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Prevalence of Mendelian Trait among Scheduled Caste of Patna (Bihar)

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Abstract – The discipline of human population biology incorporates study of biology and environmental factors, as well as the forces of micro-evolution leading to macro-evolution which ultimately influence the biological structure of human populations. The unit of study in understanding variations in man is a 'breeding population' sometimes also referred to as 'Mendelian population'. India is inhabited by people of great diversity, different creeds and customs forming what may be designated as multiple (or plural) society. There are about 3000 castes in India, some have genesis in castel stock while others are occupational, linguistic, religious and territorial entities. Each caste is a social unit or what may be called 'monopolistic guild' in itself. All these groups are not entirely independent; usually people belong to two or more of such groups at the same time. The climate of India has many regional variations determined by locations, altitude, distance from the sea or the mountains and the general relief. India is divided into eight climatic regions based on the monthly value of temperature and precipitation. India is a Union comprising 25 States and 7 Union Territories and these may be categorized into six zones (North, West, East, Central, South India and Islands).

The present paper aims at investigating, from the data collected on the basis of information received through the present study on the four endogamous Scheduled Caste populations in and around the District of Patna (Bihar), namely Dushada, Chamars, Pasis & Mushars, regarding the prevalence of certain bio-genetic traits among them.

Keywords: Mendelian trait, ABO, Rh, Scheduled Caste, Blood Group, Color Blindness

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INTRODUCTION

Humans are product of biology as well as culture and always strive for better life. It is their genetic structure may be considered to make them able to copes them to adapt them in the new zone. So, study of genetic structure of populations is of great importance in knowing their adaptation as well as their ethnic relationship. Genetic variability is the common feature of many organisms. The modern human populations carry in their genes, the encoded history of remote past and earlier migration history. Human populations differ genetically in varying proportions of the alleles of various sets. Human biological variations are related to the ethnic and ecological background of the population. The genetic similarities within the population show the common origin or the admixture of gene pool. The existence of genetic variation in man is caused by many factors along with selection, migration, gene flow and genetic drift. Populations of the same ethnic origin living in different geographical regions appear to show variation in biological characters among them. A population is characterized by a set of gene frequencies. Hence, the gene frequency data are essential prerequisite for studying the genetics of any population. The Indian population is structured into 40,000 endogamous groups, of which 37,000 groups belong to the Hindu caste system. Hindu population constitutes the largest community. The caste system in India has its origin in the verna system, with its language, state, and religious base; hence caste differentiation can be studied from these points of views. The caste system reflects the Indian occupationally and religiously defined hierarchies.

Essentially, the castes are therefore Mendelian populations of the species *Homo sapiens,* and they are recognized as different from each other, because the gene pools of various castes differ to some extent from each other. The differences are usually manifested phenotypically in its broader sense. As far as the question of gene flow is concerned, these castes are not "closed" but in practice do so very-very rarely. From the ongoing account, it has become clear that the unit of study of genetic variation in man is a Mendelian population represented by a caste/sub-caste of the Hindu community which forms an endogamous unit. The various evolutionary forces act upon such populations and shape their specific genetic

profiles in due course of time. Hence, the Mendelian population is an integrated unit of evolutionary change (Harrison et al., 1988).

From the above discussion, it can be derived that "fitness" is actually an evaluation of "adaptation". The fitness has two distinguishable aspects: (A) Reproductive fitness- which means that any individual who is represented by more descendants in future generation is more fit than those who have lesser number of them; (B) Survival fitness- which reflects the ability of an individual to survive in the prevailing environmental condition. Fitness in this sense is a physiological concept based on the organism's ability to maintain homeostasis in the face of various stresses. The two kinds of fitness, reproductive and survival, however appear to be intimately and necessarily associated with each other. Individuals, showing most efficient adaptation to physical stress of the environment, are more likely to survive to maturity, and therefore, to reproduce more successfully.

