**BRIEF COMMUNICATION**

**Prevalence of Dyschromatopsia in adolescents in Pinar del Río province**

Prevalencia de Discromatopsia en adolescentes de la provincia Pinar del Río

**Elisbeth Pérez-Montes de Oca1****,Yanet Romero-Reinaldo2, Osmany Marcheco-Moreira3**

1University of Medical Sciences of Havana. Faculty of Medical Sciences "Victoria de Girón". Havana, Cuba.

2University of Medical Sciences of the Revolutionary Armed Forces. Central Military Hospital "Dr. Luis Días Soto". Havana, Cuba.

3University of Medical Sciences of the Revolutionary Armed Forces. Dr. Carlos J. Finlay" Central Military Hospital. Havana, Cuba.

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**ABSTRACT**

**Introduction:** dyschromatopsia is a vision disorder that makes it impossible to distinguish colors. It is manifested by the deficiency, inefficiency or inexistence of cone and rod photopigments. It has an approximate incidence of 8-10 % in men and 0.,4 % in women in a general population.

**Objective:** To determine the prevalence of dyschromatopsia in adolescents in the province of Pinar del Río in the year 2021.

**Methods:** An observational, descriptive and transversal study was carried out in adolescent patients diagnosed with dyschromatopsia in the province of Pinar del Río during the year 2021. The universe was composed of 959 patients. Adolescent patients studied in the health area through the Pinar del Río clinics diagnosed with dyschromatopsia through the Ishihara test were included. Patients without visual impairment and those older than 19 years were excluded. Descriptive statistics were used, the results were obtained as absolute and relative percentage frequencies.

**Results:** The prevalence of dyschromatopsia in adolescentes in Pinar del Río province was 2,81 %, with a prevalence rate of 28 adolescent dyschromatopsia per 1,000. The male sex predominated (96,29 %). The municipality with the highest prevalence rate was Sandino, with 121,2 per 1000 subjects, followed by Minas de Matahambre (80x1000) and Viñales (41,6x1000).

**Conclusions:** Dyschromatopsia in the province of Pinar del Río occurred more frequently in male adolescents aged 14 years. The municipality with the highest prevalence rate was Sandino.

**Keywords:** Adolescence; Dyschromatopsia; Prevalence; Ishihara Test.

**RESUMEN**

**Introducción:** la discromatopsia es un trastorno de la visión que imposibilita distinguir los colores. Se manifiesta por la deficiencia, ineficacia o inexistencia de fotopigmentos de los conos y los bastones. Tiene una incidencia aproximada del 8-10 % en hombres y el 0,4 % en mujeres dentro de una población general.

**Objetivo:** Determinar la prevalencia de Discromatopsia en adolescentes en la provincia de Pinar del Río en el año 2021.

**Método:** Se realizó un estudio observacional, descriptivo y transversal en pacientes adolescentes diagnosticados con discromatopsia en la Provincia de Pinar del Río durante el año 2021. El universo estuvo compuesto por 959 pacientes . Se incluyeron los pacientes adolescentes estudiados en el área de salud a través de los consultorios de Pinar del Río diagnosticados con Discromatopsia a través del test de Ishihara . Se excluyeron los pacientes sin afectación visual y los mayores de 19 años. Se empleó estadística descriptiva.

**Resultados:** La prevalencia de discromatopsia en adolescentes de la provincia Pinar del Río fue de 2,81 %, con una tasa de prevalencia de 28 adolescentes discrómatas por cada 1 000. Predominó el sexo masculino (96,29 %). El municipio con mayor tasa de prevalencia fue Sandino, con 121,2 por cada 1000 sujetos, seguido de Minas de Matahambre (80x1000) y Viñales (41,6x1000).

**Conclusiones:** La Discromatopsia en la provincia de Pinar del Río se presentó con mayor frecuencia en adolescentes masculinos de 14 años. El municipio con mayor tasa de prevalencia fue Sandino.

