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Incidence of Colour Blindness among four Varna Population of Hindu Religion of Lucknow District, Uttar Pradesh (India)

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Abstract

To find out the incident of sex-linked defective colour vision for tracing the genetic variation among the people of Lucknow district in Uttar Pradesh, a research was planned among the four Varna population using standard Ishihara's colour plate chart. The present study was conducted on a total 400 individulas belonging to Brahmin, Kshatriya, Vaishya and Shudra Varnas. It is noted that 2.75 percent individuals are colour blind among all the four Varna and none of females as per theoretical expectations has been detected to be colour blind. While considering the Varna wise variation, it is observed that highest frequency of colour blind belongs to Vaishya Varna closely followed by Brahmin and Kshatriya whereas Shudras have the lowest frequency. It may be noted that majority of case (8 cases) belong to Deutranopia and only 3 cases are of Protanopia type. While considering the allele frequencie , it is noted that Vaishya population are characterised by a higher frequency of X^c allele (0.0400) as compared to other group of Varnas.

Keywords: Colour Blindness, X- linked trait, Ishihara Colour Test, Varna.

INTRODUCTION:

Colour blindness is one of the common genetic disorders observed in all human populations. The colour blindness is a recessive genetic trait expressed due to presence of a defective gene present on sex-chromosome X, thus called X-linked or sex-linked trait. The genes are located on the X chromosome within the Xq28 band. Another study with the help of DNA hybridization confirmed that the genes for red-green deficiency are on X chromosomes and is used as a genetic marker to study human diversity. The fact that colour blindness is so much more prevalent among men implies that, like hemophilia, it is carried on the X chromosome, of which men have

only one copy (As in hemophilia, women are protected because they have two X chromosomes a normal gene on one chromosome can often make up for a defective gene on the other.) It is criss-cross inheritance as males express the trait while females only transmit it. Thus, this colour vision anomaly is widely used as a genetic marker in the study of human variation in various ethnic groups of India. (Singh et al, 2010). The detection of colour-blind subjects was done by using the method suggested by Ishiara (1951) based on 38 plates.

Among the various classes of inherited colour vision deficiencies in humans, red and green weaknesses in dichromate and anomalous trichromats are the most prevalent, affecting approximately 5 percent of the human population. These deficiencies result from molecular changes at the loci coding for red and green visual pigments (Nathans et al. 1986). There is no consensus as to the origin of these sex-linked polymorphisms or to the evolutionary forces influencing gene frequencies. The major model that has emerged from the last century of studies is 'selection relaxation' (Pickford 1958, 1963; Post 1962*a*,*b*, 1971). A low incidence (2 per cent) of red-green (R-G) deficiencies in hunting peoples and higher values (8 per cent) in agricultural and industrial societies led Post (1962*a*) to suggest that natural selection was still operating to remove colour vision defectives in hunting populations, while in agricultural or industrial societies there has been a relaxation of selection resulting in an increase in gene frequency from mutational pressure (Reimchen, 2011).

Post's model has provided a popular framework for interpreting population differences in colour deficiencies (Bhasin, 1967; Dobson et al., 1967; Ray, 1969; Chattopadhyay, 1970; Post, 1971; Malhotra et al., 1974; Malhotra, 1978; Sastry, 1974; Mueller ad Weiss, 1979; salzano, 1980). Yet various aspects of the model have been criticized (Thoday, 1965; Adam et al., 1966; Adam, 1973; Halberstein and Crawfold, 1974; Murty and Vijayalaxmi, 1974; Mukherjee et al., 1979). Ford (1964) suggests that mutation is not a sufficient condition to generate such high frequencies and that this may be a balanced polymorphism. Adam (1973) has pointed out that it is primarily the deuteroanomalous trait that has increased in frequency, whereas Post's model would predict that other deficiencies should increase in frequency as well. Furthermore, although the oldest cultures are predicted to have the highest frequencies of deficients, this is not the case (Dobson et al., 1967; Adam, 1969). Adam (1969) was of the opinion that it is highly unlikely that selection has acted simultaneously upon the various forms of colour-blindness. Robert (1967) also pointed out that there is no clearly acceptable evolutionary explanation for the different levels of colour-blindness in human populations. Haberstein and Crowford (1974) were is agreement with Adam and Robert (B. Choudhury, 1994).

The basic premise of Post's model rests on the assumption that departures from full trichromatic sensitivity represent a suboptimal condition of the visual processing system. While this may be reasonable, there are sufficient data to justify further

scrutiny of this assumption. Recent studies of the visual system of the Amazonian squirrel monkey (*Saimiri*) and the spider monkey (*Ateles*) also yield evidence for a polymorphism in colour vision including variations comparable to the protoanomalous form (weak red deficiency) in humans (Jacobs, 1981), suggesting either a comparable suboptimal system or ecological adaptations. Experimental observations on human vision indicate that red-green insensitive individuals can detect relatively smaller differences in brightness of colours than normals (Adam, 1969), particularly at reduced light intensity (Iinuma and Handa, 1976; Hurvich, 1981).