For evaluating the survival fitness of the population, various parameters affecting the survival of its members, are very essential to know that include frequency of certain biogenetic (Mendelian) traits. Genetic markers in human blood, particularly the blood groups of the individuals, are the simplest parameters in this regard because of their association with different disease (Bhasin and Walter, 2001). Literature is full of information suggesting better resistance or susceptibility of the individuals of a particular blood group to a particular disease. Not only this, some sort of incompatibility has been also reported to exist when spouses belong to one or the other blood group. The association of blood groups with different types of diseases has been established by many workers in the past (Waterhouse and Hogben, 1947; Boorman, 1950; Aird et al., 1953; Allan, 1953; Matsunaga, 1955; Vogel and Helmbold, 1972; Vogel, 1975; Mourant et al., 1978). The diseases of typhoid and paratyphoid as well as tuberculosis and sacoidosis, have high frequency among Rh-negatives (Mourant et al., 1978). Viral diseases also show in general a deficiency of Rh-positives, which is significant for mumps and viral meningitis (Pacirorkiewiscz, 1970). Duodenal ulceration also exhibits a significant association with Rh-groups (Mourant et al., 1978). Besides blood group based polymorphism, two well known genetic traits that also affect the survival (adaptive) fitness of the individuals are the sensitivity (or the blindness) to red-green colours (colour blindness) as well as to the bitter taste of phenylthiourea/ phenylthiocarbamide (PTC). From the distribution of colour-blindness in the different population groups of the world, Post (1962, 1971) and Pickford (1963) cited it to be the best trait for investigating 'relaxed selection'. This argument is based on the low rates of colour-blindness prevailing in primitive communities as compared with higher rates among civilized communities. Post (1962) was of the opinion that colour vision defects would be more damaging to primitive population since they have to depend upon game for their subsistence and in which full vision power for differentiating colours is of vital importance. Comparatively high frequencies of colour blindness in agricultural society are due to the relaxation of selection operating in them. Dutta (1966), compiling the data of Indian population, found lower prevalence of colour blindness among tribals them advanced Hindus and thus confirmed the Post's hypothesis of relaxed selection. Kapoor et al. (1983) categorized the various studies available on the population of India and observed lower incidence of colour blindness among groups with primitive cultures; similar findings have been earlier reported by Malhotra et al. (1974) and Malhotra (1978a). Kapoor et al. (1983) concluded that the differences in these categories for the incidence of colour blindness indicate selection relaxation in settled communities. Selection pressure tends to eliminate colour blind individuals from primitive populations whereas the habitats of advanced populations provide a protected environment for the colour blind gene. Deka (1977) and Deka et al. (1977) also observed low frequencies of colour blindness among Scheduled tribes, followed by Scheduled castes, whereas the frequency was quite high among the caste groups. Naidu (1978) observed low frequency of colour blindness among primitive tribals of Andhra Pradesh ccompared to advanced non-tribals. Almost similar pattern has also been observed from different zones of India (Bhasin et al., 1994). These observations perfectly fit into the hypothesis proposed by Post (1962). Adam et al. (1967) and Adam (1969, 1985, 1986), however, did not fully support the Post's hypothesis of relaxed selection, yet the possibility of relaxation of selection was not ruled out. They found high frequency of colour vision defects among some of tribal populations of India. Although the high frequency of inbreeding and settled agricultural economy are the reasons given to explain the prevalent high frequency of colour blindness in these populations, the validity of the theory of relaxed selection will have to be substantiated by further studies and more quantitative data. Ability to taste PTC, like colour blindness, also exhibits a strong dimorphism in human population. A number of studies, showing a strong association of this polymorphism with the activity of thyroid (Harris and Kalmus, 1949 b) have revealed the high occurrence of adenomatous goiter among non-tasters (Kitchin et al., 1959; Azevedo et al., 1965). In addition to this, it was found that athyreotic cretins were significantly more likely to be non-tasters than normal controls (Shepard and Gartler, 1960; Frazer, 1961). Non-tasters have even more susceptibility to dental caries (Chung et al., 1964) and diabetes mellitus (Terry, 1950). Reports are also available regarding the association of non-tasters with other diseases (Saldanha, 1956; Beiguelman 1964; Brachtel and Walter, 1974; Mourao and Salzano, 1978), detailed work would

however be needed to advance further comments in this direction.

Needless to say that on the basis of aforesaid parameters, populations can be compared among each other for their survival (adaptive) fitness. Population geneticists have used frequencies of biological traits for studying variation in different human population groups (Vogel and Motusky, 1997; Bhasin and Walter, 2001). It is well known that populations belonging to different races have different values for the above mentioned parameters. On the other hand, those who are living in the same locality (indigenous) and seemingly closer to the each other, may not show differences on these account. Populations that have arisen by fusion will exhibit perceptible differences among themselves, and those arising out of fission mechanism will fail to do so.

The aim of the present work was therefore to study the biodemogenetic characteristics of the four predominant Scheduled Castes (Mendelian populations) of Patna district (Bihar), namely Dusadhs, Chamars, Pasis & Mushars. This will help as to evaluate inter-population variations among them in terms to ascertain their probable mode of origin, by fusion or fission.

PROFILE OF THE POPULATION SELECTED FOR THIS STUDY:

The locality of the present survey, the District of Patna in the State of Bihar (India), is one of the oldest continuously inhabitated regions in the world. The modern city of Patna is situated on the southern bank of the Holy River Ganga. The city is approximately 35 km long and 16-18 km wide. About 15.48 percent (7.30 lakh) of the total population in the district is represented by Scheduled Castes, the second highest population of Scheduled castes at the district level in the State after Gaya. According to the Census Report (2001), the four predominant Scheduled Castes (in term of population) in the district of Patna are Dusadh (2.77 lakh), Chamar (1.99 lakh), Pasi (0.93 lakh) and Musahar (0.93 lakh) which together form more than 90 percent 0f the total Scheduled Caste population.