**Palabras clave:** Adolescencia; Discromatopsia; Prevalencia; Test de Ishihara

**INTRODUCTION**

Color blindness is a vision disorder that makes it impossible to distinguish colors (dyschromatopsia). It is named after the British physicist John Dalton who was a carrier of this visual disease, which became known only after his death.(1)

This disorder is manifested by the deficiency, ineffectiveness or non-existence of photopigments by specialized sensory cells, the cones and rods, which are found in the retina of the eye. Both specialized cells are made up of pigments called conjugated proteins (cyanopsin, chloropsin and rhodopsin), and these in turn are made up of proteins called opsin bound to the carotenoid 11-cis-retinal. These proteins are responsible for sending the sensory stimulus through the optic nerve to the cerebral cortex. Even when chromatic discrimination is abnormal in these people, acuity is not affected by this alteration, the latter being caused by independent and isolated causes.(1,2,3)

People with this disorder have two types of photoreceptors, i.e., one type of cone is absent, producing a total visual impairment. What the observer does is to match the colors with the mixture of two photopigments.(2,7)

It has three classifications: protanopia: absence of the red photoreceptor. They confuse red with gray and blue with purple. Protanopes have their neutral point at the 492 nm wavelength, perceiving it as white. Deuteranopia: absence of the green photoreceptor. They mistake green and purple for gray.

Deuteranopes have their neutral point at the 499 nm wavelength, perceiving it as white. Tritanopia: absence of the blue photoreceptor. They confuse greenish yellow and purplish pink with gray; yellowish green with bluish purple and orange with purplish red. The tritanopes have their neutral point at the wavelength of 570 nm, perceiving it as white.(1)

Dyschromatopsia occurs with an incidence of approximately 8-10 % in men and 0,4 % in women in a general population. Sex differences have been described in the proportion of people affected by congenital pathologies, since they affect 8 % of the male population and only 0,5 % of the female population, due to the hereditary factor affecting the X chromosome.(1,4,6)

Congenital dyschromatopsias seem to be more frequent in North America and Western Europe; it has also been suggested that non-Caucasian races present a lower incidence, but the exact causes of the variations in frequency are not known.(1,7,8)

The present study was carried out with the objective of determining the prevalence of Dyschromatopsia in adolescents in the province of Pinar del Río.

**METHODS**

An observational, descriptive and cross-sectional study was carried out in adolescent patients diagnosed with dyschromatopsia in Pinar del Río Province during the year 2021.

The universe was composed of 959 adolescents in the province. A purposive sampling of patients with visual impairment was carried out in the place and period described above, resulting in a total of 28 patients diagnosed with dyschromatopsia. Adolescent patients diagnosed with dyschromatopsia through the Ishihara test were included, with complete individual clinical histories, by means of a medical checkup in the health area through the Pinar del Río clinics. Patients without visual impairment and those older than 19 years were excluded. Descriptive statistics were used, the results obtained were made as absolute and relative percentage frequencies.

Medical records were used as the primary source of information. The variables age and sex were studied. The information was collected by means of a data collection form.

The data obtained were deposited in a database and processed using Microsoft Office Excel. Descriptive statistics were used for data analysis, using absolute and relative percentage frequencies.

The ethical principles established in the Declaration of Helsinki were taken into account during the research. As part of the research, confidentiality was guaranteed for all data obtained, which were used strictly for research purposes.

**RESULTS**

The prevalence of dyschromatopsia in adolescents in Pinar del Río province was 2,81 %, with a prevalence rate of 28 adolescent dyschromatopsia per 1000 adolescents. Male subjects predominated (96,29 %). Only one female subject was identified with this disease (3,7 %). The average age was 14 years.

The municipality with the highest prevalence rate was Sandino, with 1212 per 1000 subjects, followed by Minas de Matahambre (80x1000) and Viñales (416x1000). (Table 1).

