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Genetics

ANALYSIS OF MORPHOGENETIC TRAITS AMONG VARIOUS ENDOGAMOUS HUMAN POPULATION GROUPS

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ABSTRACT Genetic variation in human is caused by many factors such as natural selection, migration, temporal variation, gene flow and genetic drift. Among the various communities of Munger district in particular the 'Saundik Vaishya' community claim our attention. The community has been preferred owing to the existence of various endogamous groups within it. These groups are basically business oriented and have played important role in the social uplift of the district. A variety of morphogenetic traits are observed among the population in the district. It is intended to study nine different traits in order to determine the frequency of the phenotype. Some characters though, dominant were observed to be present in less number of people in the sample, such as dimples, manus mid phalangeal hair, tongue rolling and tongue folding. The frequency distribution of various traits among the studied population shows homogenous distribution. In future, it would be interesting to study whether or not the inheritance of these traits is dependent on one another. Overall, the frequencies of these traits were according to Indian trends.

KEYWORDS : Morphogenetic traits, Genetic variation, Endogamous, Homozygous, Hypertrichosis

INTRODUCTION

Every human population has a unique structure which can be studied in terms of its distribution, size and sex composition. Populations of the same racial origin living in different geographical regions appear to show variation in biological characters. Genetic similarity between populations shows the common origin of the gene pool. The genetic heterogeneity between populations indicates the diversity or isolation by some unknown barriers (*Pandey et al., 2013*). Genetic mechanisms on morphogenetic traits are still not clearly understood. It is seen to occur with variable frequency in different populations. Thus, it is useful in evaluating and analyzing the evolutionary forces and classification (*Das and Sengupta, 2003*). The human genetic variations play an important role in bringing about the diversity in human population and contribute to the dynamics of evolution of human.

Every population is characterised by a set of gene frequency. Thus, it is the gene frequency which is used as a key for studying the genetics of any human population group. Genetic variability is the common feature of human beings. The existence of genetic variation in human is caused by many factors along with selection, migration, temporal variation, gene flow and genetic drift (*Bhasin et al., 1992*). The importance of these factors in understanding genetic variation has been described earlier in details (*Vogel and Motulsky, 1986*). Morphogenetic variation in human population may be temporal or spatial. In studying spatial variation, environment deserves special consideration in which a population lives.

Studies among Indian populations have shown wide genetic diversity. It is characterized by gradients of gene frequencies of uneven distribution of very high or low frequencies of characters scattered in populations (*Malhotra and Vasulu, 1993; Majumdar and Mukharjee, 1993*). During the last four decades, numerous studies have been carried out on the genetic composition of various endogamous population groups in India like-Rajputs (*Mukhopadhyay and Kshastriya 2004; Pattanayak et al. 2006; Meitei and Kshatriya 2010; Warghat et al. 2011*), Scheduled Caste population (*Patni and Yadav, 2003; Sidhu et al. 2003; Pandey et al. 2012, 2013*), OBC (P*rabhakar et al. 2005; Reddy and Reddy, 2005; Dore Raj and Reddy 2010*) and Muslim population (*Ara et al. 2008; Rai and Kumar, 2010; Pandey et al. 2013*).

Among the various communities of Munger district in particular the 'Saundik' Vaishya community claim our attention. The Saundik community of Munger district has been picked up as a case study. The community has been preferred owing to the existence of various endogamous groups within it. Saundik Vaishya comprises many endogamous populations of which the four - Dhaneshwar, Kalal, Jaiswal & Biahut Kalwar are considered here relevant for our studies. These groups are basically business oriented and have played important role in the social uplift of the district.

The present paper is to represent the temporal changes in genetic traits (Hypertrichosis, Earlobe, Widow's Peak, Dimple, Number of digits, Relative length of Index finger, Manus mid phalangeal hair, Tongue rolling and Tongue folding) during the last four decades, if any, between four endogamous groups of Saundik Vaishya community of Munger district in Bihar. Since the studies on these communities have been done long time back (*Sinha, K. K., 1982*). Hence, we want to update the data in order to observe the temporal changes (if any) that, might have occurred over a long period of time difference.