A preliminary survey was conducted in different villages/urban mohallas in the various Developmental Blocks of Patna district (Bihar) to locate the presence of four dominant Scheduled Castes (the Dusadh, the Chamar, the Pasi and the Musahar communities) residing therein. The villages/mohallas thus identified were numbered and 48 of them (in 17 Blocks) were randomly selected for intensive survey and collection of data on the two parameters of study, the quantification of the reproductive performances of the four predominant Scheduled caste populations as well as the analysis of the prevalence of certain biogenetic (Mendelian) traits in them.

More than 1000 pesons, each of Dusadh and Pasi communities, were surveyed while the number of persons surveyed in each of Chamar and Musahars populations remained limited to 700-800 owing to their shy nature, poor participation and non-cooperation in survey work.

The term “Scheduled castes” stands for the population of such people from among the “Depressed classes” who have been explicitly recognized by the Constitution of India as per Presidential Orders issued under the provisions of Articles 341 of the Constitution.

Ninety percent of the Secheduled Castes are rural based and provide substantial support to Indian agriculture. The occupational structure of the Scheduled Caste work force is, by and large, made up of the following components:

1. Landless agricultural labourers,
2. Cultivators with small holdings,
3. Small commodity in producers or artisans, and
4. Workers in industries related with their traditional crafts (such as leather tanning, shoe making etc.)

Among the total Scheduled Caste population in Bihar (13 million), the Chamars have the highest population (4.09 million). The Dusadh community follows them closely (4.02 million). According to the census, there are 23 such caste groups in Bihar that are considered under the Scheduled Caste category (Census of India, 2001).

Here it becomes necessary to state that if we talk in context of the Education &Socio-economic status of the four talked castes in Patna. “Dusad(s0)” are at the top of ladder among these four while “Mushar(s0” are at the lowest.

TEST FOR ABO BLOOD GROUPS:

Discovery of ABO blood group by Karl Landsteiner (1900) was a milestone in the history of immunohaematology. Very soon a fourth group viz. AB was discovered by Decastello and Sturli (1902). Grouping of human blood into four categories, viz. A, B, AB and O therefore depends upon the presence of A or B or the both blood group antigens or their complete absence in their red blood cells. Landsteiner also initiated the study of the simply inherited polymorphic traits in man on the basis of ABO blood groups. The inheritance of blood group was suggested by Epstein and Ottenberg in 1908. In 1911, Von Dungern and Hirszfeld established the Mendelian Pattern of their inheritance. In 1924, Bernstein determined the mechanism of inheritance of all the four blood

groups of ABO system which were shown to be inherited as Mendelian characters by means of three alleles, i.e., I^A, I^B, and I^O of a single gene. The ABO locus is assigned to the distal end of long arm of human chromosome 9 ($9_q34.1$-$_q34.2$). Out of the three, the alleles I^A and I^B are dominant upon I^O and they themselves show co-dominance upon each other. The three alleles in various combinations form four different phenotypic groups which are A (I^AI^A or I^AI^O), B (I^BI^B or I^B I^O), AB (I^AI^B) and O (I^OI^O).

Existence of difference in the allele frequencies of the ABO blood groups from one population to another was first noted by Hirszfeld and Hirszfeld (1919) and this was followed by many extensive studies for this system on various populations of the world including India.

Methodology

Door-to-door survey was carried out to determine the blood-group frequency among the individuals of all the four populations.

The test, based on haemagglutination reaction, was performed by the process of slide-agglutination method (Bhasin and Chahal, 1996; Dacie and Lewis, 2001) with the help of monoclonal IgM antibodies (SpanClone, Span Diagnostics Ltd., Surat, India). Human RBCs possessing A and/or B antigen will agglutinate with the corresponding antibody (anti-sera).

Two circles were marked (as A and B) on a clean slide where one drop of corresponding anti-serum was placed (i.e., antisera A at circle marked A and antisera B at circle marked B). One drop of fresh blood was placed on each of the marked area after pricking a left hand finger of the subject by a lancet (Amkay Products Pvt. Ltd., Vasai, Maharashtra) sterilized needle. Separate applicator sticks were used to mix blood with antisera and the slide was tilted back and forth for 2 minutes. Agglutination of RBCs with an antiserum indicated the presence of the corresponding antigen. Similarly, absence of agglutination of RBCs with an antiserum indicated the absence of the corresponding antigen. Results were analyzed within 2 minutes, as drying of the reaction mixture at the periphery may be misinterpreted as agglutination. Validity of antisera was checked at interval with known blood groups.

The frequencies of three alleles (I^A, I^B, I^O) were calculated by Hardy-Weinberg principle of genetic equilibrium using Bernstein's correlation (Strickberger, 1985).

