

Level of Awareness of Color Vision Disorders among the Public Secondary School Children in Emohua Local Government Area of Rivers State

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Abstract

Aim: To assess the level of awareness of color vision disorders among the public secondary school children in Emohua local Government area of Rivers State.

Background: Colour vision disorders (CVD) also known as color blindness or color vision defects are a group of disorders associated with defective perception of colors. They are said to be one of the commonest genetic and inherited disorders observed in the human population.

A normal person is said to require all the primary colors to match those within the spectrum. Any given cone pigment may be deficient and this is termed an anomaly, or absent, termed an anopia.

Methodology: The study is a community-based descriptive cross sectional study. Ethical clearance for the study was obtained from the Ethical committee of the hospital. Structured questionnaire were administered to all consenting students to determine awareness of color defects. All data generated were entered into a personal computer and then analysed with the help of a statistician using commercially available Statistical Package for Social Sciences Package version 21. Mean and standard deviations were determined for age. The age groups gender, other demographic distribution of the subjects amongst other were presented using frequency tables and charts

Results: One thousand secondary school pupils showing a 100% response rate were interviewed and examined for Colour Vision Disorder during the study period. The mean age of the students was 14.3 ± 1.8 years with an age range between 9 and 20 years. Less than one-third of the students were aware of colour blindness ($n = 234$; 23.4%).

Keywords: Awareness; Colour Vision; Rivers State; Secondary School

Background

Colour vision disorders (CVD) also known as color blindness or color vision defects are a group of disorders associated with defective perception of colors. They are said to be one of the commonest genetic and inherited disorders observed in the human population.

A normal person is said to require all the primary colors to match those within the spectrum. Any given cone pigment may be deficient and this is termed an anomaly, or absent, termed an anopia. Trichromats possess all three types of cones, but they may not be functioning optimally hence the term Anomalous trichromacy. Anomalous trichromacy is the mildest form of color vision disorder. The absence of one type of cone is termed monochromatism and examples include: deuteranopia, protanopia and tritanopia while an absence of two types of

cones is termed dichromatism: this is named by the type of cone present i.e. blue cone dichromatism for red and green deficiency, red cone dichromatism for blue and green deficiency and green cone dichromatism for blue and red deficiency and an absence of the three types of cones is termed achromatopsia, a rare condition in which the individual only sees in gray and black [1]. Most individuals with color vision disorders are anomalous trichromats [2,3].

Trichromats are classified as Protanomalous, Deuteranomalous and Tritanomalous [4]. Protanomaly is the abnormality of red sensitive cones; Deuteranomaly is the abnormality of green sensitive cones and Tritanomaly the abnormality of blue sensitive cones.

Although CVD is said not to impact negatively on one's activity of daily living [5], the discomfort associated with living with color vision deficiency can be frustrating and sometimes dangerous. This could range from not being able to read road signs, not knowing whether to stop or go in traffic, not knowing whether some commonly used fruits such as tomatoes are ripe or not, or not being able to tell whether our commonly enjoyed beef is well cooked or not and ultimately to either not being able to pursue the career you have always dreamt of or doing so with utmost difficulty [6].

It also has an impact on the larger population that is not color blind as these occupations involve giving services to others and mistakes in the dispensation of these services are usually borne by the populace. Effects could range from being served poorly cooked food prepared by a color blind individual, to being in a road traffic accident caused by a color blind road user or driver or plane crash as a result of signal misinterpretation by a color blind pilot.

In essence, color blindness does not only impact the individual but the society at large.

Methodology

The study is a community-based descriptive cross sectional study involving public secondary school students from randomly selected schools in Emuoha Local Government area. Ethical clearance for the study was obtained from the Ethical committee of the hospital. A multistage sampling technique was used to randomize students from 14 secondary schools out of 33 registered schools in Emuoha local Government area. Sample size was calculated using the Leslie Kish formula [7] for single proportions where prevalence was set at 4.2% [8] at a confidence interval of 95% and a 0.5% precision.

