Original Article

# Color Vision Disorder for Preschool Children at El-Agamy District

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## Abstract

Back ground: Although colour vision disorders may be identified as early as age 4, lack of knowledge has a detrimental effect on preschoolers' learning and professions in the future. Aim: To assess color vision disorder for preschool children at El-Agamay district. Design: A descriptive research design was utilized. Sample: A purposive sample includes 200 preschool children. Setting: At El-Agamy district preschools. Tools: (1) A structured interview questionnaire include: Socio demographic data, medical history, and knowledge of preschool parents, (2): Ishihara test plates. Results: 88% of studied preschool children's parents had unsatisfactory level of total knowledge about color vision disorder Also. 4.5% of preschool children had history of inherited color vision disorder and all of them had no history of eye accident. Also, 80% of them had mild degree of red green color vision disorder. Conclusion: Majority of preschool children's parents had unsatisfactory level of knowledge about color vision disorder, minority of preschool children had red green color vision disorder and minority of them had mild degree of color vision disorder Recommendation: Establish health education about color vision screening to ensure early detection of color vision disorder among preschool children.

**Keywords:** Color vision disorder, Preschool children.

## INTRODUCTION

Normal red, blue, and green cones in the retina are required for normal colour vision in humans. These cones allow for the visualisation of mixtures of colours that fall in the range of the visual spectrum as a response from the brain that was stimulated and produced by the colour. Color vision is a prominent function in the visual system to understand the colourful world. It is described as the ability to make discriminations based on the wave length compositions of the light independent of its intensity [1].

Cone cells' inability or malfunction to distinguish various light wavelengths is known as colour vision disease (CVD), which can be either congenital or acquired. In order to prevent any malfunctions in the lives of preschool children, early diagnosis and screening of CVD at the time of school entrance are sought. Congenital form is caused by a hereditary ailment that will be incurable and non-progressive throughout life [2].

Early detection in both conditions will experience disorders in daily activities, learning and skill acquisition for certain professions and therefore cannot have certain jobs, resulting in a decreased quality of life and socioeconomic issues. The acquired form of CVD is caused by injury, trauma, ocular disease, drugs and some toxins, as well as other causes unrelated to genetic changes [3].

Preschoolers should begin developing a normal vision system at the age of four in order to define colours correctly. In addition, if there is a problem with colour recognition, preschoolers will show signs of discomfort during colouring activities and may avoid them. Social isolation may also develop, which will impede the development of their lives in various ways [4].

The risk of decreased awareness will lead to a lot of difficulties in learning and social activities at school as well as academic life, so considering comprehensive eye examination at school will include using the ishihara test is necessary need to prevent preschool children from any further complications in their life as in learning process, provide suitable path for occupation in the future [5].

Community health nursing (CHN) is an important professional resource that can assist and facilitate positive changes in educating parents about the manifestations of colour vision disorders and also enlightens them with knowledge to safeguard preschool children from any harm in their lives. CHN has a fundamental aspect in health to identify situations where factors relating to health or development may have an impact on preschool children's lives [6].

Significance of the study:

Although there is no estimate of colour vision disorder in Egypt, a thesis by doctor Amer-Toukhy in the Dental Faculty of Alexandria claims that this hidden issue is caused by colour vision screening tests from preschool age to university age, without awareness of this issue and its implications for choosing a career. As a result, a study to evaluate colour vision disorder for preschool children is necessary [7].

Another study conducted in primary schools found that the prevalence of colour vision disorders was 1.9%, indicating a hidden issue caused by the lack of use of colour vision screening tests in young children as well as a lack of awareness in society about the effects these disorders have on affected people's lives [8]. Therefore, a research is required to evaluate preschoolers' colour vision disorders.

AIM OF THE STUDY

This study aims to assess color vision disorder for preschool children at El-Agamy district through the following objectives: (1) Assessing knowledge of parents about color vision disorder. (2) Determining degree of color vision disorder for preschool children by using Ishihara test.

RESEARCH QUESTIONS

1- What is knowledge of parents about color vision disorder?

2- What is the relation between medical history and color vision disorder for children?

3- What is the degree of color vision disorder for preschool children by using Ishihara test?

## SUBJECT AND METHODS

Research Design: A descriptive research design was applied to achieve the aim of this study.

Setting: The study was conducted at El-Agamy district preschools.

Sampling:

A Purposive sample include 200 preschool children was used according to inclusion criteria: -

1. Child age from 4 to 5 years.
2. Accepted to participate in the study.
3. Language preschool child.

Tools for data collection:

Data collection done by using two tools:

1st tool: A structured interview questionnaire was used in this study; it is developed by the investigator after reviewing the national and international related literature and includes 4 parts.

Part I: Socio-demographic data about preschool children and their parents include age, sex, ranking of the preschool child between his siblings, age of father and mother …etc.

Part II: Medical history of the children and their parents as: Any disorder in color vision, child condition during birth, insertion of foreign object in eye and any complaints from school teach about child disorder in color vision, Difficulty in understanding…etc.