Observations made

All the four populations have different patterns of the incidence of various blood groups in them. Among the Pasis, the group 'A' is most prevalent in both the sexes (37.29%). The next most common group in them is 'B' (24.23%) to be followed by 'O' (21.96%) and 'AB' (16.57%). High frequency of group 'A' followed by 'B' has also been reported among the endogenous groups of Sarswats in Western India (Bhatia et al., 1976). Among the Dusadhs, group 'B' is most frequent in both the sexes (34.11%). The next in distribution are groups 'A' (24.73%) and 'O' (21.14%), which are more or less of the same magnitude. The least common group in this population is AB (17.32%). Group 'B' is also frequent among the Sansis, a tribal caste of eastern Punjab (Sindhu et al., 1980). Highest frequency of 'B' group is also reported in a tribal group (Pradhan) of Andhra Predesh (Pingle et al., 1981). Among the Chamars, there is almost similar incidence of groups 'A' and 'AB' (27.00% and 27.14% respectively). Group 'O' and 'B' in their own turn are again almost equal in their distribution (24.00% and 21.86% respectively). Almost similar distribution of group 'O' and 'B' has been reported in the Tibetans of Darjeeling (Singh et al., 1974). Among the Musahars, the group 'O' is most frequent (37.20%) in both sexes. Group 'A' and 'B' come next to it and have almost a similar frequency (24.71% and 23.38% respectively). The group 'AB' is least frequent (14.71%). High frequency of the group 'O' followed by the 'B' group is also evident among the Naga Vamsams of costal Andhra Pradesh (Venkateshwara et al., 1981) Similar results have also been found in some Iraqi populations (Al-Rubeai, 1975). Group 'AB' therefore appears to be comparatively least frequent in almost all the four populations. Low frequency of the 'AB' group is also reported among the Sansis of Punjab (Sindhu et al., 1980), in some Iraqi populations (Al-Rubeai et al., 1975) as well as in some Japanese populations (Fujita et al., 1978). The incidence of the four blood groups in the two sexes of each of the four populations is almost equal. The χ^2 value between the two sexes calculated for this porpose (at 5% level of probability and 3 degree of freedom) appears to be quite insignificant (2.67 among the Dusadhs, 4.24 among the Chamars, 2.80 among the Pasis and 2.42 among the Musahars). The frequency of I^O allele alone is more than 60% among the Musahars and more than 45% among the remaining three populations. The I^B allele is approximately 30% among the Dusadhs and Chamars, and more than 20% among the Pasis and the Musahars. The I^A allele frequency is higher among the Pasis (30%) and 17 to 22% among the Dusadhs, Chamars and Musahars. These differences in the gene frequencies have also been found among Kanet (Scheduled Tribes) and Koli (Scheduled Caste) of Kinnar district of Himachal Pradesh which clearly indicate biological distinct in the local populations (Papiha et al., 1980). On the basis of this allele frequency, the expected number of the individuals of the four blood groups was calculated using Hardy-Weinberg equations, and compared with the observed values obtained during the survey. The χ^2- values obtained during

such comparison were indicative of significant differences in each of the four populations. It means that none of the populations is the state of genetic equilibrium for this trait and so the individuals of different blood groups can be said to different survival rates.

The four populations were thereafter compared among themselves for the incidence of the four blood groups in them. It was found that all the four populations differed significantly with each other on this account. Significant differences between populations have been reported among nine endogamous groups of Kumbhars from Maharastra (Dutta et al., 1976). Nentsi tribal populations from North-Western Siberia also differ from each other in the distribution of ABO blood group system (Sukernik et al., 1979). Nevertheless, significant differences within a caste spatially separated from each other have been found as reported among Kaibartas of upper and lower Assam (Sen Gupta and Sarthak, 1979).

TEST FOR Rh-BLOOD GROUP:

On the basis of the presence or absence of Rh antigen, the whole human population has also been divided into Rh^{+ve} and Rh^{-ve} groups. The first human blood found to lack all known antigens, Rh-null was found by Vos et al. (1961). Initially the genetic mechanism of the Rh-system seemed to be governed by a single pair of alleles, R and r, as postulated to account for the difference between Rh^{+ve} and Rh^{-ve} individuals. Wiener (1970) developed a hypothesis based upon a series of multiple alleles. According to Race and Fisher (1948), three pairs of gene are involved in the production of Rh antigen that are not allele but are located near each other on the same chromosome. The dominant form of these genes is represented by C, D and E, and its recessive form by c, d and e. A person is classified Rh^{+ve} on the basis of the presence of any of the three dominant alleles, and the presence of all the three recessive alleles make the person Rh^{-ve}. Later, Rosenfield et al. (1973) developed a new Rh notation system to be represented by only two alleles, D and d.

