Prevalence of Color Vision Deficiency in Students of Muhammadiyah Palembang University

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ABSTRACT

A Color blind is an inability of a person to distinguish some colors that can be recognized by others. This condition is caused by genetic mutation in OPN1LW, OPN1MW, and OPN1SW gene. This situation is derived with an X-linked pattern or can also be obtained after birth. This study aimed to determine the prevalence of color blindness among students of Muhammadiyah Palembang University. This research was a descriptive observational study with cross sectional design that used secondary data. A sample size of 174 subjects was taken using stratified random sampling at Faculty of Economics and Business, Faculty of Law, and Faculty of Islamic Studies. The selected students were students of 2017 intake whose names were registered at www.forlap.dikti.go.id. Data on color vision status were taken from the archives of color blindness screenings owned by the Family Physician Clinic of Medical Faculty of Muhammadiyah Palembang University. Color blind screening was carried out by Medical Team for new student admission consisting of 7 general practitioners and used Ishihara book as a tool. Research subjects consisted of 88 males (50.6%) and 86 females (49.4%). This study only found 1 male subject with color blind (0.6%). This figure is lower than the national incidence rate of 0.7%, and the incidence rate in South Sumatra is 12.8%. Hasil penelitian ini sesuai dengan teori bahwa biasanya buta warna terjadi pada laki-laki karena memperoleh kromosom X dari ibu yang membawa alel buta warna. Kesimpulan, prevalensi buta warna pada mahasiswa Universitas Muhammadiyah Palembang tergolong rendah bila dibandingkan prevalensi nasional.

Keywords: Color blind, color blindness, hereditary disease, X-linked disease

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Original Research

Prevalensi Buta Warna pada Mahasiswa Universitas Muhammadiyah Palembang

Prevalence of Color Vision Deficiency in Students of Muhammadiyah Palembang University

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ABSTRAK

Buta warna adalah ketidakmampuan seseorang untuk membedakan beberapa warna yang dapat dibedakan oleh orang lain. Penyakit ini disebabkan oleh mutasi pada gen OPN1LW, OPN1MW, dan OPN1SW. Keadaan ini diturunkan dengan pola X-linked atau bisa juga didapat setelah lahir. Tujuan penelitian ini adalah untuk menentukan prevalensi buta warna pada mahasiswa Universitas Muhammadiyah Palembang. Penelitian ini merupakan penelitian deskriptif observasional dengan desain potong lintang yang menggunakan data sekunder. Besar sampel sebanyak 174 orang diambil dengan metode stratified random sampling di Fakultas Ekonomi, Fakultas Hukum, dan Fakultas Agama Islam. Mahasiswa yang dipilih adalah mahasiswa angkatan 2017 yang namanya terdaftar di www.forlap.dikti.go.id. Data status penglihatan warna diambil dari arsip skrining buta warna milik Klinik Dokter Keluarga Fakultas Kedokteran UM Palembang. Skrining buta warna dilakukan tim kesehatan penerimaan mahasiswa baru, yang terdiri dari 7 dokter umum, dengan menggunakan Buku Ishihara sebagai alat bantu. Sampel terdiri dari 88 orang laki-laki (50,6%) dan 86 orang perempuan (49,4%). Penelitian ini hanya menemukan 1 subjek penelitian dengan buta warna (0,6%) berjenis kelamin laki-laki. Angka ini lebih rendah dari angka kejadian nasional yaitu 0,7% dan angka kejadian di Sumatera Selatan 12,8%. Hasil penelitian ini sesuai dengan teori bahwa biasanya buta warna terjadi pada laki-laki karena memperoleh kromosom X dari ibu yang membawa alel buta warna. Kesimpulan, prevalensi buta warna pada mahasiswa Universitas Muhammadiyah Palembang tergolong rendah bila dibandingkan prevalensi nasional.

Kata Kunci: Buta warna, penyakit herediter, penyakit X-linked

ABSTRACT

AColor blind is an inability of a person to distinguish some colors that can be recognized by others. This condition is caused by genetic mutation in OPN1LW, OPN1MW, and OPN1SW gene. This situation is derived with an X-linked pattern or can also be obtained after birth. This study aimed to determine the prevalence of color blindness among students of Muhammadiyah Palembang University. This research was a descriptive observational study with cross sectional design that used secondary data. A sample size of 174 subjects was taken using stratified random sampling at Faculty of Economics and Business, Faculty of Law, and Faculty of Islamic Studies. The selected students were students of 2017 intake whose names were registered at www.forlap.dikti.go.id. Data on color vision status were taken from the archives of color blindness screenings owned by the Family Physician Clinic of Medical Faculty of Muhammadiyah Palembang University. Color blind screening was carried out by Medical Team for new student admission consisting of 7 general practitioners and used Ishihara book as a tool. Research subjects consisted of 88 males (50.6%) and 86 females (49.4%). This study only found 1 male subject with color blind (0.6%). This figure is lower than the national incidence rate of 0.7%, and the incidence rate in South Sumatra is 12.8%. Results of this study are consistent with the theory that color blindness usually occurs in men because of obtaining X chromosome from a mother who carries color-blind allele. In short, the prevalence of color blind in students of Muhammadiyah Palembang University is lower compared to the national prevalence.