Part III: Knowledge of preschool child parents; it included 8 questions as meaning of color vision disorder, types, signs and symptoms, method of diagnosis, follow-up for children with color vision disorder, complications of color vision disorder in children, ways to reduce the complications of color vision disorder in children, and treatment of color vision disorder in children.

Scoring system for knowledge items:

Knowledge was contained 8 questions, the right answer was scored one point and the wrong answer was scored zero point, the total scores of the questionnaire were 8 grades. These scores were summed and were converted into a percent score. It was classified into 2 categories:

- Satisfactory knowledge if score ≥ 60% (5-8 grades).
- Unsatisfactory knowledge if score from <60% <5 grades).

2nd tool: Ishihara test plates: It was adopted from Shinobu Ishihara [9] it was 38 plates consist of some plates number and other are figures of lines, this was used to declare red, green vision disorder, normal color vision and color blindness by this test, reading the plates from 1-21 determine the preschool child if say all of them correct were normal color vision. If incorrect answer was declaring CVD if the results of reading 17 plates correct was declare normal color vision, if 13 or less until 9 plates reading incorrect was declare CVD also the plates reading from 22-25 was show the type of color vision disorder protan or duetan, the degrees of protan and duetan classification extend from mild degree to strong or sever, every preschool child has separated sheet including the answers.

Validity:

To evaluate the count validity, the proposed instrument was created and presented to five specialists in community health nursing from the nursing faculty at Helwan University.

Reliability:

Reliability analysis by measuring of internal consistency of the tool through Cronbach's Alpha test.

Tools Alpha Cronbach

Knowledge of preschool child parents 0.846

Ishihara test plates 0.860

Ethical Considerations:

The Faculty of Nursing at Helwan University's Scientific Research Ethics Committee granted official approval for the intended study to be carried out. Before giving their informed consent, individuals were fully told about the study and their involvement in it. Participation in the study was optional. The study's objective and nature had to be disclosed, participants had the option to withdraw at any time, and the material had to be kept secret so that no one else could access it without the participants' consent. Respect was shown for morals, values, culture, and beliefs.

The Preparatory phase:

Using books, papers, journals, and magazines, it included a review of past, present, national, and worldwide related literature as well as theoretical understanding of different areas of the subject in order to build techniques for data gathering.

Pilot Study:

The use of the created tools and the intelligibility of the questions were tested in the pilot study, which involved 10% (20) of preschoolers and their parents. The time needed to complete the questionnaire for each individual has also been estimated through the pilot. The respondents were included in the main research sample since the pilot test findings indicated that there were no changes needed to the tool items.

Fieldwork:

- Information was gathered between the beginning of October 2021 and the end of December 2021.
- Prior to collecting data, the preschooler and their parents were simply given a brief explanation of the study's objectives by the investigator.
- Data was collected 2days/week (Sunday, Monday) for 3 months till the needed sample was completed.
- The instructions on the plates were held 75 cm away from the child's field of vision in a room with natural light. The kid had three seconds to read the numbers on the plates and ten seconds to trace the lines on the plates.
- A succinct overview of the study's objectives and anticipated results. utilising authorised personnel's correct methods of communication

Statistical design:

The Statistical Package for Social Science (SPSS) version 24 computer programme and Microsoft Excel were used to conduct the statistical analysis of the data. For categorical data, frequencies and percentages were used, while for quantitative data, the arithmetic mean (X) and standard deviation (SD) were used. Data were presented using descriptive statistics. Chi square test (X2) was used to compare qualitative variables in order to see whether there was a correlation between the two. P value less than 0.05 was regarded as significant.

## RESULTS

Table (1): Shows that, 61% of the preschool children their age is 5 years, as regard to sex and child ranking, 58% & 54% of the preschool children are males and the second child and 58% of the preschool children their parents had secondary education, and 67% and 48% of the preschool children's parents are employee, Also, 75% and 62.5% of the preschool children had 3-4 family members and < 3 rooms. In addition, 97% & 62% of the preschool children have stable family and enough monthly income, 13% of the pre-school children there was a kinship relationship between husband and wife, 100% of them were cousins.

Table (1): Frequency Distribution of the Preschool Children and their Parents according to their Socio-Demographic Data (n=200).

| **Socio-demographic data about preschool children** | **No.** | **%** |
|---|---|---|
| **Sex** | | |
| Male | **116** | **58** |
| Female | 84 | 42 |
| **Age (year)** | | |