Methodology

A test for Rh (D) incompatibility was performed by the process of slide agglutination method with the help of SpanClone anti-D (Rh_o) monoclonal IgM antisera (Span Diagnostics Ltd., Surat, India). One drop of anti-D was dispensed on a clean dry slide, and a drop of blood was then added to it, mixed well with applicator stick and the slide was tilted back and forth for 2 minutes. If agglutination resulted, D antigen was present on the test RBCs and the blood was assigned $Rh^{(+ve)}$. No agglutination with anti-D antiserum indicated the absence of D-antigen, the blood group being $Rh^{(-)}$. Agglutination of erythrocytes therefore indicated incompatibility, whereas even distribution of erythrocytes indicated no reaction. Frequencies of dominant (D) and recessive (d) alleles were calculated from the number of phenotypes scored.

Observations made

The incidence of Rh^{-ve} subjects in all the four populations is slightly higher than the range known for Indian populations. It is comparatively higher among the Dusadhs (5.62%) with decreasing magnitude among the Chamars (5.29%), the Musahars (4.41%) and the Pasis (3.71%). Though slight inter-sex variations in the frequency of Rh^{-ve} persons were observed within each population except Musahars, they were never statistically significant. Such high value is not unique for these populations alone, because Pingle et al., (1981) have found that in Rajgonds, a tribal group of Andhra Pradesh, it is 6.18%, and as high as 10 to 17%among the Sarswat Brahmins in Western India (Bhatia et al., 1976). High value of Rh^{-ve} subjects is not only restricted in India, rather it is found in populations of other countries too; 8.31% in some Iraqi populations (Al-Rubeai, 1975), 7.37% in some Japnease population (Fujita et al., 1978) and 4.5% in Basrah, Iraq (Islam. Sukat and Islam Mohamad Khan, 1978). The frequency of dominant (D) and recessive (d) alleles shows a similar pattern of their incidence in all the four popualations. Consequently, the expected frequency of individuals homozygous (DD) for the dominant allele is very high to be followed by heterozygous recessive (dd) ones.

All the four populations, except between the Pasis and the Dusashs, other in the incidence of this trait among themselves.

TEST FOR COLOUR BLINDNESS:

Colour-blindness is an absolute X-chromosome linked trait (X_q28) in which a person is unable to perceive one of the primary colours, specially the red and the green ones. A colour blind male thus has a single recessive allele (rg) in his X-chromosome. For a female to be colourblind, it is essential that she possesses the recessive allele on her both X-chromosomes, which is possible only when her mother is either a colour blind or its carrier (heterozygous) but the father is a colour blind. As the latter eventually is much rare, the females are hardy colour blind. This colour-vision anomaly is widely used as a genetic marker in the study of human variations. In the present work, the subjects for the survey were males only, partly because of the above mentioned reason, and partly due to their women being mostly illiterate and shy in nature in being put to such examination. Clement's (1930) work is one of the earliest accounts available for the population difference in colour blindness. Various Indian populations have been surveyed to know the frequency of this X-

linked trait (Shastry, 1974; Malhotra, 1974, 1978; Mukherjee et al., 1979; Agrawal et al., 1981; Bhasin et al., 1992, 1994).

Methodology

As most of the subjects were illiterate, six pseudo isochromatic (Ishihara) colour plates (No. 26, 28, 30, 32, 34 and 36) were used for identifying the colour blind persons (Photographic plate's 4a-c). The subjects were asked to trace the winding lines within 10 seconds per plate.

Observations made

The over-all frequency of colour blind male is unexpectedly high in all the four populations. It is as high as 4.26% among the Dusadhs and 2.99% among the Pasis, but comparatively less abundant among the Chamars (2.21%) and the Musahars (2.39%).

The four populations were thereafter compared statistically among themselves for the incidence of colour blindness in them and it was found that only the Dusadhs and the Chamars differ from each other.

TEST FOR PTC TASTING:

Fox (1931, 1932) was first to observe the dual taste perception of human beings to phenylthio-carbamide (phenyl thiourea), abbreviated as PTC. Persons perceiving bitter taste of this chemical are called tasters, while those without any distinct taste are called non-tasters. Genetically, the difference between tasters and non-tasters resides in a single gene difference with two alleles 'T' and 't' (Brandtzaeg, 1958). The allele 'T' (for tasting) is dominant over allele 't' (for non-tasting). Individuals with genotype 'tt' are non-testers and the presence of a single 'T' in the (T-) genotype makes the person taster. The frequency of non-tasters varies from population to population (Saldhana and Nacrur, 1963; Alkasu et al., 1974; Sukla and Tayagi, 1975). Many investigators (Sharma, 1959; Sanghvi and Khanolkar, 1961; Seth, 1962; Mahapatra and Das, 1968; Kalla, 1971; Srivastava, 1974; Than-Than Sint and Mya-Tu, 1974; Deka and Pattojoshe, 1975; Barnicot and Wood Burn, 1975; Al-Rubeai, 1975; Ibraimov et al., 1977; Debnath and Sen, 1980; Deb and Sukla, 1981; De Stefano, 1982;

Agrawal and Bhalla, 1981) have studied the distribution of this trait in different populations of India and abroad. However, little data are available for this character from Bihari populations in general and scheduled castes in particular (Basu, 1969; Das and Sharma P., 1976; Ansari and Sinha, 1978; Chakarbarti and Mehrotra, 1980; Srivastava, 1985; Singh et al., 1999).

