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Study of Prevalence and association of some morphogenetic traits expression with the gender, specific to North Maharashtra region, Dist. Jalgaon, MS, India

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ABSTRACT

Morphological traits are the physical characteristics of the individuals developed by the gene and their interaction. Nine morphogenetic traits include Earlobe attachment, Dimples, Rolling of the tongue, Chin, Hitchhiker's thumb, Handedness, Widow's peak, Crossing of the arm, and Hair nature were included in the study. Dominant and recessive traits are mentioned based on the literature review. Total 422 samples of students between the ages of 18-30 are randomly selected from the Jalgaon region. The Chi-square test of independent association is performed at 0.05 significance level for the evaluation of the association of morphogenetic trait expression with gender. The study's findings can be used in anthropological and medical-legal research.

Keywords: Morphogenetic traits, Phenotype, Prevalence, gender association

INTRODUCTION

Genetic variation leads to morphological variation formed due to mutation and various biological processes. The variation survived by the random, chance, natural selection, migration, and organization of ancestors (Cavalli *et al.* 1994). Little variation in a gene can also lead to a high impact on human phenotype (Chakravarti, 1999). Various sequencing techniques like single nucleotide polymorphism, micro and mini satellites, deletions, and insertion of nucleotides are used to detect the variations at the genomic level (Chakravarti, 1999). But at the same time, it is also important to study the expression pattern at the phenotypic level. The morphological study is useful to get a track record of the genetic variation that occurred in a specific population.

Morphological traits are the external appearance or the physical characteristics of the individuals. A trait is a distinct variant of an organism that is an observable character of an individual (Munir, *et al.* 2015). Although the mechanism of genetic control is not confirmed more research is needed in this field but phenotypic has importance in the field of evolution, taxonomy, and human diversity (Das and Sengupta, 2013).

A genetic variation in the traits of the human being shows varieties of morphogenetic characters among the population (Anna, 1976). The pattern of inheritance explains how alleles work together to produce traits (Rostand and Terty, 1964). There is a misconception about the dominant and recessive traits in the population that the dominant character will reduce the recessive character over time (Usha, *et al.* 2016). The similarity in morphological traits shows the common origin of the genes.

The genetic diversity across different populations reveals their diversity or isolation due to unidentified barriers (Pandey *et al.* 2013). The survey-based method is useful when it comes to knowing the association between genetics and diseases, and also futuristic for disease-prone DNA identification, and relation with the morphogenetic trait (Cardon and Bell, 2001). This study attempts the study prevalence of some morphogenetic traits in the study area.

Ordu *et al.* (2014) studied the inheritance pattern of earlobe attachment in the Nigerian population the results show a simple dominant recessive pattern. The natural process of aging is one of the affecting forces of earlobe elongation that influences earlobe distortion about 30 to 35% increase in length of the earlobe in the age group of 20-40 years subject (Azaria *et al.* 2003).

Kewal, *et al.* (2019) studied the individualistic character of the ear in the population and gives its application in the personal identification and forensic approach. Dimple is the morphological trait that shows an autosomal dominant pattern having a phenotypic character of indentation on the human face (Kosif, 2015). The genetics of tongue-rolling has not yet been proven beyond a reasonable doubt, but the loci controlling this trait may also affect variations in personality (Azimi-Garakani *et al.* 2008).

Smooth and cleft chin are two variants in the chin trait, where the cleft chin is controlled by the dominant genotype and recessive for the smooth chin (McKusick, 2013). A study by Usha *et al.* 2016 shows less dominant character i.e. cleft chin in males with the same dominancy in females. The thumb shows two types of morphology straight or curved (Hitchhiker's thumb). A straight thumb shows a straight line that may contain a slight arch when observed from the side. A curved thumb is dominant over a straight thumb (Usha, *et al.* 2016). The majority of the person in a population shows right-handedness which is a dominant trait and left-handedness shows less which is recessive (Usha, *et al.* 2016). Widow's peak also called mid-digital hairline is due to the expression of the gene for the hairline. This gene has two alleles, one for widow's peak which is dominant, and the straight-line is recessive (McKusick and Lopez 2009). Upon folding of arms across the chest, the left arm on the top of the right is dominant, and the right arm on the top of the left is the recessive trait.

