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Prevalence of Color Vision defects (CVD) Among Adult Human Population of District Gilgit, Gilgit-Baltistan, Pakistan.

Iftikhar Hussain[1], Saira Amir[2]

[1]Department of Biological Sciences Karakorum International University Gilgit, Pakistan
[2] Department of Biosciences Comsats University, Islamabad Pakistan

***Corresponding Author:** Iftikhar Hussain, Department of Biological Sciences Karakorum International University Gilgit, Pakistan. ifti14561@gmail.com*

ABSTRACT

The incidence and prevalence of color blindness varies from region to region in district Gilgit, since there is no such report about the prevalence of color blindness in the region Gilgit. The present study was carried out to find the genetic base diversity of colorblindness in human population of district Gilgit. The data were collected from all areas of district Gilgit. For colorblindness investigated in targeted areas of KIU Campus, Gilgit city and Danyore village. Total of 995 individuals were tested for significant colorblindness through the method of Ishihara test plates. Among these 984 (98.8%) were found normal for colorblindness and 11 (1.10%) were found significant colorblind. Out of 11 (1.10%) investigated colorblindness individuals 3 were found Red color blind, 3 for Green and 5 Red-Green colored blind. All colorblind types were found in male population. Overall 111 females were tested but no colorblind was detected.

Keywords: *Color vision, Kiu departments, Gilgit, Pakistan.*

INTRODUCTION

The Gilgit Baltistan of Pakistan spans an area of 72,496 square kilometers, bordering China, Afghanistan, AJK and India. Gilgit Baltistan is connection of three greatest mountain ranges of the world; the Karakorum, the Hindukush and the Himalayas. As a result of its politically sensitive location, the Gilgit Baltistan has been accorded special territorial status; the area was administered directly by the Federal Government, through the "Ministry of Kashmir affairs & Northern Areas (Gilgit Baltistan).

The whole region of Gilgit-Baltistan is divided into ten Districts: Gilgit, Baltistan, Diamer, Astore, Ghezir, Ghanche, Hunza, Nagar, Karmaah and Shigar These, in turn, are further sub-divided into a total of 13 sub-divisions and 19 Tehsil.

The region's administrative headquarter is located in Gilgit City (Government of Pakistan and IUCN, 2003).The recent population census (1998) estimated that there were just over 870,000 people in the Northern Areas (Gilgit Baltistan). Despite the growth of the Gilgit-Baltistan urban areas, the population remains overwhelmingly rural. The annual population growth rate is estimated to be 2.47 percent (Government of Pakistan and IUCN, 2003)

COLORBLINDNESS

Colorblindness is an abnormal form characterize by the incapability to noticeably differentiate different colors of range. An average male can differentiate a selection of color by mixing in various proportions the three (03) primary colors i.e. red, blue and green. The power of individual perception to one of these three primary colors is either subnormal or lost completely and occasionally it may happen that individual may lose sense of color differentiation completely. It has been established that color vision defect is inherited as X-linked trait with the normal color vision dominating over color vision defect (chromosome location Xq28). The first known scientific paper on CVD was written by John Dalton who himself was colorblind, so CVD is also known as Daltonsim (Dalton, 1794). The second most attempts on population differences in color blindness were carried by Clement (1930).Sensitive losses that generated these after images were applied independently to separates singles originated from red and green cone (David and Donald., 1979)

The molecular nature of three different types of X-linked color-vision defects, protanomaly, deuteranomaly and protanopia, in a large 3-

generation family was determined (D.,Borget.al., 1988). It is commonly said that males are more colorblind as compare to female? Normal human color vision is mediated by the presences of three kinds of cones containing of three different visual pigments, blue (which is short), green (which is middle) and red (which is long wavelength sensitive). (Samir et al., 1992)

Incidence of Red-Green color blindness was studied in a Libyan population and was then compared with the same in two samples of Indian population (Rahman et.al., 1998). Color vision and its deficiencies are long-standing concerns of human geneticists, but it was only with the molecular characterization of common forms of color vision abnormalities (beginning in the late 1980s) that mechanisms emerged to explain well-documented clinical findings. Now, new questions have arisen about the evolution and structural variability of the pigment genes and the regulation of their expression. In recent studies, the identification of mutations in the gene that encodes a cGMP-gated cation channel has resolved the molecular basis of complete color blindness, thereby extending our knowledge of color vision and revealing significant analogies among some sensory signal transduction systems. (Wissinger and Sharpe., 1998)

Human color vision is normally trichomatic i.e. the mixture of red, green, and blue lights. There are three types of cone photo pigment, each with different spectral sensitivity, are universally acknowledged to be the foundations of human trichomatic color vision. Among vision scientists, they are now most frequently referred to as short- (S-), middle- (M-) and long- (L-) wavelength-sensitive, according to the Relative spectral positions of their peak sensitivities (i.e. their lmax values). (Sharpe et al., 1999).