Keywords: Color blind, color blindness, hereditary disease, X-linked disease

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INTRODUCTION

Color blindness is an inability of a person to distinguish several colors that can be recognized by others (1). This inability is caused by mutations in the long wave, the medium waves, and/or the shortwave opsins genes. The long wave opsin gene (OPN1LW) and the medium wave opsin gene (OPN1MW) are located on the Xq28 chromosome, while the short wave opsin gene (OPN1SW) is located on chromosome 7q32 (2). This disease is usually hereditary inherited from parents to children with an X-linked recessive pattern. This hereditary pattern is indicated by the inheritance from a mother to her son, as a result the child suffers from color blindness. If the allele is inherited to her daughter, then the daughter will be a carrier (3).

Color blindness that is inherited congenitally consists of three types, i.e. monochromacy, dichromacy, and trichromacy anomalies. Monochromacy is total color blindness, where the sufferer cannot distinguish colors due to cone cells damage in the retina. Dichromacy is color blind due to damage to one of the pigment cones, so the color is only two dimensions. Dichromacy consists of protanopia (no red photoreceptor), deuteranopia (no green photoreceptor), and tritanopia (no blue photoreceptor). Trichromacy anomalies are color blind due to damage to retinal cone pigment cells in the spectrum sensitivity section. Trichromatic anomalies consist of protanomaly and deuteranomaly (difficult to distinguish between red and green) and tritanomaly (difficult to distinguish between blue and yellow) (4).

Color blindness is not medically life threatening. The situation that makes it difficult related to this disease is the limitation of future career choices for sufferers. Some jobs do not tolerate color blindness, such as medical doctors. Clinical expertise of a doctor can be disrupted due to color blindness. This can affect decision making in a treatment (5).

The incidence of color blindness in some countries is higher in men. In European Caucasian race there are about 8% of people who are color blind, Japanese race is approximately 6.5%, and Chinese race is around 4% (6). The incidence of color blindness in Indonesia based on patient complaints is 0.7%. South Sumatra is one of the six provinces with a prevalence of color blindness above national prevalence with a total of 12.8% (7). The high prevalence of color blindness in South Sumatra needs attention because this disease can be inherited. Muhammadiyah University of Palembang which is one of the major universities in South Sumatra becomes the choice of many prospective students, thus it can be a representative location for color blind screening. This study was conducted to identify the prevalence of color blindness in Muhammadiyah University of Palembang students as a contribution to basic data on color blindness. Early identification of color blindness at school age and higher education is an important strategy to provide an early basis for career development choices.

METHOD

This study was an observational descriptive study with a cross-sectional design using secondary data. The sample size was calculated using the formula for cross-sectional research and obtained 174 research subjects. The research subjects were then taken using the stratified random sampling method at the Faculty of Economics, the Faculty of Law, and the Faculty of Islamic Studies, UM Palembang. These three faculties were chosen because the students did not have to be color blind free, therefore the characteristics of their students were heterogeneous. The selected subjects were students of the 2017 intake. The list of student names was obtained from www.forlap.dikti.go.id, and data on color vision status were obtained from the medical records archive on examination of new prospective students belonging to the Family Doctor Clinic of the Faculty of Medicine, UM Palembang. The color vision status examinations have been carried out by the Health Team consisting of 7 general practitioners and 1 ophthalmologist at the New Student Admission of UM Palembang from March to August 2017. The examination of color vision status was done by asking students to read the numbers in the inner color plates in Ishihara test chart book. Ishihara test uses a pattern or number on a card (plate) with a different series of small and large color balls (pseudochromatic) (3). Research subjects were asked to read each card in a maximum duration of 10 seconds. If the subject can read 10-14 cards correctly, he or she is categorized as not color blind. If the subject is only able to read less than 7 cards, then categorized as partial color blindness. If the subject can only read card number 1 and is unable to read all cards number 2-14 then categorized as total color blindness. This research has obtained a certificate of ethical clearance of research from the Units of Bioethics, Humanities, and Islamic Medicine of the Faculty of Medicine, Muhammadiyah University of Palembang (No. 001/EC/UBHKI/FK-UMP/IX/2017).