| Socio-demographic data about preschool children | No. | % |
|---|---|---|
| 4 | 78 | 39 |
| 5 | **122** | **61** |
| **Mean ± SD** **4.71 ± 0.91** | | |
| **Child ranking** | | |
| First child | 66 | 33 |
| Second child | **108** | **54** |
| Third child | 20 | 10 |
| Fourth child | 6 | 3 |
| **Socio–demographic data about parents of preschool children** | **No.** | **%** |
| **Father's age (years)** | | |
| 20-<30 | 60 | 30 |
| 30-<40 | **95** | **47.5** |
| 40-<50 | 40 | 20 |
| ≥ 50 | 5 | 2.5 |
| **Mean ± SD** **41.9 ± 12.22** | | |
| **Mother's age (years)** | | |
| 20-<30 | 78 | 39 |
| 30-<40 | **102** | **51** |
| ≥ 40 | 20 | 10 |
| **Mean ± SD** **37.8 ± 10.57** | | |
| **Father's educational level** | | |
| Do not read and write | 5 | 2.5 |
| Reads and writes | 10 | 5 |
| Basic education | 25 | 12.5 |
| Secondary education | **100** | **50** |
| University education | 60 | 30 |
| **Mother's educational level** | | |
| Do not read and write | 8 | 4 |
| Reads and writes | 12 | 6 |
| Basic education | 30 | 15 |
| Secondary education | **116** | **58** |
| University education | 34 | 17 |
| **Father's occupation** | | |
| Employee | **134** | **67** |
| Not employee | 66 | 33 |
| **Mother's occupation** | | |
| Employee | **96** | **48** |
| Housewife | 104 | 52 |
| **Number of family members** | | |
| 3-4 | **150** | **75** |
| 5-6 | 44 | 22 |
| > 6 | 6 | 3 |
| **Number of rooms** | | |
| < 3 | **125** | **62.5** |
| 3-<5 | 67 | 33.5 |
| ≥ 5 | 8 | 4 |
| **Family social status** | | |
| Stable | **194** | **97** |
| Separate | 6 | 3 |
| **Monthly income** | | |

| Socio-demographic data about preschool children | No. | % |
|---|---|---|
| Enough and save | 54 | 27 |
| Enough | **124** | **62** |
| Not enough | 22 | 11 |
| **Is there a kinship between the husband and the wife?** | | |
| Yes | 26 | 13 |
| No | **174** | **87** |
| **If yes, what is a kinship?** | | |
| Cousin | **26** | **100** |

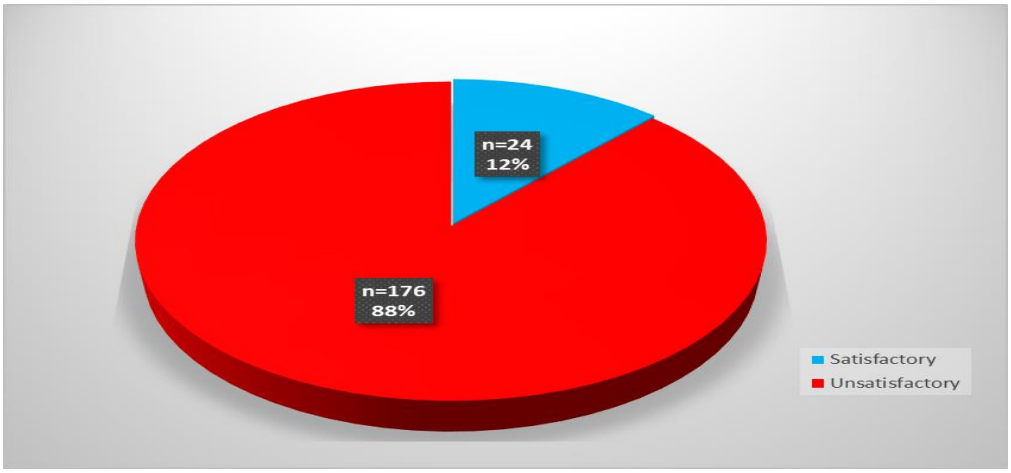


Figure (1): Percentage Distribution of the Preschool Children's Parents according to their Total Knowledge about Color Vision Disorder (n=200).

Figure (1): Clarifies that 88% of the studied preschool children's parents had unsatisfactory level of total knowledge about color vision disorder, 12% of them had satisfactory level.

Table (2): Frequency Distribution of Preschool Children and their parents according to their Medical History (n=200).

| Medical history of the children and their parents | No. | % |
|---|---|---|
| **Suffering from color vision disorder** | | |
| No | **200** | **100** |
| **The condition of the child at birth** | | |
| Normal | **200** | **100** |
| **History of a foreign body in the eye** | | |
| No | **200** | **100** |
| **Teachers complain the child's color vision disorder.** | | |
| Yes | **12** | **6** |
| No | 188 | 94 |
| **Difficulty in understanding instructions and asking for them to be returned** | | |
| Yes | **12** | **6** |
| No | 188 | 94 |
| **Suffering from introversion, isolation and lack of participation by others** | | |
| Yes | **15** | **7.5** |
| No | 185 | 92.5 |
| **History of an accident that caused a wound in the eye or head** | | |
| No | **200** | **100** |
| **Family history of inherited color vision disorder** | | |
| Yes | **9** | **4.5** |
| No | 191 | 95.5 |
| **Difficulty during coloring activity** | | |
| Yes | **20** | **10** |
| No | 180 | 90 |
| **Know the names of all colors and can distinguish them** | | |
| Yes | 180 | 90 |
| No | **20** | **10** |
| **If no, what colors are hard to identify? (n=20)** | | |