Methodology

The sorting technique with serial dilutions of Harris and Kalmus (1949) was used because of its superiority in discerning the threshold of the individual with near perception. A stock solution containing 0.13% (W/V) of this chemical was made in tap water, and the solution was named number 1. The next solution (number 2) was prepared by diluting the solution number 1 to half of its strength. Successive dilution to half the strength of the previous ones was continued until the solution number 14 was obtained. Thus the number 1 was the strongest solution and the number 14 was the most diluted one.

The test was started from the diluted concentration (number 14). The subjects were called one by one, and one drop of the solution was put on his/her tongue. Those who perceived a definite bitter taste at any concentration of the solution were grouped as tasters and this gave a value for the threshold. Those who did not perceive the taste even at the strongest solution were called non-tasters. Thus the threshold of an individual is that when she/he perceives a distinct bitter taste at any solution number.

Observations made

The distribution of PTC threshold among the Pasis, the Dusadhs and the Chamars was bimodal and continuous. Such bimodality has been reported in different Indian and foreign populations as well (Hartmann, 1939; Falconer, 1947; Harris and Calums, 1949; Mohr, 1951; Ibrainov, 1977; Ansari and Sinha, 1978;). The antimode in them lies between solutions numbered 5 and 6. Thus all the individuals of these populations who fell in the tasting limit between solutions numbered 5 to 14 were counted as tasters. The rest of the subjects including those of the zero group were taken to be no-tasters or taste blind (Harris and Kalmus, 1949).

The Musahars show a different pattern, here no bimodal distribution was observed. Rather, the nature of curve indicates a normal distribution of the tasters. The mode class was solution number 10. Such loss of bimodality in this population is rather an uncommon feature, not in context to various populations of India and abroad, but also those living in Bihar. Even the tribal populations show a bimodality (Das Sharma, 1976; Goud and Rao, 1979). It can therefore be said that the Musahar population differ not only from the general populations but even from the tribal ones on this account. Out of four populations, the tasetes are more common among the females of the Pasis, the Chamars and the Musahars than their males. The Dusadhs are, however, an exception where the frequency of male tasters (71.90%) is higher than that of their females (66.12%). When the data for both the sexes were pooled together, it was found

that the tasters are more common among the Chamars (78.86%) and the Pasis (73.09%) to be followed by Dusadhs (70.00%) and the Musahars (67.79%).

CONCLUSION:

Based on the above collected data & observations made we conclude that

1. All the populations show different patterns of the incidence of ABO blood groups in them. The Group 'A' is the most prevalent (37.22%) among the Pasis in both the sexes. Group 'B' is the most frequent (34.11%) in both the sexes of Dusadhs. Among the Chamars, there is more or less a similar incidence of group 'A' and 'AB' (each 27%). Group 'O' is most abundant among the Musahars (37.20%).

2. The frequency of IO allele alone is more than 60% among the Musahars and more than 45% among the remaining three populations. The IB¬ alleale is approximately 30% among the Dusadhs and the Chamars, and is more than 20% among the Pasis and the Musahars. The frequency of IA allele is higher among the Pasis (30%) and 17% to 23% among the remaining three populations.

3. The frequency of Rh-negative subjects is comparatively higher in all the populations, as it varies from 3.71% (among the Pasis) to 5.62% (among the Dusadhs).

4. The frequency of colour-blind males is unexpectedly high in all the populations, ranging from 2.21% among the Chamars to 4.26% among the Dusadhs.

5. A normal distribution of tasters occurs in all the four populations. The tasters are more common among the females of the Pasis, the Chamars and the Musahars than their males. The Dusadhs are, however, an exception where the frequency of male tasters (71.90%) is higher than that of their females (62.12%).

On the basis of incidence of these genetic traits, G^2 of Sanghvi (1953) was calculated to quantify the differences between pairs of population to estimate genetic distance between/among different populations. The value obtained suggests that the four populations are almost equidistant (G^2 = 7.97 to 12.50) from each other, and appear at four vertices of a quadri-lateral structure. Their inter-populational differences are so large that they failed to form any cluster.

Figure 1 illustrates the Frequency of ABO Blood groups, while Frequency (%) of ABO blood group allele (I^A, I^B and I^O) is demonstrated by Figure 2 and Frequency (%) distribution of subjects of $Rh^{(-ve)}$ Blood group is shown by Figure 3. Figure 4 exhibits the frequency (%) of D(p) and d (q) allels in the populations. Whereas Frequency (%) of colour blind males in different Populations is demonstrated by Figure 5 and Frequency (%) of tasters in different populations is illustrated by Figure 6.