Hair is morphologically characterized as straight and curly. Straightness and curliness are controlled by single pair of alleles showing partial dominance (Rehman *et al.* 2020).

The study of human morphological variation can be used to investigate the diversity that arises within and among the population due to genetic variation. The importance and variations in the morphological traits may encourage a researcher in conducting further studies to solve the cases based on external morphology.

MATERIAL AND METHOD

The study was carried out on an unrelated population of college students native to the Jalgaon district. Jalgaon district is located in the Northern region of Maharashtra state in India.

A total 422 students between the ages of 18-30 are randomly selected for the study. The consent of the subjects will be taken before the data collection. The purpose and the meaning of the research will be explained to each subject. The subjects with a normal morphological appearance will be considered and those with deformities will be excluded.

Table 1. The data were collected according to the given data collection

Sr. No.	Morphogenetic Character	Variation/Trait	Dominant/Recessive
1.	Earlobe attachment	• Free • Attached	Free- Dominant Attached- Recessive (McKusickand Lopez, 2010).
2.	Dimples	• Present • Absent	Dimples are the small round indentations in the face (especially cheeks) Present – Dominant Absent- Recessive (Ebeye et al., 2014)
3.	Rolling of tongue	• Roller • Non Roller	Roller – Dominant (Sturtevant; 1940) Non Roller- Recessive
4.	Chin	• Cleft chin • Smooth chin	Cleft chin also referred to as a dimple on a chin. Cleft chin /Dimple Present –Dominant Smooth chin - Recessive (McKusick 2013)
5.	Hitchhiker's thumb	• Straight • Curved	Curved thumb –Dominant Straight- Recessive (Usha et al.2016).
6.	Handedness	• Right-handedness • Left-handedness	Right-handedness - Dominant Left-handedness- Recessive (Usha *et al.* 2016).
7.	Widow's peak	• Present • Absent (Straight line)	Present- Dominant Absent (Straight line)- Recessive (McKusick and Lopez 2009)
8.	Crossing of arm	• Left arm on the top of the right • Right arm on the top of the left	The left arm on the top of the right is dominant, and the right arm on the top of the left is the recessive trait.
9.	Hair nature	• Straight • Curly	Straightness and curliness are controlled by single pair of alleles showing partial dominance (Rehman *et al.* 2020).

RESULTS

Table 2: Distributions of Morphogenetic traits in the studied sample population are as follows

Sr. No.	Morphogenetic traits	Phenotype	Frequency (N)	Percentage (%)
1.	Earlobe attachment	Free	302	71.56
		Attached	120	28.43
2.	Dimples	Present	102	24.17
		Absent	320	75.82
3.	Rolling of tongue	Roller	265	62.79
		Non- Roller	157	37.20
4.	Chin	Cleft chin	107	25.35
		Smooth chin	315	74.64
5.	Hitchhiker's thumb	Straight	208	49.28
		Curved	214	50.71
6.	Handedness	Right-handedness	334	79.14
		Left-handedness	88	20.85
7.	Widow's peak	Present	151	35.75
		Absent	271	64.21
8.	Crossing of arm	Left arm on the top of the right	219	51.89
		Right arm on the top of the left	203	48.10
9.	Hair nature	Straight	312	73.93
		Curly	110	26.06