Recent analysis of DNA fragments of the loci coding for the visual pigments show that deficients have asymmetric combinations of the major gene fragments as well as increased numbers of gene copies relatives to normal observers (Nathans et al., 1986), patterns inconsistent with mutation rate as a source of these polymorphisms, (Reimchen, 2011).

MATERIALS AND METHODS

The present study is conducted among the four Varna population of Lucknow district of Uttar Pradesh. Lucknow is the largest and most developed city in north India after Delhi. It is situated in the middle of the Gangetic plain. It is located at 26.84 latitude and 80.92 longitude and situated at elevation 126 meters above of sea level.

The areas selected for field work from Lucknow were Gomti Nagar, Alambagh, Aliganj, Bakshi Ka Talab, Telibagh, Chowk, Qaiserbagh, Aminabad and Rajaji Puram.

For this research a total 400 people (including male and female) of four Varna were screened using standard Ishihara's colour plates chart. This test was conducted in day light in a room avoiding direct sunlight. The colour vision testing plates are held at (75 cm) from the person and tilted at right angle to the line of vision. The colour Ishihara chart was shown to all participants and they were asked to read the impressions in the colour chart. The time given for telling the number on a plate was less than 5 sec. The impression perceived by a person with normal colour vision was different from the impression perceived by a person with colour vision deficiency.

RESULT AND DISCUSSION

The pattern of colour-blindness as indicated by the four Varnas of the present series is presented in Table 1.In the total 400 individuals screened, as many as11 cases of colour blindness were detected. It is noted that 2.75% individuals are colour-blind among all the four Varnas and none of females as per theoretical expectations has

been detected to be colour-blind. While considering the Varna wise variation, it is observed that highest frequency of colour-blind belongs to Vaishya Varna closely followed by Brahmin and Kshatriya Varnas and Shudras have the lowest frequency. The eleven colour-blind, persons have been further classified according to the nature of colour-blindness.

The details are given in Table–1, fig 1. It may be noted that majority of case (8 cases) belong to Deutranopia and only 3 cases are of protanopia type. While considering the allele frequencies (Table – 2), it is noted that Deuterons (Y) type is preponderant over protans (X) type in all the groups of four Varna. The value of Y/X is higher in Vaishya (3.0) and lowest in Shudras (1.0). The frequency of colour-blindness is also found to be higher in Vaishyas (4%) and lowest in Shudras (1%). Thus, the Vaishya Varna are characterised by a higher frequency of X^C allele (0.0400) as compared to other group of Varans.

Table 1: Classification of colour-blindness among the four Varnas of Lucknow

Population Group	**No.**	**Normal**		**Colour-blind**			
				Deutranopia		**Protanopia**	
		No.	***%***	***No.***	***%***	***No.***	***%***
Brahmin	100	97	97	2	2	1	1
Kshatriya	100	97	97	2	2	1	1
Vaishya	100	96	96	3	3	1	1
Shudra	100	99	99	1	1	–	–

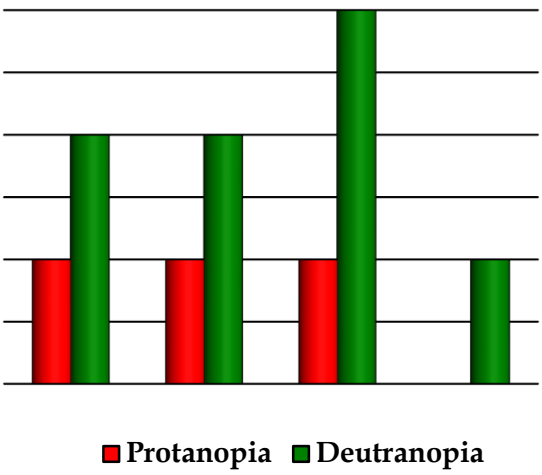

Fig. 1: Incidence of Colour Blindness among four Varnas

Table 2: Incidence of various types of colour vision deficiency (CV) and gene frequencies among four Varna males

Population Group	**Tested Numbers**	**Colour vision deficiency**			**Total Colour-blind**	**Allelic frequencies**	
		Protons	***Deutrons***	***Y/X***		***Colour blind*** X^C	***Normal*** X^+
Brahmin	100	1	2	2.0	3	0.0300	0.9700
Kshatriya	100	1	2	2.0	3	0.0300	0.9700
Vaishya	100	1	3	3.0	4	0.0400	0.9600
Shudra	100	-	1	1.0	1	0.0100	0.9900

X^+ and X^C are dominant are recessive alleles of colour-colour-blindness

It is further noted that in terms of frequencies of protans and deutrans as well as the allele frequency there is no difference between Brahmin and Kshatriya population. This is further confirmed by comparison of the chi-square test indicating that the observed differences are insignificant.

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