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Prevalence of color vision deficiency (CVD) and ABO blood groups in Kannur district of Kerala, India.

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Abstract: Colour's have profound influence in life. Colour vision deficiency (C. V. D), A. B. O & Rh blood groups are inherited entities with different geographical regions, and from race to race it varies. As the C. V. D once occurred cannot be changed in life time.750 cases of Colour Vision Deficiency individuals were examined and were identified and confirmed by testing colour vision of the person by Ishihara's Chart test for both eyes. Those found to be suffering from congenital colour blindness were then subjected to A, B, O & Rh grouping by slide method. Our results showed statistical significant positive relationship between congenital C. V. D individuals and their A, B, O, R, H blood groups. Our aim was to study relationship between A, B, O blood group, Rh factor, G-6PD and to know if any Colour Vision Deficiency (C. V. D) present in this population.

Key words: A.B.O.; C.V.D; Colour; G-6PD; Rh grouping.

Introduction

In humans, many genes and the respective traits controlled by them are recognized as being linked to the X chromosome. These X -linked traits can be easily identified in a pedigree because of the crisscross pattern of inheritance. One example of X -linked recessive disorder is colour blindness / Colour vision deficiency (C.V. D). Colour Vision Deficiency (C. V. D) is the decreased ability or inability to perceive colour differences or see colour, under normal lighting conditions. Colour Vision Deficiency affects a significant percentage of the population. There is no actual blindness but there is a deficiency of color vision. The cause is developmental fault in retinal cones in one or more region, and transmit of perceive color in light information to the optic nerve. This type of Colour Vision Deficiency is usually a sex-linked condition. The genes that produce photo pigments are carried on the X chromosome; if some of these genes are missing or damaged.

The mother in generation I pass the trait to all her sons but to none of her daughters. If the offspring in generation II marry normal individuals, the color blind sons will produce all normal male and female offspring (III - 1, 2, and 3); the normal visioned daughters will produce normal visioned disorders, in comparison to recessive autosomal disorders. This X -linked recessive character occurs exclusively in males. This is so because the only sources of the mutant allele in the population are in heterozygous females who are "carriers" and do not express the disorder. They pass the allele to one half of their sons, who develop the character because they are hemizygous. Heterozygous females also pass the allele to one half of their daughters, who become carriers but do not develop the character[1].

Landsteiner (1946)[2] made the first observation on the existence of difference between the bloods of normal individual belonging to the same species, in human beings. He divided human beings into 3 distinct groups i.e. A, B & O. A, B was discovered as the fourth and rarest of all in 1902 by his pupils Von Decasteue and Sturli. On the surface of red cells blood groups represents a system of antigens. According to Simple Mendellion law these antigens are inherited. Rh and A, B, O are inherited independently from each other from the major system of Blood. Evidence has been forthcoming that different blood groups persons differ in their susceptibility to certain diseases. Some studies showed relationship between blood groups and some diseases i.e. peptic ulcer, certain neoplasm, cancer of stomach and female genitalia, carcinoma urinary bladder, pancreas, diabetes and salivary glands [3-7].

Extensively various studies on mental disorders[8] and congenital disorders[9], muscular dystrophy[10] and its association with blood groups have also been studied. Like blood groups, anomalies in colour vision especially congenital ones are also determined by heredity. Encouraged by above mentioned facts the present study has been under taken with the aim to find the association between A, B, O blood groups and colour defects in North Kerala (Malabar) population.

Materials and Methods

Persons with ocular abnormalities and vision defect were excluded from our study. Informed consent was obtained from the participants and coded questionnaires were completed to determine socio demographic, lifestyle information, age, and gender, was collected by questionnaire. Ethical approval to conduct this study was granted by the Local Ethical Review committee. 750 positive cases of colour defective individuals were identified by screening the persons using Ishihara (1959)[11]

Ishihara are Colour Plates test to identify red-green range defect, this test was performed in departmental laboratory which has adequate day light. The plates were kept at normal reading distance of 75cm from the subject and the plates are made to the right angle to the line of vision.

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The subjects suffering from colour blindness were then subjected to A, B, O and Rh blood grouping by slide agglutination method. A standard methodology was followed by commercially prepared and available anti sera A, B, and Rh blood groups by anti- D was taken and placed on left and right side of glass slides and for Rh on separate glass side. Anti-sera and red cell suspensions were mixed with each other by separate glass rods. After minutes both slides were examined for clumping of red cells, with naked eye and were confirmed with magnifying lens. To detect colour blindness one very simple test was used. Ishihara colour test are series of pictures of coloured spots often used for red green colour blindness. A figure number is embedded in the spots which has slightly different colour. A person with normal colour vision would be able to read the number properly but a person with colour blindness might read the number wrong or may not even see it.

For A, B, O Blood Grouping H and was made to dangle down to increase the flow of blood in the fingers. Fingertip was cleaned to be pierced with spirit or 70% ethanol (usually ring or middle finger). With the help of the sterile needle, pierced the fingertip and placed one drop of blood in each of the circles drawn on three slides. One drop of each of the antiserum on their respective slides and mixed the antiserum with the blood drop using separate mixing stick, observed agglutination in the form of fine red granules within 30 seconds to 1 minute with a naked eye and with microscope for conformation.

Glucose-6 Phosphate dehydrogenase deficiency was detected with Brilliant crystal Blue dye test of Motulsky and Campbell-kranel[12] to overrule the X-linked pattern of inheritance, missense mutations, common metabolic disorder of red cell.