The participants who met the inclusion criteria

1. All secondary school students who consented to the study or whose consent was given by guardian or teacher.
2. Students with visual acuity (VA) > 6/24.

Exclusion criteria

Secondary school students with visual impairment (V.A < 6/24) in the better eye).

The participants had a comprehensive ophthalmological eye examination after which a structured questionnaire was administered to assess their level of awareness of color vision deficiency.

All data generated were entered into a personal computer and then analysed with the help of a statistician using commercially available Statistical Package for Social Sciences Package version 21 (SPSS-21). Mean and standard deviations were determined for age. The age groups gender, other demographic distribution of the subjects amongst other were presented using frequency tables and charts

Results

One thousand secondary school pupils showing a 100% response rate were interviewed for awareness of Color Vision Disorder during the study period.

N	Males	Female	M:F	Age range	Mean age
1000	495 (49.5%)	506 (50.6%)	1:1.02	9 - 20 years	14.3 ± 1.8 years

Table 1: Demographics of study population.

There was no significant difference between the proportion of male (n = 495; 49.4%) and female students (n=506; 50.6%) with $X^2 = 0.144$, $df = 1$ and p-value 0.704.

Age group in years	Male n (%)	Female n (%)	Total n (%)	p-values
< 10 years	1 (0.2)	2 (0.4)	3 (0.3)	0.563
10 -12 years	63 (12.8)	61 (12.1)	124 (12.4)	0.857
13 -15 years	303 (61.3)	349 (69.0)	652 (65.2)	0.071
16 -18 years	117 (23.7)	93 (18.4)	210 (21.0)	0.091
>18 years	10 (2.0)	1 (0.2)	11 (1.1)	0.007
Total	494 (100.0)	506 (100.0)	1000 (100.0)	

Table 2: Age group and gender distribution of the study population.

Less than one-third of the students were aware of colour blindness (n = 234; 23.4%) and this was found to be low when compared to those not aware. This finding was statistically significant ($X^2 = 283.02$, $df = 1$, p-value 0.0001).

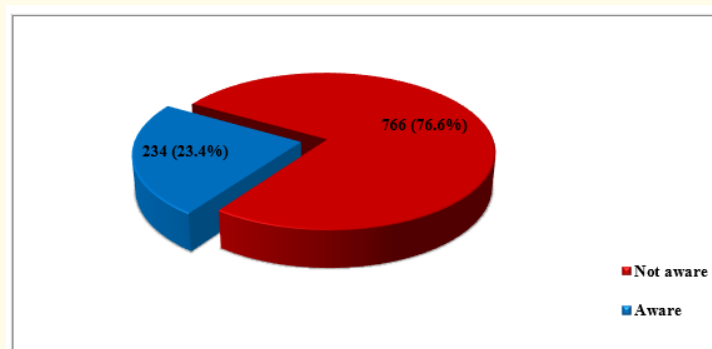


Figure 1: Level of awareness of colour vision disorders among study subjects.

The level of awareness of colour blindness among the students was found to increase with age and this was statistically significant ($X^2 = 56.11$, $df = 4$, p-value = 0.000). Among the male students, less than one third of them were aware of Colour Vision Disorders (n = 112; 22.7%) and a similar proportion of females were also aware among the female population (n = 122; 24.1%). There was no statistically significant difference in the level of awareness between genders ($X^2 = 0.289$, $df = 1$, p-value = 0.591) as shown below.

Table 4 shows the source of awareness of colour vision disorders among the students. More than half of the students who had a knowledge of CVD became aware of colour blindness through their school (n = 145; 62%) and the least source of information was from friends and relatives (3.8%). About two-thirds of the students aware of colour blindness agreed that it could interfere with carrying out daily activities in affected persons, (n = 162; 69.2%). Family history of colour blindness was recorded in 23 (2.3%) students.

