

Prevalence of Colour Blindness in School Children in Guntur City, Andhra Pradesh

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ABSTRACT

Introduction: Color vision is a function of three types of cone pigments which are present in retina. Any abnormality in these cone pigments may cause deficiency of color vision which is called as color blindness. Some people are unaware of the disease as they simply adapt to the environment to certain extent and thus remain undetected. Study objectives were to evaluate the prevalence of color blindness in school children of age group 10 years to 15 years, in various schools of Guntur.

Material and Methods: A prospective study was done on 1629 students to evaluate the prevalence of color blindness. Ishihara Pseudoisochromatic Color Plates 38 edition were used to examine the school children for color blindness. If the child was identified as colour blind, then they were further classified into its types. The data collected was comprehended to evaluate the prevalence of color blindness, prevalence of types of color blindness and gender wise prevalence.

Results: Students of 6 schools were screened in the age group of 10 to 15 years. 1629 students were included in the study; 841 (51.62%) were males and 788 (48.37%) females. Color blindness was seen in 31 students (1.9%) including 28 (1.71%) males and 3 (0.184%) females. Among the colour blind 28 (90.3%) were protanopes, 3 (9.7%) were deuteranopes and none were tritanope. Among the protanopes, 26 (92.8%) were males and 2 (7.2%) were females and in deuteranopes, percentage of males affected was 2 (66.6%) and females was 1 (33.3%).

Conclusion: Prevalence of color blindness is found to be higher in males (3.3%) than in females (0.3%), which is true for congenital color blindness. Red-green color blindness is the most common defect. It is inherited as X-linked recessive trait. Males have only one X-chromosome, hence they are prone to suffer from the defect while females are mainly carriers. This study will be helpful to color blind students to know their disability and to adjust accordingly to overcome their difficulties.

Keywords: Colour Blindness, Red Green Defects, Vision Screening, X-Linked Recessive Trait, Ishihara Chart, School, Children, Gender

pigments, one from each of three spectral classes are required. The three classes of cones are variably sensitive to their corresponding spectrum and are referred as the blue, green and red cone pigments. Color vision deficiency is divided into congenital and acquired forms². In general population Red Green defects (Protan and Deutan) shows the highest prevalence.³

Red-green color blindness, an X-linked recessively inherited disorder that occurs in males and is transmitted through females and about 8.0% of females are carriers⁴. Because these defects are inherited as X linked Traits, the incidences are much higher in male (8.0%) than in females (0.4%)⁵. The prevalence of red-green color blindness was found to vary between different races, tribes and ethnic groups⁶.

Acquired causes of color blindness includes conditions such as serious ocular diseases, injury or diseases of retina, toxicity or systemic conditions⁷. Some people are unaware of the disease as they simply adapt to the environment to certain extent and thus remain undetected. Being unaware of the disability, student may have difficulties in certain aspects while learning in school and may not be able to reach their actual potential. Color blind persons, unaware of their disability, may choose certain professions, which may not be suitable for them, like traffic policeman, train driver or technician in color industries, which require proper color perception leading to lesser efficiency in work as well as may cause accidents. So it is important to find out the prevalence in children and identify the problems associated with color blindness. Taking these aspects into account, our study is carried out to find out prevalence of color blindness in school children so that they can be guided properly in their learning process as well as in choosing and adjusting with the suitable profession.

The present study was done to find prevalence rate and type of color blindness in students of age groups 10 years to 15 years and to compare the prevalence gender wise.

MATERIAL AND METHODS

A purposive sampling of schools of Guntur was done after taking consent from the school authority as well as the

INTRODUCTION

In 1798 John Dalton discovered Color blindness. Colour vision is the capacity to discriminate a light stimulus as a function of its wavelength. Light with wavelength between 380-760 nm causes photoreaction on retina, which leads to visual perception in humans. The sense of colour is perceived from the combination of various sensory and cognitive processes.¹

Trichromatic Theory of Young Helm Holtz suggests that human color vision is trichromatic and 3 cone photo

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students' guardians for the examination. A team comprising of Ophthalmologist, Optometrist and Ophthalmic Assistant visited 6 different schools in guntur for evaluation.

Student was called according to the roll number in a room Clinical examinations of both eyes were done. Age and gender of the child were noted. The student was tested for colour vision deficiency using Ishihara's Type Tests for Colour- Blindness, 38 Plates Edition. The Ishihara's colour vision charts were held at a distance of 75 cm from the student and at right angle to the line of vision in an adequately lighted room resembling natural day light. Student was asked to read out the numbers seen on the colour vision charts. The time out given for identifying the number on a chart was less than 5 sec⁸. The child was assessed after examination as normal or color blind and the type, if the child is colour blind. Interpretation was done as per the instructions on the booklet provided with Ishihara's type tests. All the students were assessed within 6 months.

STATISTICAL ANALYSIS

Prevalence of colour blindness in school children was calculated by using following formula. Prevalence=Number of all current cases of a specific disease existing at a given point in time × 100/Estimated population at the same point in time⁹. Also prevalence of colour blindness was calculated gender wise.