The genes responsible for red-green Color vision deficiency are located on the long arm of the X-chromosome within the Xq28 band, while the blue pigment gene resides on the 7th chromosome Being a genetic disorder, the incidence, of color blindness, varies from race to race and different in different geographical regions of the world inhabited by people of different ethnicity John Dalton was the first scientist to give a clear description of his affliction of the colorblind.(Karim and Saleem., 2003).There are many types of genetic color blindness. For example, people who have the inability to distinguish any color variations have monochromatic, a condition of being completely color-blind. There are many other types of genetic color blindness that are less serious than monochromatic, such as protanopia, red-purple appears gray to the sufferers. Basically there are three types of colorblindness which are Red Color Blind, Red-Green Color Blind and Green Colorblind.

Red green deficiency is by far the most common form of colour blindness. The scientific basis for the same is that, DNA sequences of the red and green receptor gene are so similar, that it is easy for mistakes to occur during the development of egg and sperm, as genetic material is replicated and exchanged between chromosomes. Those with a less common type have difficulty distinguishing blue and yellow. In very few cases, colour deficiency exists to an extent that no colors can be detected; only shades of black, white and gray are seen. (Bansal et al., 2005)

Most color vision defects are congenital and permanent. Red-Green defects show the highest prevalence in the general population. Impaired color vision, in the case of red-green color blindness, is genetically determined by X-linked recessive inheritance and thus occurs in males but is transmitted via female and about 8.0% of all women are carrier of it. Color vision deficiency is mostly congenital because of the absences or weakness of one or more or theses primary cones. Most cases of congenital CVD are characterized by the Red-Green Deficiency. Most cases are males as it is an X-linked disorder.

The X-linked Red –green deficiency affects apport.8%of the male population and only 0.4% of females in most Western Countries. It is Non-progressive and an untreatable, resulting condition.

Most cases of CVD remain undiagnosed, resulting in various handicaps. Colorblindness or color vision deficiency affects approximately 1 in 12 men's which is 8% and 1 in 200 women in the world. Talking of world only in Britain there is approximately 2.7 million colorblind people which are about 4.5% of total population of Britain.

There are many factors which can cause colorblindness, but majority of people with colorblind is due to their genetic problems and some people become colorblind due disease like diabetes etc. The color 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 is on X chromosomes and is used as a genetic marker to study human diversity. The ability to have trichomatic vision distinguishes humans from non-primates.

Men have a much higher possibility of getting color blindness than women. Various professions require normal colour vision.

A colour blind person should therefore be advised against training for such occupations as pilots, certain jobs in armed forces, electrical jobs, navigators, and police and aircraft maintenance workers.

Similarly people with abnormal colour vision are reported to have a significantly higher rate of road accidents.

MATERIALS AND METHODS

To study colorblindness in the population, samples both males and females (population) ishihara test were used for detection of colorblindness. This test contains 4 different plates .Plate 1, 2, and Plate 4 contains numbers and Plate 3 contains one or two wiggly lines. Set the Plates away from sample apporx.75cm, and give 5 seconds to identify each plate. People who have normal vision and all forms or colorblindness should able to distinguish the plate 1, 2, 3, and 4. (Ishihara.,1991).

The people who have Red Color Blind Cannot Read Plate 2,The people who have Red-Green Colorblind cannot Read the Plate 3 while the people who have Green Color Blind Cannot Read the Plate 4.

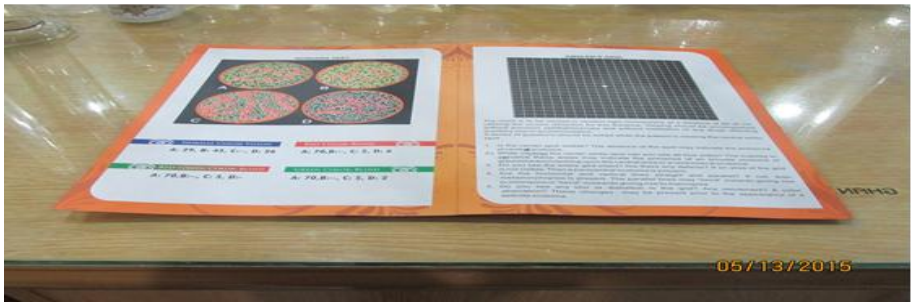

Fig1. *Appartus/Chart (Ishihara Test Plates) used to identify colorblind samples.*

