatic plate test is the most commonly used colour vision test. They are relatively straightforward to administer, readily available and inexpensive. The colors that make up the figure and that constitute the background all fall on a common dichromatic confusion line. So, patients with anomalies of color vision have difficulty in seeing the figures embedded into the plates.¹¹ The Ishihara test can't detect tritan plates and doesn't classify the severity. Mild deuterans may pass the test and normal individual with poor discrimination may fail.¹²⁻¹⁴ The Farnsworth D-15 test allows the differentiation of protan, deutan and tritan defects, it does not allow the differentiation of dichromats from anomalous trichromats, neither it

detects minor defects and certain anomalous trichromats may pass the test^{11,15,16}

METHODS AND MATERIALS:

This is a cross sectional study carried out in Government primary and high schools by the Department of Ophthalmology, Gandhi Medical College and Hospital, Secunderabad to analyse the prevalence of colour vision deficiency in school children in four mandals in Hyderabad district, Telangana state.

This study was conducted under National School Eye Health Programme during the period of September 2017-March 2018. The total number of children screened were 13,149 of which 6665 were boys and 6484 were girls. Students between 9-14 years were included in the study. Data regarding name, age, sex, class was taken from the class teacher after the approval and permission from the respective school principal.

Ishihara pseudoisochromatic colour plates (chart 38 plate 1991 edition) was used for the study. Class room for examination was selected with adequate natural day light. The plates were held at a distance of 66cm from eye with the line of sight perpendicular to the pages and the children were encouraged to read the test plates serially as instructed to the students before the test using local language.

The test was conducted based on standard recommendations of colour vision testing.

Children with systemic disease, on chronic drug therapy, or with history of head injury or ocular injury were excluded from the study, however we did not encounter students with such criteria. The entire data was filled by trained optometrist. The children with colour vision deficiency were cross examined by the ophthalmologist.

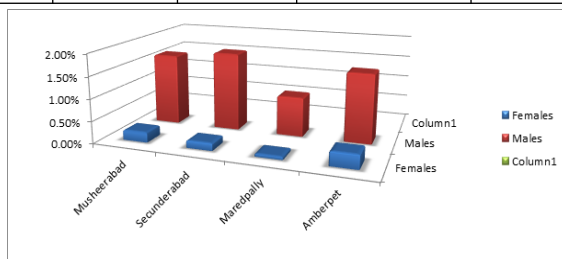
After examining colour vision, visual acuity was examined by using Snellens chart at 6 meters distance. All the testing was done binocularly. Students with decreased vision having refractive error were corrected with glasses and were reexamined for colour vision. Children who made more than defective responses between plates 2 and 21 were marked as colour deficient. As the study was conducted to screen all the eye problems in school children, detailed study on colour vision was not done.

RESULTS:

A total number of 13149 school children were screened in the present study. 156 schools were screened consisting of 50.68% males and 49.31% females as shown in table 1 and table 2. Out of 118 children with colour vision deficiency 105 are males and 13 are females (table 3)

TABLE 1 : Mandal Wise Distribution Of Colour Vision Deficiency

SNO (n=4)	Name Of the Mandal	No. of schooln=156	Total no. of children n=13149	No.of boys n=6665	No. of girls n=6484	no. of boys with CVD n=105	no. of girls with CVD N=13	Children with colour vision deficiency n=118
1	Musheerabad	58	5304	2800	2504	46	6	52
2	Secunderabad	45	3569	1836	1733	33	3	36
3	Maredpally	19	2206	885	1321	8	1	9
4	Amberpet	34	2070	1144	926	18	3	21

**FIG 1:** Mandal Wise Prevalence Of Colour Vision Deficiency Among Males And Females**TABLE 2 :**prevalence Of Colour Vision Deficiency

No of screened	Normal colour vision	Percentage of normal colour vision	Defective colour vision	Percentage of CVD
13149	13031	99.10%	118	0.89%

TABLE 3 :Gender specific prevalence of colour vision deficiency

Gender	No .screened	No .of CVD	Percentage of CVD
Male	6665	105	1.57%
Female	6484	13	0.20%

The overall prevalence of colour vision deficiency in Hyderabad district was 0.89%.

DISCUSSION:

Ishihara plates can only be used to detect and classify red-green color vision deficiencies, which are the most common types of CVD.¹⁷ Ishihara test has the mean sensitivity of 96%, the mean specificity of 98.5%, in addition to it revealed good retest reliability¹⁸.

In the present study, the overall prevalence of colour vision deficiency was 0.89% (118 among 13149 subjects). No obvious acquired cause for colour vision defect was observed. In a study conducted by Moudgil et al.¹⁹, the prevalence of colour vision deficiency was 1.87% among 3259 students. In contrast the overall prevalence among other studies were 3.90% in Shrestha et al. study and 3.35% in a study conducted by OM Oriowo and AZ Alotaibi²⁰ among 1632 school children in Saudi Arabia. The prevalence of colour vision deficiency in a study conducted by Atrivie et al.²¹ was 1.87% (28 of 1500 subjects). In comparison to the above studies the prevalence of CVD is low in Hyderabad district.

Out of the 6665 males and 6484 females screened,1.57% of males and 0.20% of females showed CVD in the present study. The prevalence of colour vision deficiency among males is lower than the 3.9%prevalence among male population seen in Shrestha et al study.²² A school based study of Patiala city, India reported 3.85%males and 0.38% females to be colour blind.²³ a study among school children in Tehran reported colour vision defects in 8.18% of males and 0.43% in females²⁴ which is more than thrice the prevalence among males found in our study. Similarly a study in Korean population reported congenital colour defects in 5.9%of male and 0.44% of female population²⁵ Prevalence rate of colour vision deficiency is found higher in males as males have only one X-chromosome, they are prone to suffer from the defect while females are carrier.

TABLE 4 . Prevalance Rates of CVD Across India

Children	Total	Males	females
Jammu And Kashmir26	4.38%	7.52%	0.83%
Patiala 23	2.9%	3.85%	0.38%
Jodhpur27	3.2%	3.2%	0%
Pune 28	2.02%	3.16%	0.40%
Andhra Pradesh29	4.07%	7.5%	0.3%
Wardha30	2.1%	3.7%	0.4%
Present Study	0.89%	1.57%	0.2%

Table 4 shows the prevalence of colour vision defect among males

and females across India. This shows the prevalence rates were comparatively lower in Hyderabad district..

In the course of studying normal colour vision,investigation have observed a wide range of colour discrimination ability especially under such circumstances as the absence of cues, poor illumination, working at speed and viewing objects that subtend a narrow angle at the eye.³¹

Many people especially males are affected by colour vision defects but they remain undetected as they adapt to the environment to certain extent.¹⁹ Most of them are unaware of the problem leading to learning disability , increased reaction time, and also they are unfit for certain jobs like traffic policemen, defence personel, electrician etc. the present study is carried to find out the prvalance of CVD to make the parents and teachers aware of the disease so that they modify the teaching methods which help the children in choosing suitable profession.

From the present study, significant male population suffers from congenital colour vision deficiency. These children with the colour vision defects should be properly counseled regarding difficulties in daily wok , planning profession , genetic inheritance to their children which would prepare them for future challenges and confusions.

METHODS OF LITERATURE SEARCH

In Preparing this article, we used he following methods for identifying relevant articles. We searched pubmed using the key words Colour Vision Deficiency, Screening, Colour Blindness, Prevalence, Dyschromatopsia, School Children, Ishihara Colour Test .

Disclosures

The conflicts of authors disclose no potential interest. There is no financial interest behind this study.

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