

STUDY OF COLOUR BLINDNESS IN JAT SIKHS

SUTENDER NARESH*

*Department of Physiology,
Govt. Medical College,
Patiala - 147 001*

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Abstract: Of the 1306 male and 791 female Jat Sikhs of Patiala city and the surrounding villages between the age group 10-60 years, 50 males and one female were found to be having colour blindness, showing an incidence of 3.83% and 0.13% respectively. The study was done with the help of Ishihara Charts and Pickford Nicolson's anomaloscope. The type of colour blindness in males in its descending order of occurrence was simple deuteranomaly 0.92%, extreme deuteranomaly 0.77%, protanopia 0.69%, simple protanomaly 0.61%, deuteranopia 0.61%, extreme protanomaly 0.15% and tritanopia 0.08%. The sole colour blind female was simple deuteranomaly type. The incidence and type of colour blindness found in males are within the range of other Indian samples. Nevertheless the incidence is much lower than the values reported in other European populations.

Key words : Ishihara charts anomaloscope trichromats
dichromats protanomaly deuteranomaly
protanopia deuteranopia tritanopia

INTRODUCTION

John Dalton was the first scientist to give a clear description of his own affliction of colour blindness in 1798. This publication stimulated much subsequent research into the pathophysiology and genetics of the condition (1). In 1881 Lord Rayleigh introduced anomaloscope for scientific analysis of colour defects (2). Since then many scientists had worked on the incidence of colour blindness in different parts of India and the world. But very few studies are available on the use of anomaloscope in India. The present study was conducted to find out the incidence of colour blindness in Jat Sikhs and to find out the type and degree of colour blindness with the help of the anomaloscope. A comparison with other studies is made. Persons with defective colour vision are at a disadvantage especially for employment purposes e.g. as pilots, drivers, in defence services and in technical fields like engineering and medical profession.

METHODS

2097 Jat Sikhs of either sex between the age group

of 10-60 years from various schools, colleges and banks of Patiala city and surrounding villages were investigated for colour vision by means of Ishihara Charts and the anomaloscope. The Jat Sikhs constitute the major part of the population of Punjab and include the great mass of dominant land owning community. In addition to the tests of colour vision, all the subjects were tested for acuity of vision by using Snellen's test chart for distant vision and Jaeger's chart for near vision.

The 15th edition of Ishihara plates (1960) was used and tests were conducted in accordance with the instructions accompanying the plates (3). First 25 plates were used in the present study as all the individuals were educated. The plates from 26 to 38 are meant for illiterate persons, so these were not used.

In the Pickford Nicolson's anomaloscope (4) three tests were performed in which a red/green, a green/blue and a yellow/blue Rayleigh equations were used respectively. Both eyes were tested separately using different equations. It is the only instrument by means

*Present address: Department of Physiology, Govt. Medical College, Sector 38-B, Chandigarh - 160 014

of which the colour blindness can be correctly classified.

RESULTS

Out of 2097 individuals (1306 males and 791 females), 50 males and one female were found to be having colour blindness (Table I, II and III). The type of colour blindness in males by using Ishihara charts only is shown in Table IV.

TABLE I: Showing the incidence of colour blindness in 2097 Jat Sikhs.

Sex	Total	Not affected	Affected	Percentage
Male	1306	1256	50	3.83
Female	791	790	1	0.13
Total	2097	2046	51	2.43

$\chi^2 = 26.91$, $P < 0.001$ Significant

TABLE II: Showing the incidence of colour blindness in urban/rural area.

	Affected	Not affected	Total
Urban	18	664	682
Rural	33	1382	1415
Total	51	2046	2097

$\chi^2 = 0.18$, $P > 0.05$ Insignificant

TABLE III: Showing the percentage of colour blindness according to age in males.

	≤ 30 years	> 30 years	Total
Affected	46	4	50
Not affected	1078	178	1256
Total	1124	182	1306

$\chi^2 = 1.06$; $P > 0.05$ Insignificant

TABLE IV: Type of colour blindness in 1306 males by using Ishihara chart test.

Type of colour blindness	Number of affected individuals	Percentage
1. Protan type		
a) Strong	10	0.76
b) Mild	4	0.31
2. Deutan type		
a) Strong	21	1.61
b) Mild	8	0.61
3. Unidentified		
Protan/Deutan type	6	0.46
4. Tritan type	1	0.08
Total	50	3.83

TABLE V: Showing type and degree of colour blindness in 1306 males by using Pickford Nicolson anomaloscope.