| Medical history of the children and their parents | No. | % |
|---|---|---|
| Red | **11** | **55** |
| Green | 9 | 45 |
| Blue | 0 | 0.0 |
| Brown | 0 | 0.0 |
| Violet | 0 | 0.0 |
| **Excellent sense of smell and tend to smell food before eating it** | | |
| Yes | 55 | 27.5 |
| No | 145 | 72.5 |
| **Excellent night vision** | | |
| Yes | 180 | 90 |
| No | 20 | 10 |
| **Allergy to bright colors** | | |
| Yes | 20 | 10 |
| No | 180 | 90 |
| **Difficulty in recognizing colors in low light** | | |
| Yes | 20 | 10 |
| No | 180 | 90 |
| **Difficulty in recognizing colors in small colored areas** | | |
| Yes | **20** | **10** |
| No | 180 | 90 |
| **Suffering from eye pain when looking at something red green background or vice versa** | | |
| Yes | **20** | **10** |
| No | 180 | 90 |
| **Distinguish between fruit colors and spoiled foods** | | |
| Yes | 180 | 90 |
| No | **20** | **10** |
| **Distinguish colors like traffic lights** | | |
| Yes | 180 | 90 |
| No | **20** | **10** |

Table (2): Shows that, 100% of the preschool children don't suffer from of color vision disorder. Also, 100% of the preschool children were born normally and don't had history of a foreign body in the eye, and 6% of them their teachers complain the color vision disorder and had difficulty in understanding instructions and asking for them to be returned, (7.5% and 100%) of the preschool children suffer from introversion, isolation and lack of participation by others and don't had history of an accident that caused a wound in the eye or head respectively. 10% of them had difficulty during coloring activity. 10% of the preschool children do not know the names of all colors and can distinguish them, 55% of them had difficulty to identify the red color. 10% of the preschool children do not have excellent night vision and have an allergy to bright colors, 10% of the preschool children suffer from eye pain when looking at something red on a green background or vice versa and don't able to distinguish between fruit colors and spoiled foods, Also10% of them don't able to distinguish colors like traffic lights.

Table (3): Presents that, 90% of the preschool children's parents had incorrect knowledge about signs, symptoms and diagnosis of color vision disorder in children, 89% & 91% of the preschool children's parents had incorrect knowledge about the ways to reduce the complications of color vision disorder in children and treatment of color vision disorder in children

Table (3): Distribution of the Preschool Children's Parents According to their Knowledge about Color Vision Disorder (n=200).

| Knowledge items | Correct | | Incorrect or don't know | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Definition of color vision disorder in children | 50 | 25 | 150 | 75 |
| Types of color vision disorder in children | 24 | 12 | 176 | 88 |
| Signs and symptoms of color vision disorder in children | 20 | 10 | **180** | **90** |
| Diagnosis of color vision disorder in children | 20 | 10 | **180** | **90** |
| Follow-up for children with color vision disorder | 25 | 12.5 | 175 | 87.5 |
| Complications of color vision disorder in children | 25 | 12.5 | 175 | 87.5 |
| Ways to reduce the risks of color vision disorder in children | 22 | 11 | **178** | **89** |
| Treatment of color vision disorder in children | 18 | 9 | **182** | **91** |

Table (4): Frequency Distribution of Degree According to Types of Color Vision Disorder (n=20).

| Types of color vision disorder | Degree | | | |
|---|---|---|---|---|
| | Severe | | Mild | |
| | No. | % | No. | % |
| **Protan (n=12)** | 2 | 16.7 | 10 | 83.3 |
| **Duetan (n=8)** | 2 | 25 | 6 | 75 |

Table (4): Shows that, preschool children with protan color vision disorder 83.3% of them had mild level, 16.7% of them had severe level. Preschool children with duetan color vision disorder, 75% of them had mild level, 25% of them have severe level.

