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THE PREVALENCE OF COLOUR BLINDNESS AMONG THE MALES OF THE BHOKSHA TRIBE IN DEHRADUN, INDIA

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ABSTRACT

Colour Blindness is an X-linked recessive disorder which predominantly appears in males. Colour blindness is the inability or decreased ability to perceive colour differences by the human eye under normal lighting conditions. The purpose of the present study was to find out the prevalence of congenital Red-Green colour blindness among the people of the Bhoksha tribe in Dehradun district, Uttarakhand. The study was conducted with a total number of 204 individuals aged from 5 years to 85 years (mean ± SD is 22.71 ± 13.15) among the randomly selected male population. Colour blindness was examined using a standard Ishihara Chart under proper light. Among the total sample of 204 males in the community, 3 males are found to be colour blind which means that 98.53% were found to be normal, and the frequency of colour blindness was 1.47%. These three cases represented protanopia, deuteranopia and achromatopsia. Colour blindness appeared among the Pundir, Chauhan and Kakkad clans of the Bhoksha tribe in three villages. In conclusion, 1.47% were found to be colour-blind in this study among the Bhoksha tribe of Dehradun, which is very high as compared with the prevalence in other tribal populations in India, although they were unaware of it. The present study supports Post and Pickford's (1962, 1963) hypothesis of relaxation of selection.

***Keywords**: colour-blindness; prevalence; Bhoksha tribe; Ishihara chart test*

INTRODUCTION

Colour blindness is one of the common genetic disorders observed in all human populations [15]. A person with normal colour vision can see all combinations

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of the three primary colours – red, blue, and green. Colour blindness is the inability or decreased ability to perceive colour differences under normal lighting conditions. According to the source of the colour blindness awareness organization, colour blindness affects about 4.5% of the world's population or 1 in 12 men and 1 in 200 women [17]. If the world's population is estimated to be 7 billion, roughly 315 million people suffer from colour blindness.

The most frequent forms of human colour blindness result from problems with either the middle or long-wavelength sensitive cone systems, and involve difficulties in discriminating red, green, and blue from one another [8]. People who have one kind of the cones missing are known as dichromats: protanopia (red cones absent), deuteranopia (green cones absent) tritanopia (blue cones absent). People with monochromatic vision can see no colour at all, and their world consists of different shades of grey ranging from black to white. Achromatopsia is a highly rare condition that affects about one out of every 33,000 people, and its symptoms can make life very difficult.

Population studies on the frequency of daltonism [5] have revealed the highest levels in Europe and North America (up to 8%) but lower in the Middle East (less than 5%) [16], with an incidence of about 5% in Asian men and 3% in Black men [9]. In the Asian population, daltonism frequency varies from 1.12% to 5.50%, but in endogamous groups in India, it is much higher – up to 8.58% [4].

MATERIALS AND METHODS

The study was conducted with fieldwork for 15 days in Dehradun district of Uttarakhand at Sabhawala, Sherpur and Tiparpur villages. The study was approved by the institutional ethical committee, Department of Anthropology, University of Delhi. The journey for the fieldwork started on 2 January 2020 from the campus of Delhi University, and the collection of data began on the next day i.e., 3 January 2020. A total of 204 individuals aged from 5 years to 85 years were studied, only males.

Colour vision defect was tested under daylight using the standard Ishihara's colour plate chart (Pseudo-isochromatic plates) introduced by Dr Shinobu Ishihara in 1917. Each participant was asked to read the numbers on the 24 plates of the test and illiterate participants were asked to trace the figures with their fingers. The participants who read all the plates correctly were recorded as normal, while those who could not read or trace the figures of the colour plates were considered to be colour blind, and the type of colour blindness was identified with the help of the key provided in the chart.

RESULTS

The prevalence of congenital colour blindness in the present study was found to be 3 (1.47%). Among the total sample of 204 participants aged from 5 to 85 years, three participants of aged 10,11, and 21 years were found to be colour-blind (Table 1). With the help of the guidelines provided in the Ishihara Chart table, three different types of colour blindness were identified among them, i.e., protanopia (red colour blindness), deuteranopia (green colour blindness) and achromatopsia (also known as monochromacy, which is considered to be total colour blindness). Furthermore, the prevalence of these three different types of colour blindness was found to be equally distributed among the Bhoksha population at the rate of 0.49% (Table 2). However, it also has been found to be distributed at different rates as 2.44%, 2.38% and 100%, as well as complete absence among the different gotras of the population as shown in (Table 3).

Table 1. Prevalence rate of Colour blindness

	n	%
No. of normal participants	201	98.53%
No. of Colour blind participants	3	1.47%

Table 2. Types of Colour blindness and their prevalence rate

Types	Colour blind (n)	%
Protanopia	1	0.49%
Deuteranopia	1	0.49%
Achromatopsia	1	0.49%

Table 3. Frequency of colour blindness among Gotras of the population

S. No.	Gotras	Normal (n)	%	Colour blind (n)	%	Total
1.	**Chauhan**	40	97.6%	1	2.44%	41
2.	**Kakkad**	0	0%	1	100%	1
3.	**Pundir**	41	97.62%	1	2.38%	42

DISCUSSION

The percentage distribution of colour blindness varies from one population to another in India. This study provides the frequency distribution of red-green colour blindness for the first time among the Bhoksa tribe population

in Dehradun according to different gotras. In general, the frequency of prevalence of colour blindness among the scheduled tribe population in India is minimal, ranging from 0.000% to 0.128% [1] as shown in Table 4. Interestingly, the present study shows that the prevalence frequency appears to be relatively high (1.47%).

Table 4. Frequency of colour blindness among scheduled tribe of India (Bhasin, 2006)

		Frequency of colour blindness		
Zones	**No. of studies**	**Mean**	**Minimum**	**Maximum**
North Zone	5	0.018	0.000	0.032
South Zone	39	0.03	0.000	0.128
Central Zone	7	0.031	0.000	0.059
East Zone	34	0.026	0.000	0.104
West Zone	23	0.023	0.000	0.090
Islands	3	0.024	0.000	0.057

Post [14] and Pickford [13] proposed an intriguing hypothesis to explain the wide range of colour blindness seen around the world, including in India. According to them, natural selection would tend to eliminate colour blindness in populations that are most reliant on the hunting and gathering economy, and Post further observed that if natural selection's rigours against colour blindness were relaxed, such as in urban societies, the number of colour blindness would tend to increase by mutation.

This model of Post and Pickford is supported very well by the high prevalence of colour blindness among the Bhoksa people. The life of the Bhoksa people is changing, especially their occupation from agriculture towards small-scale industry and working as labourers in the nearby town and cities. On the other hand, the Bhoksa community strictly follows tribal endogamy. Due to rapid urbanization in the area, the prevalence of colour blindness is on the rise and occurs at a higher rate than in other scheduled tribes in India due to the relaxation of selection.

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