RESULTS

6 schools were screened for studying color vision in school children age group 10 to 15 years. Total of 1629 students of 6 schools were screened. Out of which 841 were males and 788 were females. Total 31 students were found to be color blind, out of which 28 were males and 3 were females. Out of 1629, only 31 students were color blind accounting to prevalence of 1.9% color blindness among school children. Among 31color blind students, males were predominantly affected by color blindness (90.3%) as compared to females (9.7%) with p value <0.01. If we compare among males, out of 841 males only 28 were color blind (3.3%). Among females, out of 788 females only 3 were color blind (0.3%) (Table 1).

protanomaly and deuteranomaly were the two types seen in our study. Protanomaly (90.3%) was more prevalent than deuteranomaly (9.7%) with p-value <0.05. Protanomaly

Gender			Total
Color blindness	Male	Female	31(1.9%)
Affected	28(3.3%)	3(0.3%)	
Not affected	813 (96.7%)	785(99.7%)	1598(98.1%)
Total	841	788	1629

Table-1: Distribution of colourblindness in gender wise

was observed in 28 students out of 31 color blind students accounting to 90.3% of total color blind students. Among 28 protanopes, 26 were males and 2 were females. Deuteranomaly was observed in 3 students out of 31 color blind students. Among 3 deuteranopes, 2 were males and 1 were females. So among color blinds, protanopia (90.3%) is more common than deuteranopia (9.7%). In protanopia also males were predominantly effected (92.8%) as compared to females (7.2%) (Table 2).

DISCUSSION

Color can be described in terms of hue (determined by wavelength) and saturation (determined by the amount of white light mixed). Those with color vision defect see fewer hues than the normal. Color-blind people actually have only defective color discrimination in greater or lesser degrees. A color vision defective may go through life without knowing his deficiency and making any incriminating mistakes, differentiating objects by their size, shape and luminosity, using all the time a complete color vocabulary based on his experience. Congenital defect are usually bilateral symmetrical and other visual functions are not affected.

Many people are affected by color blindness and mostly they remain unaware of it. Color blind children have certain learning difficulties. They become aware only when they undergo a routine ophthalmic check up.

It is also observed that the prevalence of colourblindness in boys is 3.3% in this study compared to 8% prevalence rate in males among Caucasians in Europe, Great Britain and United States² but it is similar to 3-4% prevalence rate of colour blindness in the Indian population¹⁰, 3.3% prevalence rate in male school children in guntur.¹¹ Whereas it is slightly more than the lowest prevalent rate i. e 2% observed in North America, South America, Fiji and in certain Asian Indian tribes.

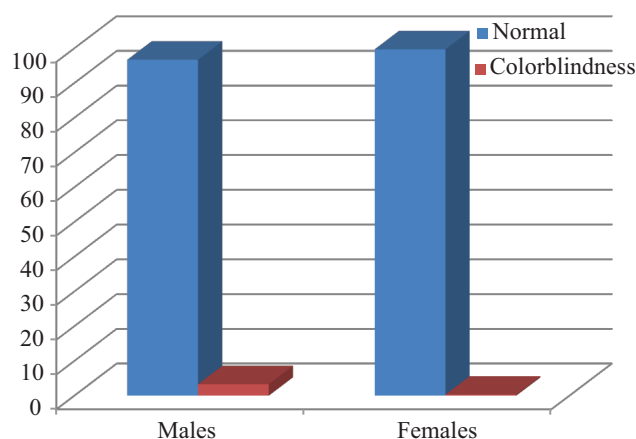


Figure-1: Distribution of colourblindness in gender wise

Colorblindness	Protanopia		Deuteranopia		Total
	Male	Female	Male	female	
Number/%	26 (92.8%)	2 (7.2%)	2 (66.6%)	1 (33.3%)	31
Total	90.3%		9.7%		100%

Table-2: Distribution of protanopia and deuteranopia

Thus though the prevalence rate for colour blindness is quite similar all over the world but a smaller difference in the prevalence rate is observed which may be due to the racial variations in the different set of population.

According to this study the prevalence of colour blindness was noted to be higher in males (i.e. 3.3%) as compared to that in females (i.e. 0.3%).

This can be explained depending on the pattern of inheritance of colour blindness.

CONCLUSION

Colour blindness is a common congenital disorder affecting general population. Most of the children were unaware of this disorder. Screening of school children for colour blindness is a highly effective strategy in detecting these conditions. This must be followed by affordable services and school health programmes.

The prevalence of color blindness is 3-4% in India. Deuteranopia (red-green color blindness) has higher prevalence than others types. Males have a high risk for colour blindness. The male students suffer from the congenital colour blind. Proper counselling should be given to those with congenital colour vision deficiency along with the parents regarding problems they can encounter in their daily activities, future jobs, genetic inheritance to their offspring, so that it could benefit them in their career guidance.

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