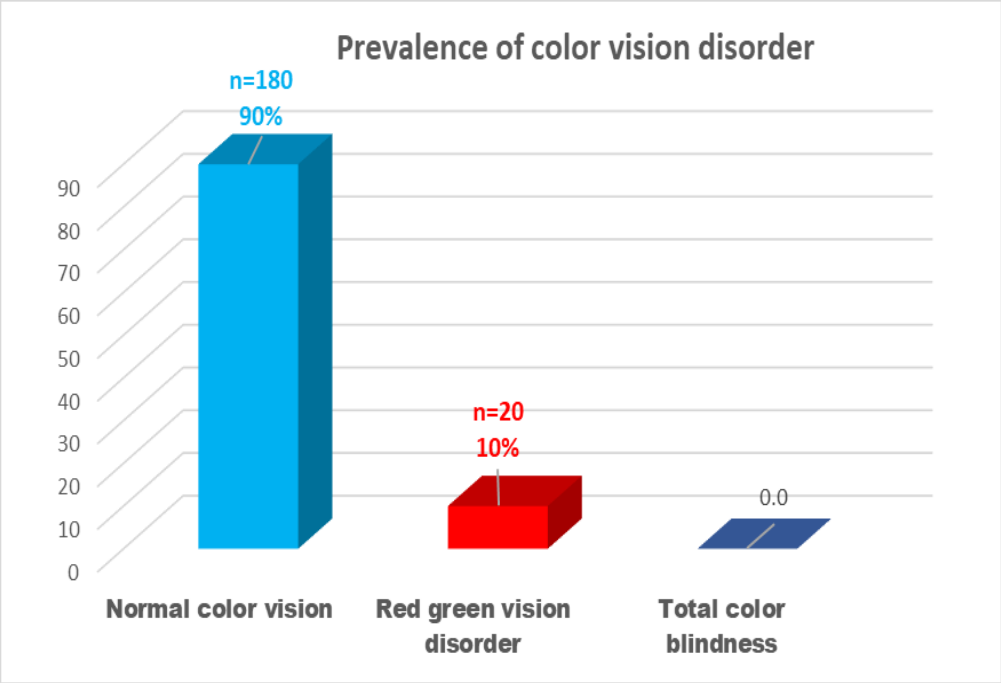


Figure (2): Prevalence of Color Vision Disorder by Using Ishihara Test (n=200).

Figure (2): Illustrates the prevalence of color vision disorder by using Ishihara test, 10% of the preschool children have red green vision disorder.

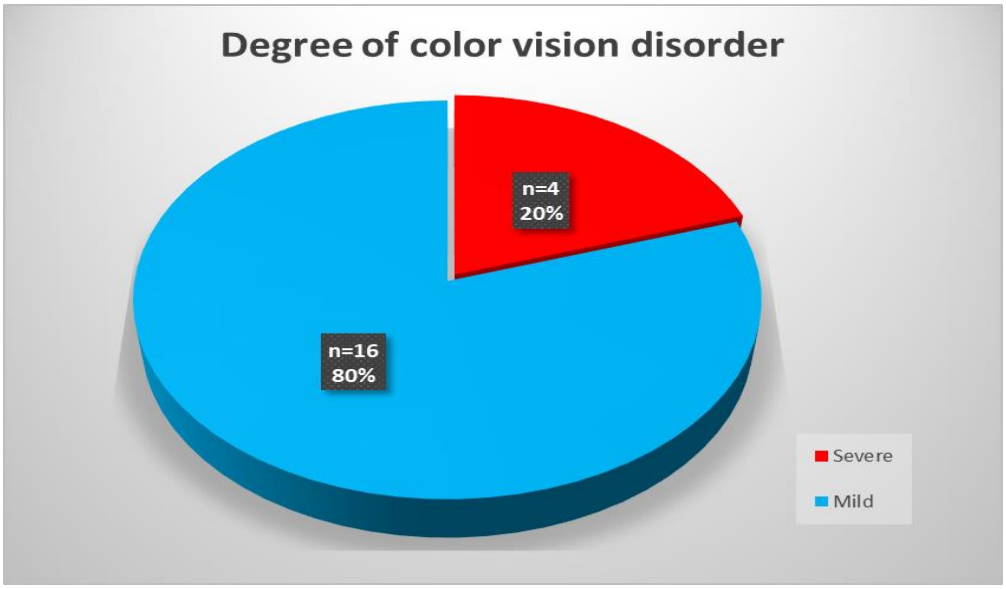


Figure (3): Percentage Distribution of Degree of Red Green Color Vision Disorder (n=20).

Figure (3): Shows that, distribution of degree of red green color vision disorder preschool children with color vision disorder, 80% of them had mild level, While, 20% of them had severe level of red green color vision disorder.