MATERIALS AND METHODS

The study was done on Saundik Vaishya community of Munger district (Bihar), India. To investigate the temporal changes in biogenetical status of Saundik Vaishya community, a survey was conducted over a period of nine months. A total of 876 non related individuals of both gender were randomly selected from four sub castes belonging to Saundik Vaishya viz. Dhaneshwar (234), Kalal (222), Jaiswal (210) and Biahut Kalwar (B. Kalwar) (210) inhabiting different villages/cities of Munger district (Bihar). They formed the experimental subjects. Standard methodology was adopted to collect data on various parameters. The following nine parameters have been studied:

a) Hypertrichosis
b) Earlobe
c) Widow's Peak
d) Dimples
e) Number of digits
f) Relative length of Ring & Index finger
g) Manus mid phalangeal hair
h) Tongue rolling
i) Tongue folding

In no case two persons belonging to the same family were subjected to test the below mentioned Mendelian traits. The consent of the parents and guardians of the children were obtained. The permission of the community leaders and school authority was obtained before the commencement of the study.

1) Hypertrichosis: For Hypertrichosis, unrelated males were observed. The presence or absence of hair on external ear pinna was recorded. Hypertrichosis is a Y-linked trait (*Gates, 1960; Dronamraju, 1960*). Occurrence of a large number of males with true hairs, support the Y-linked hypothesis for this trait. Hypertrichosis is seen rather frequently in Indian males, but also common in Caucasians, Australian and Japanese. A large number of studies have been carried out to show the genetics and variability in different population.

2) Earlobe: Human ear pinna due to its minute variation in form and shape has attracted various investigators of anthrop-genetic studies. It may be pendulous (free) or non-pendulous (attached) and Pendulous is dominant over non-pendulous (*Hilden, 1922*). Though the mechanism of inheritance of ear lobe does not seem to follow simple Mendelian pattern, it has been listed as a dominant trait (*Mc Kusick, 1966*). A

recessive gene is responsible for the attachment of the ear lobes to the side of the head so that the lobe does not hang freely.

3) Widow's peak: The trait "Widow's Peak" is characterised by the presence of a pointed V-shaped patterns in the hairline in the center of the forehead. The hairline drops downward in the center of the forehead. It is very distinguishable somatoscopic trait. The allele for this trait is dominant over straight or curved hairline (*Winchester, 1979*). Subjects, randomly selected, were asked to preen their hair by a comb from front to backward. Children of age group 13 to 19 were preferred for this purpose, because baldness in adult may lead to error.

4) Dimples: In certain individuals, fat pads in the cheeks hang downward due to their low placement and thus form a depression called dimple. Dimples in the cheek are a dominant trait. The dimples may be more than one per cheek or a dimple may appear in one side of the cheek and not in the other cheek. Dimples (DD or Dd) are dominant over no dimples (dd) (*Winchester, 1979*).

5) Number of digits: Five - finger condition is dominant over six - finger condition.

6) Relative length of Ring & Index finger: The index (2^{nd}) and the ring (4^{th}) fingers are in between thumb and little fingers and are separated by the middle (3^{rd}) finger. The finger present in the middle (3^{rd} finger) is the largest one. The index and the ring fingers vary in their relative lengths.

7) Manus mid phalangeal hair: It is the presence of hair on the middle segment of the fingers, which is dominant (HH) over hairless middle digits or lack of hair (hh). It is one of the most interesting as well as easily studied traits.

8) Tongue rolling: Some people, when their tongue extend, are able to roll it into a U-shaped configuration. A dominant gene seems to be responsible for this ability (*Sturevant, 1940; Hsu, 1948; Gahres, 1952)*. The ability to roll the tongue into a U-shaped trough is dominant over lack of this rolling ability.