**Table 1.** Prevalence of dyschromatopsia in adolescents in Pinar del Rio province.

|  |  |  |  |
| --- | --- | --- | --- |
| **Municipality** | **Population** | **Dyschromatopsia** | **Rate\*** |
| Los Palacios | 54 | 1 | 18,5 |
| Consolación del Sur | 174 | 4 | 22,9 |
| Pinar del Río | 176 | 2 | 11,3 |
| San Luis | 80 | 1 | 12,5 |
| San Juan y Martínez | 84 | 2 | 23,8 |
| Guane | 105 | 2 | 19 |
| Mantua | 68 | 1 | 14,7 |
| Sandino | 33 | 4 | 121,2 |
| La Palma | 62 | 2 | 32,2 |
| Viñales | 48 | 2 | 41,6 |
| Minas de Matahambre | 75 | 6 | 80 |

\* Rate per 1,000 adolescents

**DISCUSSION**

Color vision is very important for life. Some difficulties may be encountered in daily activities, for example, in matching the color of clothes, in recognizing flowers and plants, or in choosing a ripe fruit. In addition, it can also affect driving since it has been detected that drivers with color vision deficiency have more difficulties in recognizing traffic signs, in studies that use colors as a means of learning and jobs in which the defect in color vision can cause situations of insecurity or danger.(7,9,10)

Some authors refer to the lack of knowledge of the prevalence and severity of acquired dyschromatopsias, due to the fact that the greatest importance has been given to congenital dyschromatopsias and most of the research refers only to these. However, the present work encompasses congenital and acquired dyschromatopsias in general.(9,11)

The article published by Valera(1) The ages of the patients attended ranged from three to 91 years. The pseudoisochromatic tests used were HRR, Matsubara (for children) and D15 and D15 desaturated. All were found to be optimal. In such cases, for the former, a color vision illumination lamp with a 45º stand was used, and for the latter the same lamp, but with a 180º flat stand, placed 40 cm away from the patient. On the other hand, in our research, patients in adolescence were studied and diagnosed by means of the Ishihara test.

We will continue comparing with the Colombian study carried out in 1979 for two different locations in Mexico, which obtained averages of 2,36 and 2,53 %.(12) Later in the research carried out by Valera in the whole country Mexico, 3,2 % were found.(1) These results differ although they are similar to our article in which 2.,81 % were found. In both studies the pathology predominates in the male sex.

It is very important to know how people's visual function is in order to detect visual pathologies that can manifest themselves earlier by means of chromatic anomalies and to know how they cope in their daily life, since it is essential to have a good chromatic vision.(13,14,15)

**CONCLUSIONS**

Dyschromatopsia in the province of Pinar del Río occurred more frequently in male adolescents aged 14 years. The municipality with the highest prevalence rate was Sandino, followed by Minas de Matahambre and Viñales.

**Conflict of Interest**

The authors declare that there is no conflict of interest.

**Authorship Contribution**

**EPMdeO:**Conceptualization, data curation, formal analysis, validation, visualization, writing-revision and editing.

**YRR:** Conceptualization, data curation, formal analysis, validation, visualization, writing-revision and editing.

**OMM:** Conceptualization, data curation, formal analysis, validation, visualization, writing-revision and editing.

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**BIBLIOGRAPHIC REFERENCES**

1. Valera Mota MM, Méndez Mondragón FT, Mendoza Tapia G, Alonso Trujillo J, Alonso Ricardez A. Prevalencia de discromatopsias en el gabinete de evaluación de visión al color de la UNAM FES Iztacala. Cienc Tecnol Salud Vis Ocul [Internet]. 2021 [Citado 21/03/2022]; 19(2): 23-32. Disponible en: <https://doi.org/10.19052/sv.vol19.iss2.3>

2. Valera MM, Barrios RM. Prevalencia de discromatopsias en la zona metropolitana de la ciudad de México. Ciencia UANL [Internet]. 2019 [Citado 21/03/2022]; 22(93): 40-44. Disponible en: <https://doi.org/10.29105/cienciauanl22.93-2>

3. Heydarian S, Mahjoob M, Gholami A, Veysi S, Mohammadi M. Prevalence of color vision deficiency among arc welders. Jour Optometry [Internet]. 2017 [Citado 21/03/2022]; 10(2): 130-134. Disponible en: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5383458/>

