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Study of Various Human Traits in accordance to Hardy-Weinberg's Law in Jammu, India

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Abstract: ***Allele frequencies remain constant when transmitted over generations if there is random mating, no genetic drift, mutations, etc. as per Hardy-Weinberg's Law. If the gene frequencies are p and q, the genotype frequency will be p2, 2pq, q2 respectively for the dominant, the heterozygotes and the recessive in a two allele system. In this present study total of 16 autosomally genetically transmitted morphological characters were taken into account to find out whether their distribution and transmission followed Hardy Weinberg's law or not. 743 samples including males and females in the age group 6 to 75 were analysed from Jammu, India. When there is higher degree of deviation than expected on application of chi square test it ascertains that certain forces like natural selection, genetic drift, non-random mating etc. have a more profound effect on the distribution of genetically transmitted autosomal characters. It was observed that in the region of Jammu 9 characters showed higher degree of deviation than expected.***

Keywords: Gene frequencies, recombinations, heterozygotes, genetic drift, mutations

1. Introduction

According to Hardy Weinberg a theoretical situation is described in which a population is undergoing no evolutionary change. So it defines the genetic structure of a non evolving population. Mutations introduce new genes into a species resulting a change in gene frequencies. Gene frequency is the frequency with which a particular allele occurs in a population. Gene frequencies would remain constant if certain conditions existed like no mutation, no gene regulation, no genetic drift, no random mating and no natural selection pressure. The two alleles of a gene (p and q) sum upto to form 100% or 1. The percentage of homozygous and heterozygous individuals remains constant over the generations. Starting point frequency of different alleles is recorded by population geneticists. The frequency is measured at intervals. Any deviation from the previously recorded frequency will indicate the degree of evolutionary change caused by variations. A particular population may not be in equilibrium at a particular time. In such a case, distribution of alleles in succeeding generations, resulting due to random mating, can be calculated by using Hardy-Weinberg Equation: $p^2+2pq+q^2$. . Different situations can be analyzed using the postulates and equations derived from the law where frequencies of two alleles are at a single locus, frequencies of more than two alleles are at a single locus or frequencies of alleles are at two or more loci.

In large panmictic population changes in gene frequencies do occur. This change can either be directional as in case of mutation, selection or migration or can be nondirectional as in case of random drift. The directional change means a change of gene frequencies progressively from one value to another in either direction. If this change is not checked the forces may lead to eventual fixation of one allele, all other alleles being eliminated. Non directional change means changes which can not be predicted from one generation to another.

2. Material and Methods

It is a survey based study in which data is collected by analyzing various autosomal genetically transmitted morphological characters in a large population occupying areas of Jammu which is 33.4500˚ N, 76.2400˚ E. The data collected included the age groups from 6 to 75 males and females. It is general and observable data. Total of 743 samples were analysed from Jammu region pertaining to 16 human autosomally inherited characters.

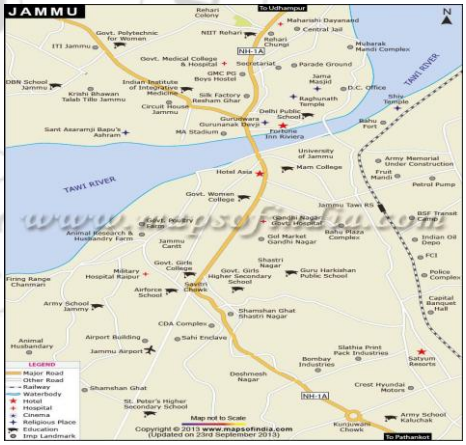

Figure 1: Map of Jammu region, India

Table 1: List of distribution of morphological characters in the population of Jammu

	Characters	Dominant	Recessive
1	Cleft in Chin	No Cleft 36	Cleft 707
2	Dimples	Present 92	Absent 651
3	Red And Green Colour Blindness	Present 739	Absent 4
4	Ear Lobes	Free Lobes 645	Attached 98
5	Tongue Rolling	Rollar 661	Non Rollar 82
6	Tongue Folding	Inability 739	Ability 4
7	Hair Line	Widow Peak 482	Straight line 261
8	Hair	Straight/Wavy 741	Curly 2
9	Finger Mid Digital Hair	Present 64	Absent 679
10	Bent Little Finger	Bent 161	Straight 582
11	Interlaced Finger	Left Thumb Over Right 380	Right thumb over left 363
13	Hitch-Hicker	Straight Thumb 162	Hitch Hicker 581
14	Handedness	Right handed 720	left handed 23
15	Hair on back of Hand	Present 619	Absent 124
16	Toe	Longer 2nd 519	Shorter 2nd 224

General Formula

Genotype	AA	Aa	aa	Total
Number, obs.	36	47	23	=106=N
Frequency,exp	p^2	2pq	q^2	=100
Number, exp.	p^2N	2pqN	q^2	=N
Deviation	2.8	5.3	2.5	
Chi-square	0.24	0.54	0.31	=1.09*

3. Results and Calculations

It has been observed that in region of Jammu 9 characters showed higher degree of deviation than expected hence, establishing that certain forces like natural selection, genetic drift, non random mating etc. have a more profound effect causing the divergence from Hardy-Weinberg's Law.

A Chi square test (X^2) for H-W Equilibrium was calculated as sum of squared deviation divided by expected number. From the above calculation it was concluded that the observed frequency distribution is different from theoretical distribution.

As the test statistics exceeds critical value of chi square test (X^2) the null hypothesis i.e. there is no difference between distribution was rejected with the selected level of confidence and alternative hypothesis that there was difference between distributions was expected with selected level of confidence. As the degree of deviation is greater it is expected that it is due to not only chance but also the certain forces (natural selection, mutation, genetic drift, non random mating etc.) acting upon them.

Hence, as been observed that in region of Jammu 9 characters showed higher degree of deviation than expected thereby, establishing that certain forces like natural selection, genetic drift, non random mating etc. have played a significant role.

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