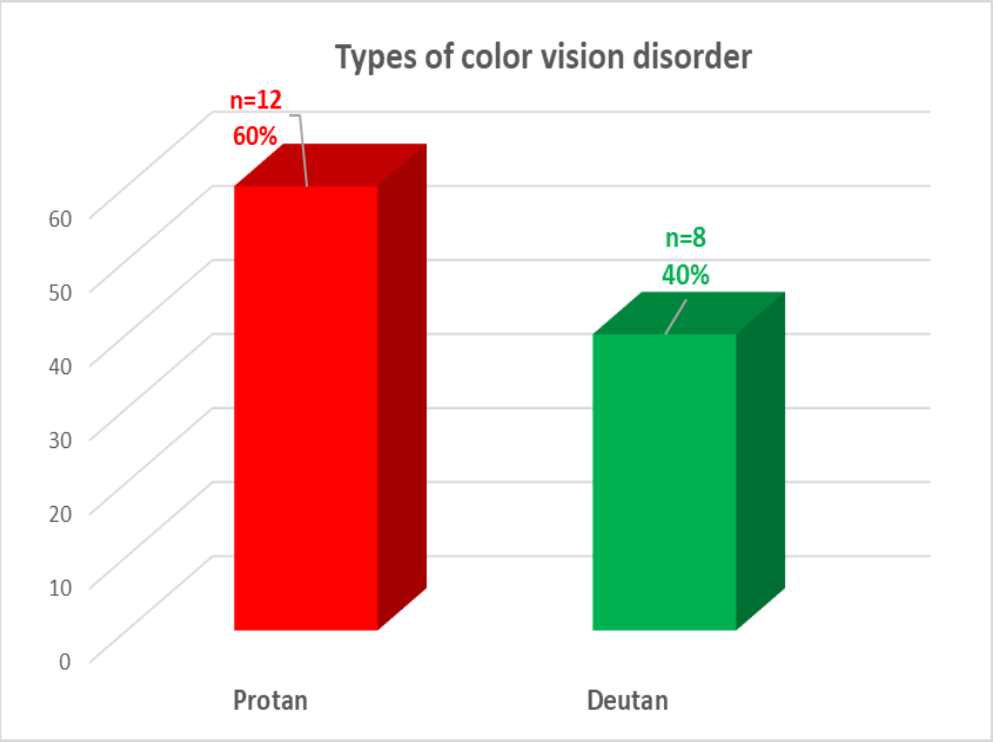


Figure (4): Percentage Distribution of Types of Red Green Color Vision Disorder (n=20).

Figure (4): Illustrates that, distribution of red green color vision disorder types 60% of preschool children had protan color vision disorder, While 40% of them had duetan color vision.

Table (5): Relationship between Medical History and Prevalence of Color Vision Disorder among Studied Preschool Children (n=200).

| Medical history of the preschool children | | Normal (n=180) | | Red green color vision disorder (n=20) | | X2 | P-Value |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | | |
| Teachers complain the child's color vision disorder | Yes | 0 | 0.0 | 12 | 60 | 12.56 | 0.009** |
| | No | 180 | 100 | 8 | 40 | | |
| Difficulty in understanding instructions and asking for them to be returned | Yes | 0 | 0.0 | 12 | 60 | 9.256 | 0.034* |
| | No | 180 | 100 | 8 | 40 | | |
| Suffering from introversion, isolation and lack of participation by others | Yes | 0 | 0.0 | 15 | 75 | 13.02 | 0.005** |
| | No | 180 | 100 | 5 | 25 | | |
| Family history of color vision disorder | Yes | 0 | 0.0 | 9 | 45 | 12.01 | 0.011* |
| | No | 180 | 100 | 11 | 55 | | |
| A kinship between the husband and the wife | Yes | 6 | 3.3 | 20 | 100 | 14.52 | 0.000** |
| | No | 174 | 96.7 | 0 | 0.0 | | |
| Difficulty during coloring activity | Yes | 0 | 0.0 | 20 | 100 | 14.87 | 0.000** |
| | No | 180 | 100 | 0 | 0.0 | | |
| Know the names of all colors and can distinguish them | Yes | 180 | 100 | 0 | 0.0 | 13.99 | 0.000** |
| | No | 0 | 0.0 | 20 | 100 | | |
| Excellent sense of smell and tend to smell food before eating it | Yes | 55 | 30.6 | 0 | 0.0 | 12.55 | 0.007** |
| | No | 125 | 69.4 | 20 | 100 | | |

| Medical history of the preschool children | | Normal (n=180) | | Red green color vision disorder (n=20) | | X2 | P-Value |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | | |
| Excellent night vision | Yes | 180 | 100 | 0 | 0.0 | 13.91 | 0.000** |
| | No | 0 | 0.0 | 20 | 100 | | |
| Have an allergy to bright colors | Yes | 0 | 0.0 | 20 | 100 | 14.93 | 0.000** |
| | No | 180 | 100 | 0 | 0.0 | | |
| Difficulty in recognizing colors in low light | Yes | 0 | 0.0 | 20 | 100 | 15.01 | 0.000** |
| | No | 180 | 100 | 0 | 0.0 | | |
| Difficulty in recognizing colors in small colored areas | Yes | 0 | 0.0 | 20 | 100 | 14.51 | 0.000** |
| | No | 180 | 100 | 0 | 0.0 | | |
| Suffering from eye pain when looking at something red on a green background or vice versa | Yes | 0 | 0.0 | 20 | 100 | 14.59 | 0.000** |
| | No | 180 | 100 | 0 | 0.0 | | |
| Distinguish between fruit colors and spoiled foods | Yes | 180 | 100 | 0 | 0.0 | 15.05 | 0.000** |
| | No | 0 | 0.0 | 20 | 100 | | |
| Distinguish colors like traffic lights | Yes | 180 | 100 | 0 | 0.0 | 14.66 | 0.000** |
| | No | 0 | 0.0 | 20 | 100 | | |

*Significant statistically at p ‹ 0.05. **highly statistically significant at p < 0.01.

Table (5): Shows that, highly statistically significant difference between color vision disorder and teachers complain about the child's color vision disorder, suffering from introversion, isolation and lack of participation by others and kinship between the husband and the wife at (p= < 0.01). Also, there is statistically significant difference with difficulty in understanding instructions and asking for them to be returned and family history of color vision disorder at (P= <0.05).

## DISCUSSION

The inability or diminished capacity to discern various colours under normal illumination circumstances is referred to as colour blindness or colour vision disorders (CVD). It is one of the most prevalent visual problems. The prevalence of CVD differs from race to race and from region to region. However, the majority of colour blindness instances go undiagnosed since there isn't enough screening [10]. There is no treatment for CVD, and colour vision impairment does not result in total blindness. However, colour vision is essential to how well a person understands their visual environment, and those who have colour vision problems may find it challenging to go about their daily lives [11]. Additionally, early identification of children's colour vision issues enables parents and educators to modify the teaching strategies as needed for proper learning [12].