RESULTS

The color blind test was carried out on the research subjects during the new student admission test at Muhammadiyah University of Palembang. The number of male research subjects was 88 (50.6%) and women as many as 86 people (49.4%). The distribution of color vision of the research subjects is summarized in table 1. Color blindness in this study was divided into 2, namely partial color blindness and total color blindness. The results only found one subject with partial color blindness, which meant that the subject was able to read less than 7 cards in the Ishihara Book. Table 1 uses row percentages and column percentages. From table 1, it can be seen that the color blind sufferer in this study was only 1 person, so when viewed by gender, the percentage was 1.1% of all male samples. When calculated from all samples, the percentage is 0.6%.

Table 1. Frequency distribution of color vision status by gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>color vision status*</th>
<th>Total*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>partial color blindness</td>
<td>Normal</td>
</tr>
<tr>
<td>Male</td>
<td>1 (1.1%)</td>
<td>87 (98.7%)</td>
</tr>
<tr>
<td>Female</td>
<td>0 (0.0%)</td>
<td>86 (100.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>1 (0.6%)</td>
<td>173 (99.4%)</td>
</tr>
</tbody>
</table>

Note: * = column percentage
DISCUSSION

The number of color blindness in all subjects (0.6%) was lower than the rate of color blindness in Indonesia based on patient complaints (0.7%) and the incidence in South Sumatra (12.8%) (7). The incidence of color blindness in all subjects of this study was also lower than some populations in other countries. From two studies in Iran, each found that color blindness in hospital laboratory employees was as much as 1.90% and color blindness in school students in India was 2.3% from 1,561 students (1.8). A study of Muslim populations in Manipur, India, obtained a red-green color blindness rate of 5.28% of the total sample (9). The incidence of color blindness in Pakistan was also higher, at 2.75% and 0.9% (10, 11). Eye health survey results in school children in Kathmandu, Nepal, reported the incidence of congenital color blindness was 1.13% (12).

This research focuses on faculties that do not require free color blindness so it is more likely to find color blindness than in faculties that require color blindness free. This condition is different from one study in Pakistan which took a sample of 215 medical students and dentists, apparently 12 people (5.58%) of whom were color blind (13). The small number of cases found compared to the prevalence in community shows the importance of more extensive and early screening.

The color blindness case in this study was found in men. Inheritance of color blindness is included into the diseases that are inherited by X-linked recessive patterns. This can happen because the OPN1LW and OPN1MW genes are located on the X chromosome that the boy will receive from his mother (14). The results of this study were different from some overseas studies which found women with color blindness; for example, the results of prospective employee examinations in Pakistan found a color blindness rate of 0.9%, of which 0.4% were male and 0.4% were female (12). Research at various institutions in Pakistan also obtained a woman (0.2%) who was color blind (10). Research on Muslims in Manipur, India, obtained a color blindness rate of 1.69% among women (9).

Although theoretically, color blindness is a disease that is inherited by X-linked recessive, that means, men are sufferers and women are only carriers, but there is a term obtained color blindness that is color blindness in women. In color blindness, there is 1 gene (OPN1SW) located on chromosome 7 so it is possible for women with color blindness to get an abnormality in the OPN1SW gene on chromosome 7, which is not in the X-linked pattern. Obtained color blindness can also be caused by abnormalities in the eyes, nerves, or brain due to exposure to chemicals (4). One exposure to chemicals that can cause color blindness is Ethambutol which is a drug for pulmonary tuberculosis. One patient underwent a treatment for pulmonary tuberculosis in the Lung Disease Treatment Unit Pontianak (UP4) experienced color blindness after taking Ethambutol for less than 2 months and one person experienced color blindness after taking Ethambutol for more than 2 months (15). This study did not consider the causal factors for color blindness, whether hereditary or acquired color blindness. This is the limitation of this study, so for further research it is necessary to conduct history taking (anamnesis) on patients and to conduct color blind examinations in the families of patients for three generations to determine whether it is hereditary or not.

This study identifies the color blindness rate that is lower than the national incidence rate and several studies abroad, but cautious must be made related to the possibility of iceberg phenomena because of the weakness of early detection. Color blindness does not only affects sufferers’ learning achievement but also parents’ satisfaction (16). Therefore, an examination of a person’s color vision conditions should be carried out in primary or junior high school because this can affect learning achievement, education pathways, and career development.

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REFERENCE