	Aware n (%)	Not aware n (%)	Total n (%)	p-value
Age group				
< 10 years	0 (0.0)	3 (100.0)	3 (100.0)	0.083
10 -12 years	4 (3.2)	120 (96.8)	124 (100.0)	0.000
13 -15 years	46 (22.4)	506 (77.6)	652 (100.0)	0.001
16 -18 years	9 (37.6)	131 (62.4)	210 (100.0)	0.003
>18 years	5 (45.5)	6 (54.5)	5 (100.0)	0.765
Total	234 (23.4)	766 (76.6)	1000 (100.0)	
Gender				
Male	112 (22.7)	382 (77.3)	494 (100.0)	0.000
Female	122 (24.1)	384 (75.9)	506 (100.0)	0.000
Total	234 (23.4)	766 (76.6)	1000 (100.0)	

Table 3: Age group, gender and level of awareness on colour vision disorders among study subjects.

Variable	No of students n	Percentage %
Source of awareness on colour blindness		
School	145	62.0
Read about it	70	29.9
Media	10	4.3
Friend and relatives	9	3.8
Total	234	100.0

Table 4: Source of awareness of colour vision disorder among the students.

Discussion

Our study found that less than a third of the students (23.4%) were aware of colour blindness. Although there is a paucity of data on awareness of colour vision, the study by Tabansi, *et al.* [5] in primary school children, reported that 62% of the respondents had heard of colour blindness the reason for the high figure may have been because the awareness survey was carried out amongst teachers and not school children, it may also have been due to the fact that the latter was carried out in the urban area compared to the index study which is rural.

In the study carried out by Dahlan and his colleagues [9] in Saudi Arabia, it was noted that more than one third of those colour blind were not aware that they had the condition, this may have been due to the fact that most colour blind individuals are anomalous trichromats and may not detect their disorder except through professional screening for colour vision [10].

This was also in line with the study by Mulusew and cohorts [8] where almost all subjects studied were not aware of their colour vision status. More than half of the students who were aware of colour vision disorders (62%) in the index study became aware through their schools further buttressing the importance of screening for colour vision in secondary schools.

About half the respondents with CVD had near normal colour vision or mild colour vision disorder (50%), while 10% had moderate CVD and 4% had severe CVD. In all classes of severity, males had a higher preponderance. In the deutan group, about 24% (24) were of

the mild and moderate severity while 7% (9) had severe deutan patterns. This was similar to the study carried out by Singh, *et al.* [11] where of the deutans studied 26 had mild patterns while 8 had severe or strong patterns. It however differs slightly from the study carried in Punjab Indians where 20 were mild deutan and 6 strong deutan [12] the difference in the frequencies may have been as a result of the difference in the number of colour blind individuals.

Also markedly differing was the study by Godar, *et al.* [13] which had a frequency for strong deutan as 0 and mild deutan as 38. This high frequency may be attributed to the fact that it was a hospital based study and may not have been truly representative of the population.

A study done in Ibadan Nigeria recently put the prevalence of color vision disorders in secondary school children at 2.3% [14] awareness was not addressed as the study was mainly aimed at elucidating the impact of color vision disorders on daily activities. Dohvoma, *et al.* [15] did a study amongst first year undergraduates and got a prevalence of 1.3% though his population was slightly older, none of the participants were aware of color vision disorders.

Reddy, *et al.* [16] also had similar findings with 1.9% prevalence of color vision defect in school children, more males' affected and low awareness of the disease.

Many suggestions have been put forward to address color vision deficiency early in the classroom; these include use of monochrome shades in teaching, high contrast colors, thicker lines or more texture [17].

It is important we consider color vision deficiencies early in life as they may impact on school work causing low grades and even influence the choice of a life time career [18].

Conclusion

From the findings of this research work, it can be concluded that most of the cases of CVD were mild in severity with the deutan pattern being the most prevalent. The awareness level of CVD amongst the students was very low.

We recommend that the results of the study be used in advocacy for the inclusion of screening for CVD to be incorporated into the curriculum of secondary school students especially at the entry level. Adequate awareness should also be created about CVD, with provisions made for counseling on its implications in choice of career and vocation.

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