Part (1): Socio-demographic data about preschool children and their parents

The result of the recurrent study showed that, more than one third of preschool children their age were five years, this result is supported by Hui [13] in Italy at a study entitled"Color identification: guiding children with color vision deficiency" who represented that 85% of the children with color vision deficiency aged from 4 to 6years,

Regarding to sex and child ranking of the studied children more than half of the preschool children were males and ranked the second child, these results are approximated to an Egyptian study conducted by Elshazly et al. [8] in Egypt and entitled "Prevalence and types of color vision deficiency among primary school students in Alexandria" which mentioned that studied children 49.5% were males. These results may be attributed to that several studies proved that color vision deficiency is more common in males rather than females.

The current study results presented that, half and more than half of the preschool children's fathers and mothers had secondary education respectively this result is in the same line with a study conducted by Karunanayake et al.[14] who showed that, 67% of his studied parents had secondary level of education. From the investigator point of view, these results might be due to increase the costs of the high education and some people don't interest to obtain a high grade of education to search about work.

The present study results displayed that, more than one tenth of the pre-school children there was a kinship relationship

between husband and wife, all of them were, these current results were supported by Abd EL Rahman [15] who studied "A large population study reveals a novel association between congenital color vision deficiency and environmental factors "and found that, the consanguinity between parents is one of causes for genetic factors for color vision deficiency. These findings could be due to the colored vision disorders may happen due to genetic disorders from kinship between parents

Part (2): Knowledge of parents about color vision disorder

According to the research question (No1), what is knowledge of parents about color vision disorder?

The present study showed that majority of the preschool children's parents had incorrect knowledge about signs, symptoms and diagnosis of color vision disorder in children. Also, majority of them had incorrect knowledge about ways to reduce the complications of color vision disorder in children and treatment of color vision disorder in children, these results were similar with the study of. Karunanayake et al. [14] represented that 75% of the parents of affected children had incorrect knowledge of their child's defect. These findings may be due to more than half of the studied parents had secondary education and that's may cause the parents don't concern with obtaining information about their child disorder and lack of accessibility to a source of information.

The present study revealed that the majority of the studied preschool children's parents had unsatisfactory level of total knowledge about color vision disorder and that was equal with the study of Karunanayake et al. [14] represented that 75% of the parents of affected children had incorrect knowledge of their child's defect.

Part (3): Medical history of the children and their parents

According to the research question (No 2), what is the relation between medical history and color vision disorder for children?

The current findings revealed that all of the preschool children didn't suffer from color vision disorder, were born normally and didn't have history of a foreign body in the eye and only have family history of congenital CVD (table 2). Beside that two third of them had first degree of kinship. In the same field, Thomas et al. [16] in Malaysia, at study entitled "Behavioral and emotional issues among primary school pupils with congenital colour vision deficiency in the Federal Territory of Kuala Lumpur, Malaysia" revealed that, 100% of mother`s children with congenital CVD stated that there was no any known medical and ocular history of the child but no mention of family history in this study. Additionally, the current study is equal to Manuel & Geta [11] in Wolkite, Southern Ethiopia at the study entitled "Prevalence of color vision deficiency among school children" which reported that none of the enrolled children showed evidence of ocular pathology or medical history that was equal with the current study all those finding agree with the present study showed that all the studied preschool children had no medical history of eye health problems

These results in the same line with Karunanayake et al. [14] who illustrated that all affected children had negative histories for previous systemic and ocular diseases or chronic use of medications. From the investigator point of view, that's may be due to color vision deficiency is an inherited condition caused by a common X-linked recessive gene not related mainly to other causes.

The current study revealed that, the minority of the studied children had difficulty in understanding the teacher instructions when asking for them to be returned. Also, these results are congruent with the study of Mashige [2] who discussed that 90 % of the students with color vision defects had more difficulties performing color related tasks. Also, Kvitle [17] in Gjøviks in their study entitled "Should color vision deficiency be a recognized special education need?" which clarified that 75% of children with color vision disorder had impaired learning and inappropriate classroom behavior to follow their teachers' instructions. These findings may be due to the teachers don't have experience to deal with those children.

The present study findings reported that, the majority of the studied children with CVD suffered from introversion, isolation and lack of participation by others and didn't have history of an accident that caused a wound in the eye or head. Also, these results are consistent with the study done by Thomas et al. [16] who mentioned 78% of colored vision deficiency children had behavioral and emotional problems compared to children with normal vision. But these results are in disagreement with Nithiyaananthan et al. [18] in Malaysia who studied behavioral Issues among primary school children with color vision deficiency" and concluded that more than 70% of children with colored vision deficiency didn't have "behavioral and social problems. These results might be due to color deficiency children have difficulty seeing the colors or seen them differently from other people and can't see all colors clearly so, they prefer to be isolated from others in the society.