Type of colour blindness	Number of affected individuals	Percentage
1. Anomalous Trichromatism		
a) Protanomaly		
i) Simple	8	0.61
ii) Extreme	2	0.15
b) Deutanomaly		
i) Simple	12	0.92
ii) Extreme	10	0.77
2. Dichromatism		
a) Protanopia	9	0.69
b) Deutanopia	8	0.61
c) Tritanopia	1	0.08
Total	50	3.83

The results of the Ishihara charts test show that 49 individuals were protan/deutan type and only one individual was of tritan type. Out of 49 protan/deutan type of individuals, 14 were of protan type, 29 were of deutan type and 6 were unidentified. These 6 protan/deutan type of individuals were unidentified because no conclusion could be derived from their readings of plates 22-25. Another observation was that out of 49 protan/deutan type of individuals there was only one whose readings were resembling the test figures totally. All other protan/deutan type did not show a typical resemblance in total, but a sum total of their all readings show that they are protan/deutan type. This shows that there are individual differences in the degree of colour blindness. The readings of one tritan type of individual resembled the test figures completely. The sole colour blind female was of strong deutan type. The results also show that deutan type of colour blindness is the most frequent type. The acuity of vision with or without glasses in all these affected individuals was found to be normal.

The type and degree of colour blindness in males as tested by the anomaloscope are shown in Table V. As most of these affected individuals are of protan/deutan type, the results of red/green equation are plotted graphically (Fig.1). The only colour blind female was simple deutanomaly type. No monochromat was found

in the present study. In all the affected individuals both eyes were defective, on testing each eye separately. An interesting observation in this study was that most of the affected individuals didn't know that they had any defect regarding their colour vision.

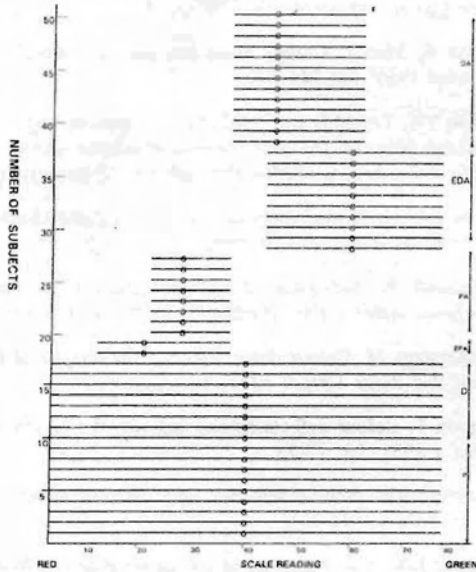


Fig. 1: Matching range and midmatching points for 50 affected individuals.

- P = Protanopia
- D = Deutanopia
- DA = Deutranomaly
- PA = Protanomaly
- EDA = Extreme deutranomaly
- EPA = Extreme protanomaly
- F = Female

DISCUSSION

The incidence of colour blindness is much more in males as compared to females. The results of the present study with anomaloscope show that frequency of trichromatism was much more as compared to dichromatism and among trichomats, the frequency of deutranomaly is more than that of the protanomaly. This can be explained by the heredity of the colour blindness (5). The difference in the incidence of colour

blindness in the urban and rural area is statistically insignificant. This is because Patiala city and the surrounding villages are not much removed from each other. As colour blindness is a heredity defect, the incidence in different age groups is statistically insignificant.

In the present study the incidence of colour blindness in males was 3.83%. A comparison with other studies show that there is less variation of the incidence of colour blindness in different parts and different communities of India than that in other parts of the world. Dutta and Kumar (6) reported an incidence of 2.88% in Brahmins, Bansal (7) reported an incidence of 5.66% in Khattris, 4.70% in Aroras and 4.61% in Gujars. Kalla (8) reported an incidence of 4.6% in Muslims and Mahajan (9) reported an incidence of 3.8% in school children.

A comparison with the other studies of the world show that the incidence in the present study is much less than the European whites 8.04% (10), Netherlands whites 7.3% (11) and French whites 9.4% (12). The incidence in the present study is almost similar to Japan 3.6% (13), China 3.7%(14), Singapore 4.8%(15), Ethiopia 4.2%(16) and American Negroes 3.71%(17). On the other hand the incidence in the present study is much higher than Congolese 1.85%(18) and people of Uganda 1.86% (19). This comparison give support to the selection relaxation hypothesis of Post (12) and Pickford (20).

Dutta and Kumar (6), Bhasin (21) and Tiwari (22) reported an incidence of 0.0% in females while Bansal (7) found an incidence of 1.13% among females and Mahajan (9) found an incidence of 0.38% in females. The incidence of colour blindness in females in the present study was 0.13%. As only one female was found to be colour blind, it is not possible to conclude regarding incidence of colour blindness in females from the present data. To find the exact incidence of colour blindness in females, a further study with a large sample is required.

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