9) Tongue folding: This character, independent of tongue rolling and generally referred to as tongue folding, is said to be genetically controlled (Liu and Hsu, 1949), and is considered as a dominant trait (*Winchester, 1979*).

The Saundik Vaishya community of Munger district was taken as the sample. The subjects were given a questionnaire sheet and a total of nine traits were taken into consideration in this study. The items of the questionnaire sheet are given in the Appendix – 1.

OBSERVATION

The data collected were analysed in Table-1. Interpretation of the data is done on the basis of our observations. It was observed that the frequency distribution of various traits among the studied population shows the homogenous distribution. Overall, frequencies of these traits were according to Indian trends.

Table – 1: Frequency of different morphogenetic traits among four endogamous population of Saundik Vaishya community of Munger district (Bihar)

Sr. No.	Morphogenetic Traits	Features	POPULATIONS			
			Dhaneshwar (234)	Kalal (222)	Jaiswal (210)	B. Kalwar (210)
			Frequency	Frequency	Frequency	Frequency
01	Hypertrichosis	Present	54.70%	59.90%	40%	44.76%
		Absent	45.30%	40.10%	60%	55.24%
02	Earlobe	Attached	28.21%	36.94%	25.24%	30%
		Free	71.79%	63.06%	74.76%	70%
03	Widow's Peak	Present	51.70%	50.90%	55.72%	37.61%
		Absent	48.30%	49.10%	44.28%	62.39%
04	Dimples	Present	10.68%	15.76%	14.76%	16.66%
		Absent	89.32%	84.24%	85.24%	83.34%
05	No. of digits	Five	99.57%	100%	100%	100%
		Six	0.43%	--------	--------	-------
06	Relative length of ring – index finger	Long ring	55.98%	54.95%	57.61%	51.90%
		long index	39.74%	38.73%	36.66%	41.90%
		Equal	4.27%	6.30%	5.71%	6.19%
07	Manus mid phalangeal hair	Present	36.33%	34.24%	37.15%	39.05%
		Absent	63.67%	65.76%	62.85%	60.95%
08	Tongue rolling	Roller	44.87%	39.63%	42.85%	41.90%
		Non-roller	55.13%	60.37%	57.15%	58.10%
09	Tongue folding	Folder	29.91%	32.88%	28.57%	26.66%
		Non-folder	70.09%	67.12%	71.43%	73.34%

DISCUSSION

There are a large number of morphogenetic traits in the behaviour and morphology of which the human species living under varying ecological zones has been found to demonstrate variation of genetic significance. In some phenotypic characters, the number of people possessing the recessive phenotype were more in number than the dominant, such as dimples, manus mid phalangeal hair, tongue rolling, tongue folding. For some characters, the numbers of people possessing the dominant phenotype were more than the recessive, such as number of digits, earlobes. For some characters, the recessive and dominant phenotypic expression was approximately same as with widow's peak in the case of Dhaneshwar and Kalal (Table-1).

Among the morphogenetic traits studied in the present investigation, the highest order of the frequency of traits is as follows: Hypertrichosis (59.90%) among Kalal, free earlobes (74.76%) among Jaiswal, absence of widow's peak (62.39%) among Biahut Kalwar, lack of dimples (89.32%) among Dhaneshwar, lack of manus mid phalangeal hair (65.76%) among Kalal, tongue non-roller (60.37%) among Kalal and tongue non-folder (73.34%) among Biahut Kalwar (Table-1).

Although tongue rolling and tongue folding are dominant traits but in the present study, the frequency of tongue rolling was found to be in the range of 39.63% among Kalal to 44.87% among Dhaneshwar, while that of tongue folding was in the range of 26.66% among Biahut Kalwar to 32.88% among Kalal (Table-1). The frequencies of tongue roller were in range of 40.67% to 53.55% among various endogamous population groups of Bhagalpur (*Sinha, 1982*). *Shah et al*. (2012) and *Das et al*. (1985) have reported higher frequency of tongue rolling in Muslim of Manipur and Assam respectively. Higher frequency of tongue rollers in Muslim community might be due to consanguinity.

