www.jmscr.igmpublication.org Impact Factor 3.79
ISSN (e)-2347-176x

IGM Publication Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Incidence of Color Blindness among State Junior High School 1 Medan Students in 2014

Authors
Nurchaliza Hazaria Siregar[1], Annisa Nidya Rahmatika Sitepu[2]
[1]Departement of Ophthalmology, Sumatera Utara University, Medical School, Medan, Indonesia
[2] Medical Students, Sumatera Utara University, Medical School, Medan, Indonesia
Corresponding Author
Nurchaliza Hazaria Siregar
MD, Department of Ophthalmology, Sumatera Utara University, Medical School
Ramos No.26/04 Medan – 20124, Indonesia
Tel.: +62 8126057923 Email: *nurchalizas@yahoo.co.id*

Abstract
Purpose: *Color blindness is the inability to distinguish the perception of some colors or all colors, which normal person can do. Color blindness is a condition that generally is inherited genetically, but can also be obtained due to damage of the eye, nerves, or brain. Color blindness is genetically determined by X chromosome in females, and passed on to their children. This study was aimed to determine the incidence of color blindness among students of State Junior High School 1 Medan in 2014, according to their gender, family history, or according to the classification of color blindness.*
Methods: *The study was a descriptive study and was performed using total sampling technique (n= 242, male 113, female 129). Data collection was done by examining color blindness using the Ishihara Chart (38 Plates). Data analysis was performed by using descriptive analysis.*
Results: *The results of this study shows that among 242 total samples, 10 male students and one female student were found to be color blind, in which two of them are protanopia, 8 persons are deuteranopia, and one person is red-green deficiency. Of the 11 persons with color blindness, one of them had a family history of color blindness.*
Key Words : *Color blindness, students, Ishihara Plates.*

INTRODUCTION

Color blindness is the inability to distinguish the perception of some colors or all colors, which a normal person can do.[1,2]

Color blindness is a condition that generally inherited genetically, but can also obtained due to several medications, damage of the eye, nerves or brain.

Inherited color blindness is genetically determined by X chromosome in females an passed on to their children. Color blindness almost never occur to females because one of two X chromosome will

almost always have normal genes for each cone type. Where as in males, who only have one X chromosome, the other missing gene can cause color blindness. X chromosome of males are always inherited from mother and never from father, so that color blindness inherited from a mother to her son and the mother is called as a *Carrier;* this condition occur to 8% of all females.[4]

There are three types of inherited color blindness: *monochromacy* (total color blindness), *dichromacy* (only two types of functioning cone cells) and *anomalous thrichromacy* (three types of functioning cone cells, in which one of them not functioning well). [1,5] From all types of color blindness, the most common case is *anomalus trichromatic*, especially *deutranomaly* that is present in 5% of males.

Actually the cause of color blindness is not only by the X chromosome disorder, but can be related to 19 chromosome and many different genes. The two genes that are related to color blindness are OPN1LW (*Opsin 1 Long Wave*), encoding red pigment and OPN1MW (*Opsin 1 Middle Wave*), encoding green pigment.[6]

Generally, around 10% of total male population experienced color blindness, while females only 1%. According to the Riset Kesehatan Dasar (RISKESDAS) 2007, the prevalence of color blindness in Indonesia is 7,4%.

Color blindness can be detected by color blind test. One of color blind test method is Ishihara. [1,5,8,9] Ishihara test is a test to detect any defect of color vision by identifying the numbers or patterns shown in the cards with various colors.

This study was aimed to determine the incidence of color blindness among students of State Junior High School 1 Medan in 2014, according to their gender, family history or according to the classification of color blindness.

METHODS

The study was a descriptive study, with a cross-sectional design conducted from 27th September 2014 to 14th October 2014.

Methods of sampling in this study was using *total sampling technique*, where the entire population was used as a sample.[10] Population in this study were all 9th grade students from State Junior High School 1 Medan, as many as 242 person, with these students as the inclusion criteria and the exclusion criteria was not willing to be a sample.

Collection of data obtained directly from the data source, through interviews to determine the demographic data and proceed with the examination using the *Ishihara* books (38 *Plate*) that was conducted directly by researcher on research sample, then all the data that have been collected are recorded, classified and then processed using computer programs for appropriate statistic.

RESULTS

Based on the results of the examination of color blindness that has been done, it was found that from the 242 subjects, 231 subjects (95.5%) had normal test results and 11 subjects (4.54%) suffered from color vision defects, with the results of the examination: 2 persons (0.8%) were *protanopia*, 8 persons (3.3%) were *deuteranopia,* 1 person (0.4%)

was *red-green deficiency* and no one had *monochromacy* (0,0%).

Table 1. Distribution of study subjects according to the results of the examination of color blindness

Results	**N**	**%**
Normal	231	95,5
Color Blindness	11	4,5
- **Protanopia**	2	0,8
- **Deuteranopia**	8	3,3
- **Red-green deficiency**	1	0,4
- **Monochromacy**	0	0,0
Total	242	100,0

This research also found that more male subjects (8.84%) had color blindness compared to female subjects (0.77%).

Table 2. Distribution of study subjects according to gender and color blindness test results

Results	Males		Females		Total	
	N	%	N	%	N	%
Normal	103	91,1	128	99,2	231	95,5
Color Blindness	10	8,84	1	0,8	11	4,54
Total	113	100,0	129	100,0	242	100,0

From 11 subjects who suffered from a color-blindness, 1 of them (9.09%) had a history of color blindness.

