

# The Incidence of Inherited Defects of Colour-Vision in Eight Endogamous Groups of Maharashtrian Brahmins

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## Introduction

The people of India consist of a large number of endogamous groups (Mendelian populations; Dobzhansky, 1951) whose members are forbidden to marry within their own groups. These groups constitute the framework of Hindu society, and are thus the ultimate significant social units. Therefore, in order to understand the Hindu social organization, called caste system, from both biological and sociological point of view, studies should be attempted at endogamous level and not at caste level. The advantage of such a procedure was pointed out as early as in 1949 by Sanghvi and Khanolkar, which gained more weight by the researches of Karve (1961) and Malhotra (1966).

The purpose of the present paper is to furnish data on the sex-linked defective colour-vision in eight endogamous groups of Maharashtrian Brahmins. There are mainly about twelve endogamous groups of Maharashtrian Brahmins. Maharashtra is one of the new states in India founded in 1960 with a population of 40 millions, where Marathi language is spoken. The Brahmins constitute about 7% of the total population of Maharashtra. A critical brief ethnographic account regarding the endogamous groups under consideration is given elsewhere (Malhotra, 1966*a*).

## Materials and methods

The sample of 1580 unrelated males between 10-55 years, was drawn mainly from four cities of Maharashtra, i.e. Bombay, Poona, Pandharpur and Nagpur. Tab. 1 shows the number of subjects tested from each of the endogamous groups, together with the percentages of colour blind.

The trait was examined by recording the 14th edition (1959) of the 1-25 Ishihara plates. The tests were conducted in a room with sufficient day light. Plate No. 1 was always shown first to all the subjects and the order of the plates was changed now and then while testing. The answers on all the plates were recorded immediately on a printed proforma. The abnormals were, however, further examined. All the subjects examined could read Arabic figures.

## Results

The results are summarized in Tabs. 1 and 2. It is observed that out of 1580 individuals tested only 60 (3.79%) were found to have defective colour vision. The sub-classification of the 60 subjects considered to be abnormal is shown in Tab. 2. According to Ishihara normals read 26, 42, 35 and 96 on plates 22, 23, 24 and 25 respectively. Deuteranopes read only 2, 4, 3 and 9 on plates 22, 23, 24 and 25 respectively, while protanopes read only 6, 2, 5 and 6 on the above mentioned plates. Deuteranomalous or mildly deuteranomalous read 2, 4, 3 and 9 more clearly than 6, 2, 5 and 6 on plates mentioned. Protanomalous or mildly protanomalous on the other hand read 6, 2, 5 and 6 more clearly than 2, 4, 3 and 9. One subject only read first plate and has

Tab. 1. Number of subjects investigated from eight endogamous brahmin groups and percentages of colour blind

Endogamous groups	Abbreviation	N. of subjects	N. of colour blind		Ratio Deuton/Proton	Total population
			F	%		
1. Chitpavan Brahmins	C. H.	198	17	8.58	1.83	119611 (1931)
2. Devrukhe Brahmins	D. V.	200	0	0.00	0.00	9047 (1901)
3. Saraswat Brahmins	S. A.	197	4	2.03	3.00	76422 (1901)
4. Karhada Brahmins	K. R.	200	6	3.00	5.00	32426 (1901)
5. Deshastha Rgvedi Brahmins	D. R.	200	12	6.00	3.00	} 302530 (1931)
6. Kanava Brahmins	K. A.	200	6	3.00	2.00	
7. Madhyandina Brahmins	M. A.	199	3	1.50	3.00	
8. Charak Brahmins	C. A.	186	12	6.45	2.50	not available
Total		1580	60			

Tab. 2. Subclassification of abnormal

Endogamous groups	Total N. of abnormal	Protanopia (F)	Protanomalia (F)	Deuteranopia (F)	Deuteranomalia (F)	Total colour blind (F)	Unclassified (F)
1. C. H.	17	4	2	9	1	1	—
2. D. V.	0	—	—	—	—	—	—
3. S. A.	4	1	—	2	1	—	—
4. K. R.	6	1	—	5	—	—	—
5. D. R.	12	2	1	8	1	—	—
6. K. A.	6	1	1	4	—	—	—
7. M. A.	3	—	—	3	—	—	—
8. C. A.	12	1	1	8	1	—	1
Total	60	10	5	39	4	1	1

**Tab. 3. Values of  $\chi^2$  for intergroup differences with respect to colour-blindness (df=1.)**

	C. H.	D. V.	S. A.	K. R.	D. R.	K. A.	M. A.	C. A.
C. H.	—	14.15**	7.18**	4.72*	0.62	4.72*	8.90**	0.36
D. V.		—	4.15*	6.15*	12.50**	6.15*	3.06	13.52**
S. A.			—	0.44	5.13*	0.88	0.00	5.84*
K. R.				—	2.86	0.09	0.44	3.42
D. R.					—	1.16	4.40*	0.22
K. A.						—	0.46	3.28
M. A.							—	7.29**
C. A.								—

\* = significant at 5% level of probability

\*\* = significant at 1% level of probability

thus been classified as total colour blind. One individual could not be fitted in any of the recognized classes. There is, however, no doubt about his deficient colour vision as he could only read 8 plates out of 25. Except this only case no difficulty was experienced in classifying various abnormals according to Ishihara's diagnosis.