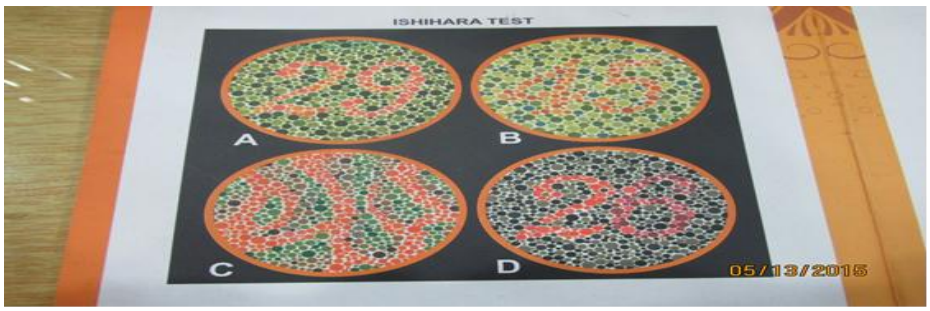

Fig2. *Different Ishihara test plates used to test colorblind.*

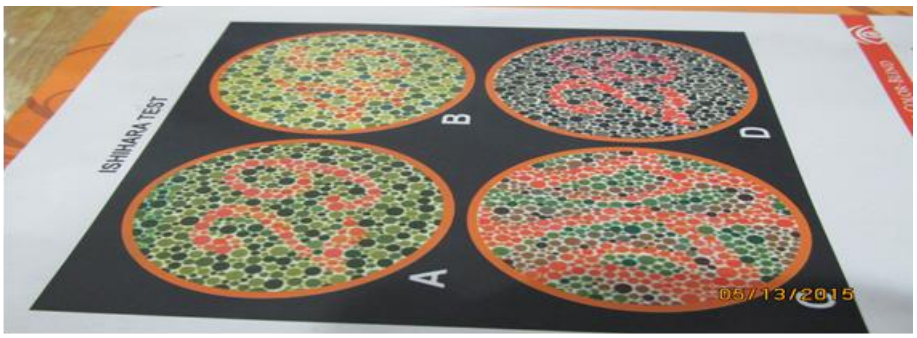

Fig3. *Closed view of Ishihara test chart used to test colorblind.*

RESULTS

The study was conducted on the phenotypic and genotypic Genetic characteristics in the human population, (Gilgit, Danyore, Sakwar, Oskandas, Jalalabad and Kiu campus) of Gilgit. The result were analyzed through SPSS (Cross tabulation

and Chi Square test). The characters recorded and our findings are shown in the tables below.

Table1. *Overall Human Population of Gilgit*

S.No.	Normal	Colorblindness	Total
1	984(98.8%)	11(0.1%)	995

In the present study color Vision Deficiency was comparatively studied in 995 total individuals in the human population of Gilgit which is including 984(98.8%) normal and 11(1.1%) colored blind persons.

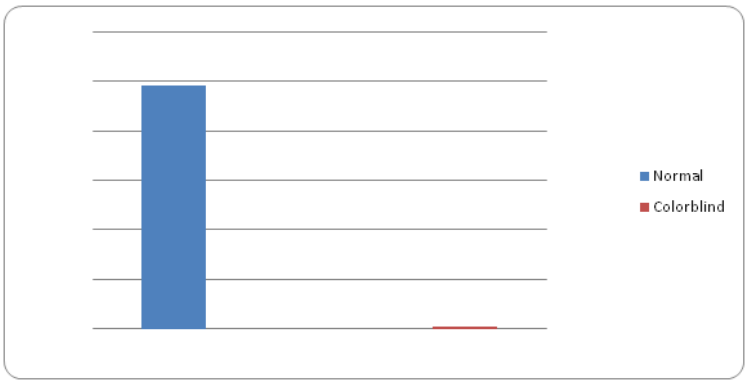

Fig4. *Colorblindness incidence in the Human Population of Gilgit*

The result showed the normal and Colorblindness incidences in the Human Population of Gilgit. The total 995 individuals were testing and found 984 normal and only 11 individuals were Colorblind.

Table1.1. *Percentage Distribution of Color Vision Deficiency in the Human Population*

Over All	Normal	Red Colorblind	Green Colorblind	Red- Green Colorblind	Total Colorblind	Total
	984 (98.8%)	3 (0.3%)	3 (0.3%)	5 (0.5%)	11 (0.1%)	995
Males	884	3	3	5	11	884
Females	111	0	0	0	0	111
Total	995	3	3	5	11	995

The total 884 males and only 11 were found to be colored blind with 3(0.3%) Red colored blind, 3(0.3%) Green colored blind and 5(0.5%) Red-Green colored blind whereas all 111 females were found to be normal.