In all the four populations studied, it was observed that the relative length of ring and index fingers are in same range in all the subjects. The frequency of longer ring finger ranges 51.90% (Biahut Kalwar) to 57.61% (Jaiswal). The frequency of longer index finger ranges from 36.66% (Jaiswal) to 41.90% (Biahut Kalwar).The frequency of equal ring and index finger are 4.27% among Dhaneshwar, 5.71% among Jaiswal, 6.19% among Biahut Kalwar and 6.30% among Kalal (Table-1). Frequency of subjects showing relative lengths of index and ring fingers are in close proximity with other investigators (*Sinha, 1982*).

Hypertrichosis is a Y-linked trait (*Gates, 1960; Dronamraju, 1960*). Occurrence of a large number of males with true hairs, support the Y-linked hypothesis for this trait. Hypertrichosis is seen rather frequently in Indian males, but also common in Caucasians, Australian and

Japanese. The frequency of Hypertrichosis was highest among Kalal (59.90%) and least among Biahut Kalwar (44.76%).

The frequency of subjects having attached earlobes varies from one population to another. *Kalia and Gupta* (1978) has reported highest incidence of free earlobes (73.84%) among Punjabis. The frequency of free earlobes was in the range of 56% - 74% in five endogamous groups of Haryana (Yadav et al., 2000). *Chadha and Sandhu* (2013) have reported the frequency of free earlobes 63.66% and 53.33% in Mahasha and Bhagat of Jammu and Kashmir respectively. *Sinha* (1982) has reported the frequency of attached earlobes (29-34%) and hence the frequency of free earlobes was approximately 70%. During our investigation, we observed that the frequency of free earlobes among Saundik Vaishya community of Munger district (Bihar) are in range (Table-1) of 63.06% (Kalal) – 74.76% (Jaiswal). Our findings support the result of *Sinha* (1982).

The data obtained reveal that the traits are fairly distributed among all the populations. Our data are in conformity with those reported by former investigators (*Tiwari and Bhasin*, 1967; *Ansari*, 1980; *Sinha*, 1982; *Pandey et al*., 2013; *Tangpu et al*., 2018).

CONCLUSION

The current study presents the frequencies of Hypertrichosis, Earlobe, Widow's Peak, Dimples, Number of digits, Relative length of Ring & Index finger, Manus mid phalangeal hair, Tongue rolling and Tongue folding among four endogamous populations groups of Saundik Vaishya community of Munger district (Bihar). The frequencies of these traits more or less follow Indian trends. Our data with some more characters to be studied in future can throw light on the origin and evolution of the population under study.

The study that has been done in our paper on human genetics has a good scope in further studies related to inheritance of traits. Also future in depth studies is needed to show how the inheritance of different traits might be interrelated or dependent on one another. We conclude from our data that, 40 years of time span is not enough to cause significant changes in morphogenetic traits in human population. Our results are in conformity with those reported by *Sinha, KK* (1982).

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Conflict of interest: The authors declare that they have no conflict of interest.

Ethical approval: All procedure performed in this study on human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later ethical approval.

Informed consent: Informed consent was obtained from all individual participants included in the study.

APPENDIX – 1

Questionnaire Sheet

Please provide your response to each items included in the Questionnaire Sheet. Your response will be kept confidential and used for the academic research purpose only.

Name:	Sex:
Age:	caste:
Parameters	Remarks
1. Hypertrichosis (hair on ear pinna or not):	Present/Absent
2. Earlobe (attached or free):	Attached/Free
3. Widow's Peak (V-shaped dropped hairline):	Present/Absent
4. Dimples (depression on cheek):	Present/Absent
5. Number of digits (no. of fingers in hands):	Five/Six
6. Relative length of Ring & Index finger (longer finger):	_____
7. Manus mid phalangeal hair (mid digital hair on fingers):	Present/Absent
8. Tongue rolling:	Roller/Non-roller
9. Tongue folding:	Folder/Non-folder

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