All the talked above, four Scheduled Caste populations are completely different from each other. They have perhaps neither evolved by fusion or by fission in the near past, and hence their inclusion in the list of Scheduled Castes has no any biological basis.

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GRAPHS

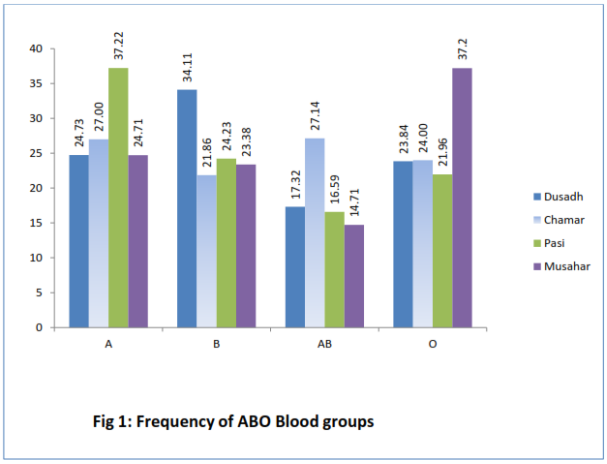

Fig 1: Frequency of ABO Blood groups

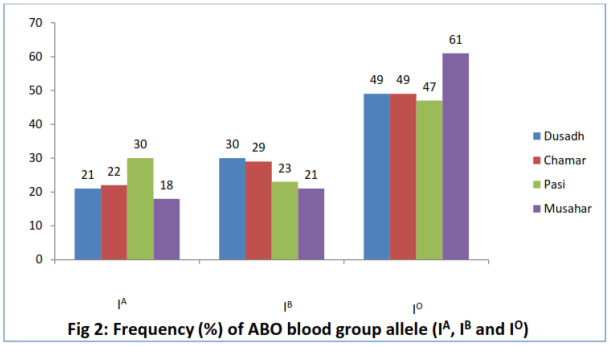

Fig 2: Frequency (%) of ABO blood group allele (I^A, I^B and I^O)

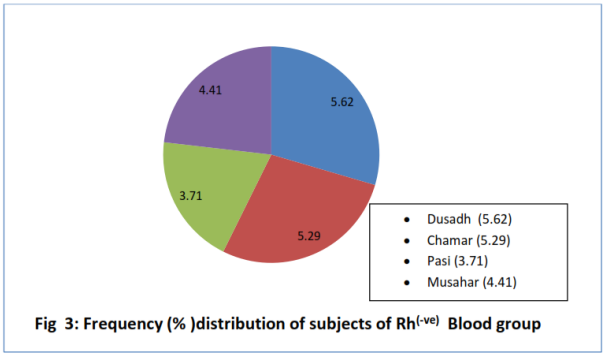

Fig 3: Frequency (%)distribution of subjects of Rh(-ve) Blood group

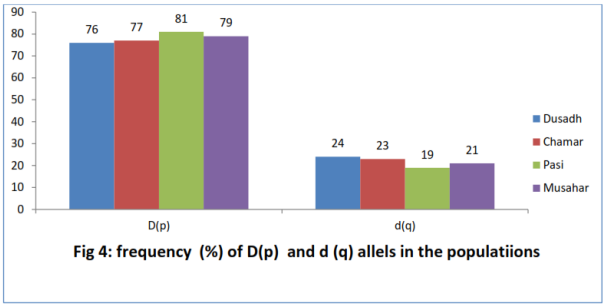

Fig 4: frequency (%) of D(p) and d (q) allels in the populatiions

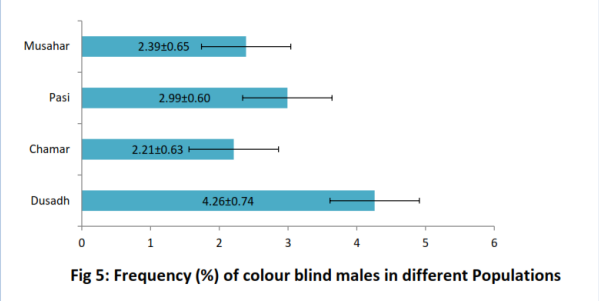

Fig 5: Frequency (%) of colour blind males in different Populations

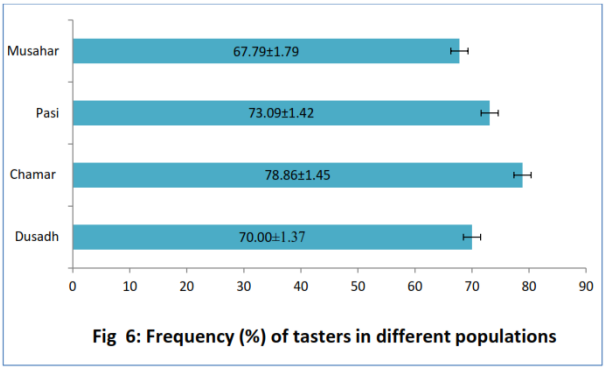

Fig 6: Frequency (%) of tasters in different populations

REFERENCES:

1. Malhotra KC (1984). Population Structure among the Dhanger caste-cluster of Maharashtra, India. In: The People of South Asia. Lukas, J. R. (Ed.), New York: NY Plenum Press.