Table1.2. *Crosstab Analysis of Color Vision Deficiency of Population with Gender*

			Gender		Total
			male	Female	
Location	Kiucampus	Count	133	111	244
		Expected Count	216.8	27.2	244.0
	Gilgit	Count	26	0	26
		Expected Count	23.1	2.9	26.0
	Danyore	Count	725	0	725
		Expected Count	644.1	80.9	725.0
Total		Count	884	111	995
		Expected Count	884.0	111.0	995.0

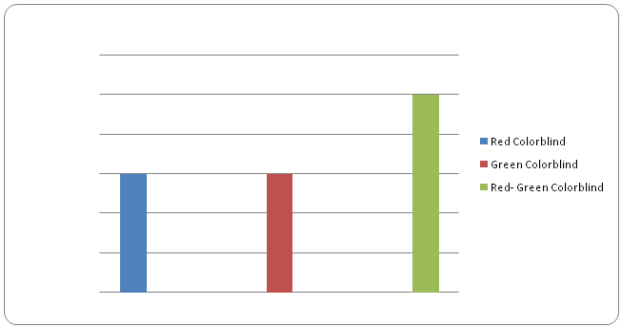

Fig5. *Types of Colorblindness found in the Human Population of Gilgit.*

The results showed the total 11 were found to be colored blind with 3 Red colored blind, 3 Green colored blind and 5 Red-Green colored blind. The total of 111 females was found to be normal.

Table1.3. *Location Wise Distribution of Color Vision Deficiency in the Human Population of Gilgit, Danyore and Kiu Campus*

Color Blind					
Location	**Colorblind**	**Red Colorblind**	**Green Colorblind**	**Red-Green Colorblind**	**Total**
Danyore	10	3	2	5	725
Gilgit	1	0	1	0	26
Kiu Campus	0	0	0	0	244
Total	11(1.10%)	3	3	5	995

The total tested samples for color Vision Deficiency was 995, among these 995,725samples was from Danyore with 10 colorblind Individuals, 26 samples from Gilgit with 1 colorblind Individual and 244 samples from KIU campus with no colorblind individual.

Table1.4. *Crosstab Analysis of Color Vision Deficiency of the Population with Location*

location * Colorblind Cross tabulation						
Count						
		Colorblind				Total
		Normal	Red colorblind	Green colorblind	RedGreencolorblind	
Location	Kiucampus	244	0	0	0	244
	Gilgit	25	0	1	0	26
	Danyore	715	3	2	5	725
Total		984	3	3	5	995

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.621[a]	6	.023
Likelihood Ratio	9.857	6	.131
Linear-by-Linear Association	2.456	1	.117
N of Valid Cases	995		

a. 9 cells (75.0%) have expected count less than 5. The minimum expected count is .08.

The total of 995 samples from three locations KIU Campus, Danyore and Gilgit. The data indicates the colorblindness in three locations. Is there is a relationship between the Color Blindness with location (KIU Campus, Gilgit and Danyore) at the significance level of 0.05.

By using Chi square test the calculated value is 14.621 with degree of freedom 6.The tabulated Value of chi-Square at degree of freedom 6 is 12.519, and the tabulated value of Chi-Square is less than the calculated value i.e. 14.621. Therefore we concluded that there is a relationship between Color Blindness with location (KIU Campus, Gilgit and Danyore).

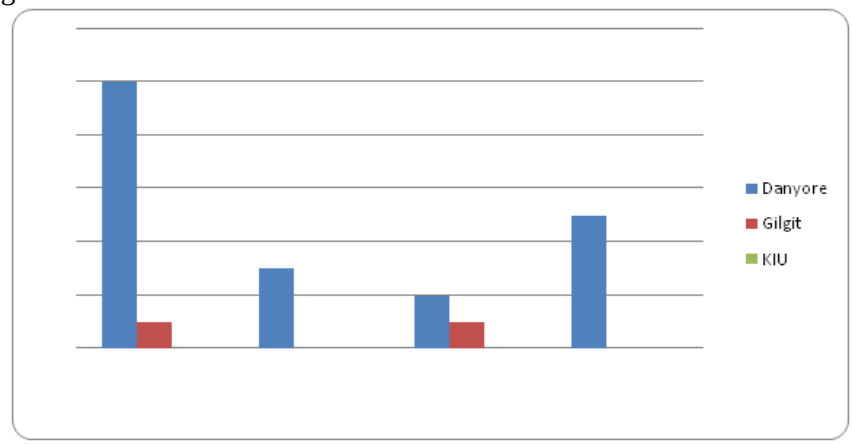

Fig6. *Location wise Colorblindness in the Human Population of Gilgit*

The results indicated that the Colorblindness in three locations in human Population of Gilgit. 26 sample from Gilgit, 725 samples from Danyore and 244 samples from KIU Campus.

In Gilgit city among 26 samples there is only (1) one red-Green color blind. The other 25 samples are normal. In Danyore city among 725 samples 10 are color blind (5 Red-Green Color Blind, 2 Green Color blind, 3Red color blind), the other 715 samples are normal. However in KIU Campus among samples 244, there is no color blind.

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