4. Fajardo-Gutiérrez A. Medición en epidemiología: prevalencia, incidencia, riesgo, medidas de impacto. Rev Alerg Méx [Internet]. 2017 [Citado 21/03/2022]; 64(1): 109-120. Disponible en: <https://doi.org/10.29262/ram.v64i1.252>

5. Woldeamanuel GG, Geta TG. Prevalence of color vision deficiency among school children in Wolkite, Southern Ethiopia. BMC Res Notes [Internet]. 2018 [Citado 21/03/2022]; 11(1): 1-5. Disponible en: <https://bmcresnotes.biomedcentral.com/articles/10.1186/s13104-018-3943-z>

6. Mengistu ZW, Abebe Y, Adamu Y, Zelalem A. Prevalence of color blindness among school children in three primary schools of Gish–Abay town district, Amhara regional state, north-west Ethiopia. BMC Ophthalmol [Internet]. 2018 [Citado 21/03/2022]; 18(1): 306. Disponible en: <https://bmcophthalmol.biomedcentral.com/track/pdf/10.1186/s12886-018-0970-4.pdf>

7. Abraira V. Medidas de frecuencia de la enfermedad [Internet]. Hospital Universitario Ramón y Cajal; s/a. [Citado 21/03/2022]. Disponible en: <http://www.hrc.es/bioest/Medidas_frecuencia_1.html>

8. Birch J. Identification of red-green colour deficiency: sensitivity of the Ishihara and American Optical Company (Hard, Rand and Rittler) pseudo-isochromatic plates to identify slight anomalous trichromatism. Ophthalmic Physiol Opt [Internet]. 2010 [Citado 21/03/2022]; 30(5): 667–671. Disponible en: <https://doi.org/10.1111/j.1475-1313.2010.00770.x>

9. Quito A. The Japanese government is tweaking its heatwave index for people with colorblindness [Internet]. QUARTZ; 2018. [Citado 21/03/2022]. Disponible en: <https://qz.com/1331921/japan-heatwave-2018-japans-ministry-of-environment-adapts-its-national-heatwave-index-for-colorblindness-accessibility/>.

10. Miquillini L, Souza M, Gomes M, Oliver N, da Costa E, Tentes, et al. A proposed correction in the weighted method to score the Ishihara test. BMC [Internet]. 2019 [Citado 21/03/2022]; 12(296). Disponible en: <https://bmcresnotes.biomedcentral.com/articles/10.1186/s13104-019-4320-2>

11. Ecuatoriano GN. INEC SALUD. [Internet]. Ecuador; 2019. [Citado 21/03/2022]. Disponible en: [www.ecuadorencifras.gob.ec/salud/](http://www.ecuadorencifras.gob.ec/salud/).

12. Mueller WH, Weiss KM. Colour-blindness in Colombia. Ann Hum Biol [Internet]. 1979 [Citado 21/03/2022]; 6(2): 137-145. Disponible en: <https://doi.org/10.1080/03014467900003471>

13. Largo Orozco D, Vargas Cardona A. Contextualización y adaptación del proyecto ColorADD, en el sistema señalético de las universidades de Santiago de Cali, tomando la Universidad Autónoma de Occidente como prueba piloto [Internet]. Universidad Autónoma de Occidente; 2013 [citado 1/6/2023]. Disponible en: <https://red.uao.edu.co/handle/10614/5789>

14. Nelson B, Kaminsky DB. Color Blindness in the Medical Workplace [Internet] CytoSource; 2019. [Citados 21/03/2022]. Disponible en: <https://acsjournals.onlinelibrary.wiley.com/doi/pdf/10.1002/cncy.22127>

15. Khosla A, Maini P, Wangoo A, Singh S, Mehar DK. Prevalence of Color Vision Anomalies Among Dental Professionals and its Effect on Shade Matching of Teeth. Journal of Clinic and Diagnostic Research [Internet]. 2017 [Citado 21/03/2022]; 11(1): ZC33–ZC36. Disponible en: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5324491/>