The current study illustrated that the minority of the pre-school children had family history of inherited color vision disorder and more than three fifth of them were first degree of kinship. These results are approved with the study achieved by Elshazly et al. [8] who mentioned that most of the studied preschool children that 1.9% of the studied subjects with CVD had a hereditary defect. From the investigator point of view, color more than acquired cause rather than the absence of color vision screening will effect on the future of preschool children

Regarding to the relationship between medical history and prevalence of color vision disorder among the studied preschool children, the findings of the current study demonstrated that, there was a highly statistically significant difference between color vision disorder and teachers complain about the child's color vision disorder, suffering from introversion, isolation and lack of participation by others and kinship between the husband and wife. These results are in agreement with the study done by Thomas et al. [16] who found that there was a highly statistically significant difference between color vision disorder and

teachers complain about the child's color vision disorder. That's may be attributed to the children with color vision deficiency have a problem in social interactions with peers and social skills due to the difficulties they face in distinguishing between colors. Also, there was statistically significant difference with difficulty in understanding instructions and asking for them to be returned and family history of color vision disorder. This result was in the same line with Kvitle [17] who illustrated that there was a significant difference was found at the children with color vision deficiency at their class participation and listening to instructions of their teachers. This finding might be due to a genetic cause related to family history which has impact on their intellectual abilities.

Part (4): The degree of color vision disorder for preschool children by using Ishihara test.

According the research question (No 3), what is the degree of color vision disorder for preschool children by using Ishihara test?

Related to the prevalence of color vision disorder by using Ishihara test the current study showed one tenth of preschool children had red green vision disorder. This result was supported by Manuel & Geta [11] who revealed that the commonest form of deficient color vision is red-green deficiency in European Caucasians which was about 8% of the children.

Also, this finding in the same line with Dohvoma et al. [10] in Yaoundé and entitled "Color vision deficiency among biomedical students: a cross-sectional study" which demonstrated that 1.3% of them had red–green perceptive disorders are X-linked recessive, and thus are seen more frequently in males than in females. Also, the current study is closed to the study of Machluf et al. [19] stated that red-green CVD is most commonly inherited in an X-linked recessive manner which it is estimated 10% of the children and consequential among males than among females. From the investigator point of view, this finding might be because of several studies proved that the most frequent and common color vision deficiency is red-green color deficiency is the same result with the current study.

The current study reflected that, majority of preschool children with color vision disorder had mild level of red green color vision disorder. While, one fifth of them had severe level of red green color vision disorder. This result is in agreement with the study of Elshazly et al. [8] who indicated that 92% of the subjects have mild red-green color.

Related to types of red green color vision disorder, the present study reported that, three fifth of the studied pre-school children had protan color vision disorder. While, two fifth of them had deutan color vision disorder. This finding agrees with Manuel & Geta [11] who showed that 43% and 59% of the studied subjects were classified as having protan and duetan defects respectively. Also, this result differs with findings by Oduntan et al. [20] who presented a study entitled "color vision deficiency among students" in Nigeria and demonstrated that high frequency of duetan compared with protan defects was observed in the study which the prevalence was 58% and 27% for duetan and protan deficiencies, respectively. These results could be due to several studies suggested that green color receptor is commonly affected than other cone receptor.

Related to degree according to types of color vision disorder, the present results showed that majority of children with protan color vision disorder had mild degree compared to minority of them had sever degree. These results are supported by Elshazly et al. [8] who found that in the duetan group, the high percent of the participants had mild 8% and moderate 4% duetan patterns, while 1% had severe duetan patterns. Also, Oduntan et al. [20] stated that 72% of children with duetan or protan deficiencies reported low level of deficiency. From the investigator point of view, that's may be because of both duetan or protan deficiency is congenital and less severity compared to acquired deficiency that worse with time.

From the investigator point of view these results are considered to be consequence of the absence of standard guidelines in our society about CVD awareness, parenteral education, genetic testing and counseling strategies and that will affect the persons with CVD in all aspects of their lives starting from preschool age.

## CONCLUSION

On the light of results of the current study and answers of questions, it could be concluded that:

The majority of the studied preschool children's parents had unsatisfactory level of knowledge about color vision disorder ,more over the prevalence of color vision disorder by using Ishihara test, it reveals the minority of preschool children have red green vision disorder, in addition the most of them had mild level of color vision disorder and reveled that less than one quarter had sever red green color vision disorder .There were highly statistically significant difference between color vision disorder and teachers complain about the child's color vision disorder, suffering from introversion, isolation, also there is statistically significant difference in understand any instructions beside that less than half had kind ship between husband and wife.

## RECOMMENDATIONS

On the light of results of the current study findings, the followings recommendations are suggested:

- Conducting color vision test with the basic vision screening from preschool age until university.
- Health education program for parents to increase awareness regarding color vision disorder and its screening.

- Guideline for raising awareness of preschool children's parents regarding degree of color vision disorder by Ishihara test.

## FURTHER RESEARCH:

- Conducting further intervention research on a large sample and other setting is needed.

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