Results

Distribution of blood groups in control and colour defective population and level of significance by using student t test and Chi Square test as shown in tables respectively.

Table 1: General distribution of ABO blood groups in Colour Vision Deficiency (C. V. D) population

Blood Group	Total Population (CVD)	Total Frequency (% Age)
A	240	32%
B	203	27%
O	233	31%
AB	82	10%
Total	750	100%

It is observed from table 1 that in general Colour vision deficiency (C. V. D) when compared with blood group A forms the dominant group (32%) with blood group O coming next (31%) as the second commonest group and B group coming next (27%). A, B group being the rarest with only 10% of the incidence (i.e A>O>B>AB)

Table 2: Distribution of ABO blood groups in Colour Vision Deficiency (CVD) Kerala population

Blood Group	No. Of Cases/100	Frequency %age	%age Difference
A	32	32%*	+19%*
B	27	27%	-8%
O	31	31%*	+12%*
AB	10	10%	-4%

*indicates significant (P≤ 0.05) difference from normal colour vision group as determined by using student's *t- test.*

It is observed from table-2 that blood group A & O shows marked rise in prevalence (19%) (12%) whereas blood group B & A. B showed decrease by 8% and 4% This prevalence rate is compared to control group. However, distribution of Rh grouping in control and Colour Vision Deficiency (C. V. D did not show any statistical significant results. The observations of the test done for colour vision using Ishihara test plates. It was found that all Colour Vision Deficiency (C. V. D) were red-green blind. Both eyes were tested separately and all colour defectives were found to be having bilateral defect. This table also shows that there is an obvious difference in percentage value of blood group A, B, O and A, B in colour defective population when compared to general population. There appears to be marked rise in incidence of blood group A, O and to a lesser extent to blood group B, AB but there is fall in incidence of blood group B and A, B. On statistical analysis blood group, an attains 19% level of more value.

Table 3: Distribution of Rh factor & Colour Vision Deficiency (C. V. D) Kerala population

Blood Group	%Age Of Abo Blood Grouping	Rh Factor Distribution	
		+ ve	-ve
A	32%	98%*	2%
B	27%	94%	6%
O	31%	93%	7%
AB	10%	94%	6%
TOTAL		94.75%*	5.25%

*indicates significant (P≤ 0.05) difference from normal colour vision group as determined by using student's *t- test.*

From table-3 it reveals that in general population Rh positive forms the dominant blood group (94.75%) than the Rh negative (5.25%) there is again obvious difference in percentage although to a lesser extent in values of blood group Rh positive and Rh negative when compared to general population. When compared on individual basis, A+ is more dominant followed by B, AB, O

Table 4: Distribution of G-6 PD and A, B, O blood groups in colour defective Kerala population

Blood Group	% Age	G-6pd Deficient
A	32%	0 (0%)
B	27%	0 (0%)
O	31%	0 (0%)
AB	10%	0 (0%)

Table-4 shows the there is no G-6PD deficiency in any of the A, B, O, AB cases

Discussion

C. V. D prevalence varies in different geographical area from race to race.[13, 14] The studies from western Nepal, showed a prevalence of C. V. D in 3.8% out of 18 boys, but none of the girls was found affected.[13] From the religious groups of different parts of the India. Vijayalakshmi *et al*,.[15] that showed a C. V. D prevalence of 2.1% in 7,542 males and 0.2% in 3,519 females. Caucasians showed prevalence of 8% in men and 0.4% in women.[16] Sardighan[17] reported in Iranian medical students a C. V. D difference of 2.13% and 0.57% in male and female respectively. Prevalence of C.V. D in USA medical students was found to be 12.8%[18], and in dental students it was 7.8%[19]. In the present study, the observation revealed prevalence of general Colour vision deficiency (C. V. D) when compared with blood group A forms the dominant group (32%) with blood group O coming next (31%) as the second commonest group and B group coming next (27%). A, B group being the rarest with only 10% of the incidence. Blood group A & O shows marked rise in prevalence (19%) (12%) whereas blood group B & A, B showed decrease by 8% and 4% This prevalence rate is compared to control group. Rh positive forms the dominant blood group (94.75%) than the Rh negative (5.25%). Individuals with C. V. D perform less well than those with normal colour vision.[20]

Conclusions

The major findings from this study are that A, B, O and Rh blood groups are inherited according to mendielia law. Our study shows an increased prevalence of blood group A, O has been observed in C. V.D subjects which are stastically significant in term with B, A, B groups prevalence reached the desired stastically ($P<0.05$). Well more effectively the study facilitates the C. V. D prevalence is due to Acquired colour vision defect (A. C. V. D) but not due to congenital colour vision defect (C. C. V. D) due to G-6-PD values. Significantly higher prevalence requires further work to explore the problem. As with higher incidence of colour vision deficiency (C. V. D), the population with C. V. D may feel difficulty in identifying and difficulty in day to day activities. There is need for screening for C. V. D in students, and employed population not only at the time of selection to various courses and jobs, but also periodically during schooling, training / practice of employment in different fields. This would facilitate the detection and management of C. V. D more effectively. Moreover, this study has only examined very small population, it will be important to study if C. V. D exists in school and college students, and various government / Private jobs employed population due to continuum of effects relating to exposure to various environmental changes, biochemical changes which may lead to neuro functional impairment.

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