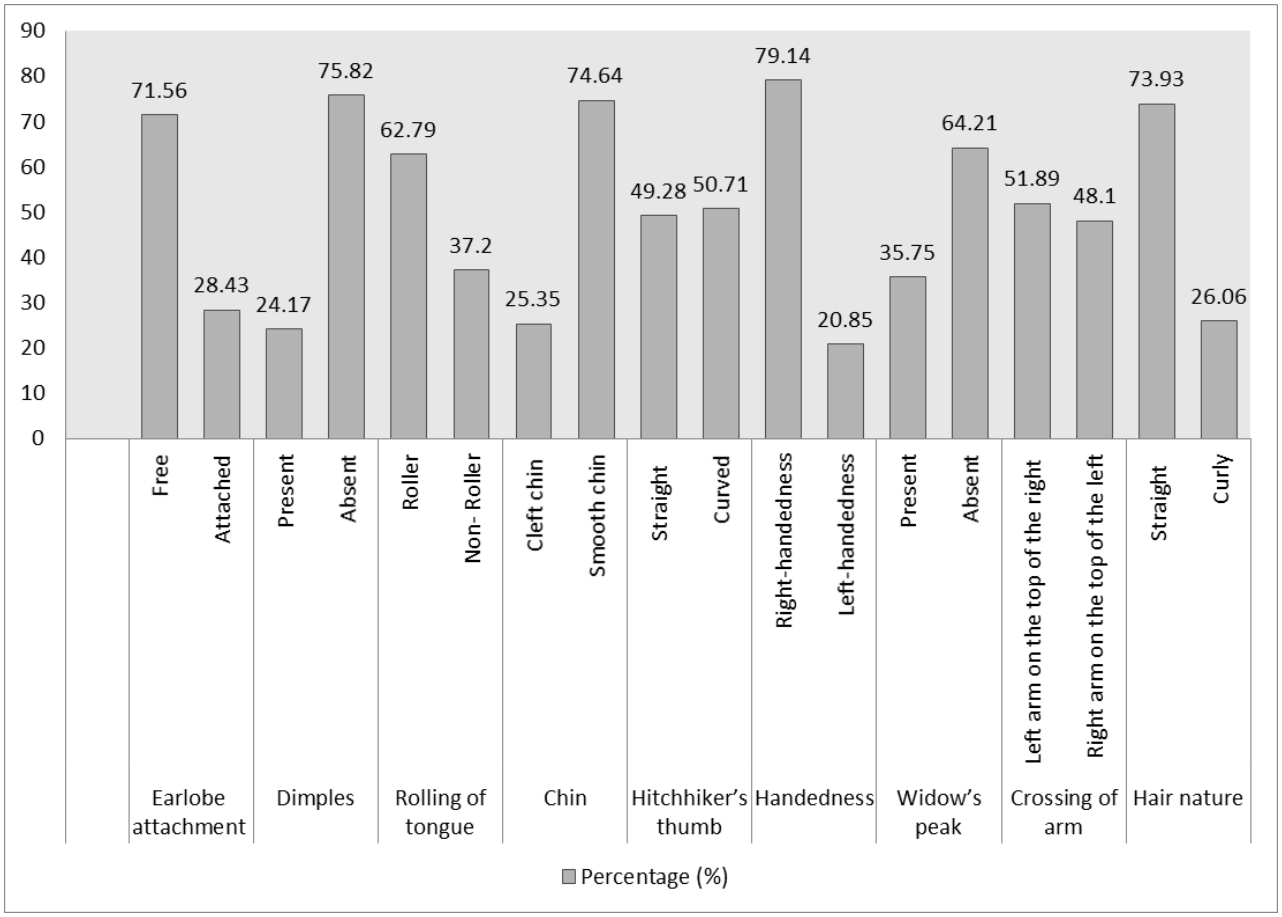

Fig. 1: Distributions of Morphogenetic traits in the studied sample population

Table 3: Association of Morphogenetic trait with the gender: Test of independent association is performed for the evaluation.