Table 3. The distribution of study subjects according to a history of color blindness and color blindness test results

Results	Color Blindness History						Total	
	Yes		No		Unknown			
	N	%	N	%	N	%	N	%
Normal	1	50	154	97,5	76	92,7	231	95,5
Color Blind	1	50	4	2,5	6	7,31	11	4,54
Total	2	100	158	100	82	100	242	100

DISCUSSION

Based on the results of the examination of color blindness that has been done, it was found that from the 242 subjects, 231 subjects (95.5%) had normal test results and 11 subjects (4.54%) suffered from color vision defects, with the results of the examination: 2 persons (0.8%) were *protanopia*, 8 persons (3.3%) were *deuteranopia*, 1 person (0.4%) was *red-green deficiency* and no one had *monochromacy* (0,0%) (table 1).

According to research conducted in Pokhara, Western Nepal (2010), the number of children who had color blindness were about 18 persons (3.8%).[11] These results are not very different from the results obtained in this study. The results of this study are also comparable with research conducted in Singapore (4.8%) and Korea (5.9%). However, the results of this study is high when compared with the data obtained by Riset Kesehatan Dasar (RISKESDAS) (2007) which states that the national prevalence of color blindness was 0.7%. [7]

The results of this study are also different when compared with the results of previous research conducted by Situmorang, A.M (2010), which the results, persons who suffer from color blindness were 129 people (39.09%) with the results of the examination: 33 persons were *protanopia* (25.58%), 74 persons (57.36%) were *deuteranopia*, 21 persons (16.28%) were *red-green deficiency* and monochromacy by 1 person (0.78%). [12] But, generally the results are the same, which most of the subject suffer from color vision defect such as *deuteranopia*, then *protanopia*, *red-green deficiency* and last *monochromacy*.

It is also consistent with the study conducted in Manipur, India (2013) which subjects with vision disorders such as *deuteranopia* (20%) were more than the subjects who suffer vision disorder *protanopia* (8.57%), in which he stated that this happens because the green color receptors are more likely to be damaged than red or blue color receptors. But it is different with the statement of Botts, P, (2010) and Hogward Hughes Medical Institute (2006) which states that the most common color vision defect is *red-green deficiency*. [13]

In this study, it is also found that more male subjects (8.84%) had color blindness compared to female subjects (0.77%). **(**table **2**)

This is consistent with some color blindness incidences in several different countries. In Australia, color blindness occurred in 8% of males and 0.4% in females. In Asia, about 4.9% of color blindness occurs in males and 0.6% in females. While in Europe, approximately 8% of the population were color blind, whereas 1-6% are of African nation, 2-7% South Asian nation, 3-6% of the East Asia nation and 1% of South American, Indian and Eskimo nation.

A study conducted in Manipur, India in 2012 also showed 8.73% of males and 1.69% of females experiencing color blindness. While the number of people with color blindness in Indonesia, according to a research conducted, 5-8% of males and 0.5% of females born with color blindness.

This study also found 11 research subjects who have color blindness, one of them (9.09%) have family history of color blindness **(**table **3**). This is in-line with the fact that genetically inherited color blindness is carried by X chromosome in females,

and passed on to their children. Because the X chromosomes in males is always inherited from their mother, and never from their father, color blindness passed from mother to son, and mother is a carrier of color blindness. This incident occurred in about 8% of all females.

REFERENCES

1. Daniel. Color Blind Essentials; 2006: 5
2. Dargahi H, Einollahi N, Dashti N. Color Blindness Defect and Medical Laboratory Technologists; Unnoticed Problems and the Care for Screening. Acta Medica Iranica. 2009 June; 48(3): 172-177.
3. Shah A, Hussein R, Fareed M, Afzal M. Prevalence of Red-Green Color Vision Defects among Muslim Males and Females in Manipur, India. Iranian J Publ Health. 2013 Jan; 42(1): 16-24.
4. Guyton AC, Hall JE. Buku Ajar Fisiologi Kedokteran. Edisi 11. Jakarta: ECG;2007.
5. Agusta S, Mulia T, Sidik M. Instrumen Penguji Buta Warna Otomatis. Jurnal Ilmiah Elite Elektro. Maret 2012; 3(1): 15-22.
6. Deeb SS, Motulsky AG. Red-Green Color Vision Defects. NCBI Bookshelf. 2011 Sept: 1-19.
7. Badan Penelitian dan Pengembangan Kesehatan. Laporan Hasil Riset Kesehatan Dasar (RISKESDAS) Nasional; 2007.
8. Heidary F, Gharebaghi R. A MODIFIED Pseudoisochromatic Ishihara Colour Vision Test Based on Eastern Arabic Numerals. MEHDI Opthalmol. 2013; 2(3): 83-85.
9. Widianingsih R, Kridalaksana AH, Hakim AR. Aplikasi Tes Buta Warna dengan Metode Ishihara Berbasis Komputer. Jurnal Informatika Mulawarman. Februari 2010; (5): 36-41.
10. Notoadmodjo S. Metodologi Penelitian Kesehatan. Jakarta: Rinek Cipta; 2010.
11. Niroula DR, Saha CG. The Incidence of Color Blindness among Some School Children of Pokhara, Western Nepal. Nepal Med Coll J. 2010; 12(1): 48-50.
12. Situmorang AM. Prevalensi Buta Warna pada Siswa-Siswi SMA di Kecamatan Medan Helvetia. Medan: Universitas Sumatera Utara; 2010.
13. Botts P, Color Blindenss. School of Earth and Environment; 2010.