2. Hunter WW (1897). A Brief History of the Indian People. London: Clarendon Press.

3. Karve I. (1961). Hindu Society: An Interpretation. Deccan College, Poona.

4. Harris, H. and Kalmus, H. (1949a). Ann. Eugen., 15: pp. 124 – 131.

5. Ishihara, S. (1959). Test for Colour blindness. Kanichara Shuppan Co., Ltd., Tokyo.

6. Mourant, A. E., Kopec, A. C. and Domaniewska Sobezak, K. (1976). The Distribution of Human Blood Groups and Other Polymorphisms. 2nd Ed. Oxford University Press, Oxford.

7. Nei M. Proc. Natl. Acad. Sci. USA. 1973, 70: pp. 3321-23.

8. Nei M. Am. Natur., 1972, 196 (149): pp. 283–292.

9. Roy Choudhary AK. (1983). Genetic polymorphisms in human populations in India. In: Satyavati GS ed. People of India. Some Genetical Aspects, New Delhi, ICMR, pp. 1–30.

10. Mandal, PK (1992). J. Hum. Ecol., 3: pp. 243–244.

11. Siddhu S. J. (1994). Hum. Ecol., 5: pp. 145–146.

12. Yadav, JS and Gupta MM (1992). J. Hum. Ecol., 3: pp. 147–148.

13. Koley, S. and Srivastava PK (1992). J. Hum. Ecol., 3: pp. 239–242.

14. Bhasin MK and Khanna A. (1992). J. Hum. Ecol., 3: pp. 193-219

15. Singh MP and Sinha SP (1988). Bio. Bull. India, 10: pp. 105–111.

16. Pandey BN, Vasulu TS, Das PKL and Pankaj PK (2000). The Mankind, 40 (4): pp. 355–380

17. Pandey BN, Das PKL, Hussain S, Anwer MR and Jha AK (2003). Anthrop. Anz., 61(1): pp. 269–274

18. Pandey BN, Jahangeer M, Mishra A Kumar D and Thakur AK (2013). Nat. J. of Life Sci., 10 (1): 77–81.

19. Sharma PD (1976). J. Ind. Anthropol. Soc., 11: pp. 121–124.

20. Pandey BN, Das PKL and Jha AK. (1993a). J. Hum. Ecol., 4: pp. 291–294

21. Stein L.P. and Rowe B.M. (1978). Physical Anthropology.

22. Shah, A., Hussain, R. Fareed, M. and Afzal, M. (2013). Iran. J. Public Health. 42 (1): pp. 16–24.

23. Walter H., Danker-Hopfe H. and Chahal SMS (1993). J. Hum. Ecol., 4: pp. 15–21.

24. Balakrishna A. and Satanaryana M. (1994). J. Hum. Ecol., 1994, (2): pp. 135–136.

25. Das SR (1958). Ann. Hum. Genet., 20: pp. 334 –343.

26. Devi KS and Veerraju P. (1990). J. Hum. Ecol., 1 (3): pp. 319–320.

27. Naidu AE and Veerraju P. (1978). Ann, Hum.Biol., 5: pp. 159–164

28. Naidu JM, Yasmin and Sachi Devi S. (1990). Further data on ABO and Rhesus blood groups among Andhra populations. J. Hum. Ecol., 1: pp. 53–54

29. Ara G. Yasir H Siddique and Afzal M. (2011). Advances in Biol. Res., 5 (5): pp. 260–266.

30. Shah, A., Hussain, R. Fareed, M. and Afzal, M. (2013). Iran. J. Public Health. 42 (1): pp. 16–24.

31. Hussain R, Shah A, Fareed M and Afzal M. (2013). Journal of Anthropol., 9 (1): pp. 15–25

32. Bhasin, M. K., Walter, H. and Danker-Hofe, H. (1994). People of India. An Investigation of Biological variability in Ecological, Geographical, Ethano-Economics and Linguistic Groups. Kamla Raj Enterprises, Delhi.

33. Mazumdar DN (1965). Races and Culture of India. Asia Publishing House, New Delhi, 4th Edition.

34. Nei M. (1977). Ann. Hum. Genet., Lond., 41: pp. 225-33.

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