Sr. No.	Morphogenetic traits	Phenotype	Gender		χ2	P	Significance *(LS=0.05)*
			Male	Female			
1.	Earlobe attachment	Free	178	124	1.852	0.173	*Not Significant*
		Attached	62	58			
2.	Dimples	Present	48	54	5.281	0.021	***Significant***
		Absent	192	128			
3.	Rolling of tongue	Roller	151	114	0.003	0.953	*Not Significant*
		Non-Roller	89	68			
4.	Chin	Cleft chin	64	43	0.505	0.477	*Not Significant*
		Smooth chin	176	139			
5.	Hitchhiker's thumb	Straight	114	94	0.712	0.398	*Not Significant*
		Curved	126	88			
6.	Handedness	Right-handedness	194	140	0.958	0.327	*Not Significant*
		Left-handedness	46	42			
7.	Widow's peak	Present	92	59	1.576	0.209	*Not Significant*
		Absent	148	123			
8.	Crossing of arm	Left arm on the top of right	124	95	0.011	0.913	*Not Significant*
		Right arm on the top of left	116	87			
9.	Hair nature	Straight	178	134	0.015	0.900	*Not Significant*
		Curly	62	48			

DISCUSSION

Expression of different morphogenetic traits shows a wide variety in the studied population. The survey showed the prevalence of free earlobe pattern of about 71.56% compared to attached earlobe which is 28.43%. Dimples are absent in 24.17%population while 75.85% of the population shows the presence. The results regarding the dimples are correlated with the study of Adekoya *et al.,* (2021) which shows more prevalence of the dominant trait related to gender. Roller tongue shows more prevalence in the population i.e. 62.79% while 37.20% can't roll their tongue i.e. non-roller. The results regarding the tongue rolling resemble the study of Rehman *et al.* studied the morphogenetic character of the Punjab, Pakistan population.

The distribution of Chin traits revealed that a smooth chin is more prevalence than a cleft chin. The smooth chin has a 74.64% distribution while cleft chins have a 25.35% distribution. Hitchhiker's thumb shows a very slight prevalence in curved trait i.e. 50.71% which can be considered as same compared to straight trait i.e. 49.28%. Usha *et al.* found that the Thrissur area in India has a greater prevalence of bent thumbs (63.6%). Right handedness (79.14%) is found more prevalent than that of left handed (20.85%). Absent of widow's peak i.e. 64.21% than the presence of widow's peak i.e. 35.75%. Results on a crossing of arms show a nearly equal distribution for the left arm on the top of the right (51.89%) and the right arm on the top of the left (48.10%). Straight hair is more common in the population (73.93%) followed by curly hair (26.06%). Additionally, environmental elements like a way of life and profession can have an impact on how often a particular trait is expressed or manifested.

Association of traits with the gender

Nine traits; Earlobe attachment, Dimples, Rolling of the tongue, Chin, Hitchhiker's thumb, Handedness, Widow's peak, Crossing of the arm, and Hair nature were studied in the sampled population (Table 2). Test of independent association is performed for the association analysis (Table 3). The research showed that among the eight traits out of nine studied in the population having no significant association between morphogenetic traits and the gender. Significant association observed between dimpled cheeks and gender. A similar result in terms of association was observed by Adekoya *et al.* (2021) within the chosen students, a substantial correlation between dimpled cheeks and gender was found by Adekoya *et al.* (2021) which is more prevalent in males.

CONCLUSION

The study concluded that there is significant association between the studied dimples cheek trait and gender. Recessive traits including the absence of dimples, smooth chin, and widow's peak have more prevalence than their counter-dominant trait. Hitchhiker's thumb and crossing of arms show nearly equal prevalence in the studied population. The finding from the study revealed no association of the studied morphogenetic traits with gender except dimpled cheek. Results may vary upon the further increase in the sample numbers. Many of our community do not aware of the wide variation in morphological traits so it is important to study the population. Morphogenetic trait variations will give a massive benefit to physical anthropologists and forensic experts to study the population pattern.

Conflicts of interest: The authors stated that no conflicts of interest.

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