The percentage frequency of the red-green blindness in the present study falls within the range of 0.00% in D.V. to 8.58% in C.H. It is interesting to note that out of 200 persons examined for D.V. none was found to be colour blind. The mean worked out for all the Brahmin groups is 3.97%.

A comparison of the relative frequencies of the abnormals reported in this study reveals that the proportion of deutan genes to proton genes for the whole series is 2.54 : 1. This proportion, however, differs markedly in different groups, and it ranges between 1.83 : 1 to 5.00 : 1 in C.H. and K.R. respectively.

### Inter-group differences

The values for inter-group differences with respect to colour blindness are shown in Tab. 3. All the groups except D.R. and C.A. reveal significant differences when compared to C.H. (the degree of significance is indicated in Tab. 3). D.V. shows significant differences with all groups except M.A. The group S.A. differs from D.R. and C.A., while M.A. shows differences with D.R. and C.A.

### Discussion

So far little is known about the variability of this trait in Maharashtra. Until now, including the present study, data on 20 different endogamous groups<sup>1</sup> are avail-

<sup>1</sup> For details cf. Dutta (1966).

Tab. 4. Comparative data

Endogamous groups	N. of persons	N. of colour blind		$\chi^2$ -value <sup>2</sup>	Source
		F	%		
1. C. H.	198	17	8.58	1.33	Present study Sanghvi & Khanolkar, 1949
	100	5	5.00	(df = 1.)	
2. D. R.	200	12	6.00	1.34	Present study Sanghvi & Khanolkar, 1949 Basu, 1966
	100	3	3.00	(df = 1.)	
	102	3	2.94 <sup>1</sup>		
3. M. A.	199	3	1.50	0.72	Present study Sanghvi & Khanolkar, 1949
	100	3	3.00	(df = 1.)	

<sup>1</sup> Basu's data are not strictly comparable as he considered Deshastha Brahmins as a whole and not a particular sub-division

<sup>2</sup>  $\chi^2$  values have been calculated from Woolf's table (1957)

able (Sanghvi and Khanolkar, 1949; Das *et al.*, 1961; Basu, 1966). These groups include samples from tribals, Hindu backward caste, caste Hindus and Brahmins. The range of variation of defective colour vision in Maharashtrian populations worked out so far ranges from 0.00 to 8.58% with a mean of 3.56%.

The available data on this trait on Brahmin groups included in the present study are shown in Tab. 4. The three Brahmin groups studied by Sanghvi and Khanolkar (1949), namely, C.H., D.R. and M.A. did not show any significant differences, statistically speaking, when compared with the present frequencies for the same groups. Basu (1966) obtained slightly low values for the Deshastha Brahmins when compared with the data on the same Brahmins of the present study.

Dronamraju (1963) reported an interesting aspect of the subjects' behaviour. According to him "... colour blind individual tends to associate more closely with other colour blind people than with non-colour blind people. It is even probable that colour blind people of the same subgroup tend to come together..." (p. 319). In this connection it may be mentioned that in the present survey, there were two such occasions on which a colour blind person was followed by another colour blind. In one set subjects with S. Nos. 31 and 32 were colour blind, the former being protanope and the later being protanomalous. In the group C.A. three subjects with S. Nos. 40, 41 and 42 were found to be colour blind and incidentally all of them were deuteranope. Basu, however, did not find any such instance in ten populations he studied.

### Summary

Data on defective sex-linked colour vision has been reported on 1580 male subjects drawn from eight endogamous groups of Maharashtrian Brahmins. The range of variation of affected persons is between 0.00 to 8.58%, with an average of 3.97%. The ratio of deutan to proton genes is 2.54 : 1.

A great deal of heterogeneity is observed in the groups investigated.

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## RIASSUNTO

La discromatopsia legata al sesso è stata studiata in 1580 individui maschi estratti da 8 gruppi endogamici di Bramini Maharashtrian. La proporzione di individui affetti varia fra 0 e 8.58%, con una media di 3.97%. Il rapporto fra gene deutone e gene protone è di 2.54:1. Nei gruppi studiati si è osservata una notevole eterogeneità.

## RÉSUMÉ

Les dischromatopsies liées au sexe ont été étudiées chez 1580 individus masculins tirés de 8 groupes endogamiques de Brahmins Maharashtrian. La proportion d'individus atteints varie entre 0 et 8.58%, avec une moyenne de 3.97%. Le rapport des gènes deutone et protone est de 2.54: 1. Une remarquable éterogénéité a été observée chez les groupes étudiés.

## ZUSAMMENFASSUNG

1580 Männer — eine Auslese aus 8 endogamen Maharashtrian Brahminen-Gruppen — wurden auf die geschlechtsgebundene Dischromatopsie untersucht. Die Proportion der von dem Leiden befallenen Personen schwankt zwischen 0 und 8.58% mit einem Durchschnittswert von 3.97%. Das Verhältnis zwischen Deutone — und Protone — Gen beträgt 2.51: 1. Beiden untersuchten Gruppen liess sich eine merkliche Heterogenität feststellen.