OPEN ACCESS
Scholars International Journal of Anatomy and Physiology
Abbreviated Key Title: Sch Int J Anat Physiol
ISSN 2616-8618 (Print) |ISSN 2617-345X (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Study of Serological and Morphogenetic Variability among Students in Federal Polytechnic, Ile-Oluji, Ondo State

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DOI: 10.36348/sijap.2023.v06i07.004 | **Received:** 21.05.2023 | **Accepted:** 24.06.2023 | **Published:** 19.07.2023

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Abstract

Background: Human beings, like all living organisms, are characterized by the presence of genetically inherited physical and/or physiological characters which made them to be genetically distinct from each other. These traits, known as morphogenetic traits, are transmitted in autosomal dominant or recessive fashion. This study strives to determine the distribution, association and inheritance pattern of morphogenetic characters among students of Federal Polytechnic Ile-Oluji, Ondo State, Nigeria. ***Materials and Methods:*** A random sample of four hundred (male 219 and female 181) students were evaluated for two serological (blood group and rhesus factor) and ten morphogenetic traits including, earlobe attachment, bent little finger, widow's peak, hitchhiker's thumb, tongue rolling, tongue flipping, cleft chin, mid-phalangeal hair, eye colour and polydactyly. The data obtained were expressed in simple percentages. Chi- square analysis was used to test for statistically significant associations between observed allelic and genotypic frequency at 5% level of significance. ***Results and Discussions:*** The study revealed Blood group O as the most prevalent (47%) followed by A (22.75%), B (18.5%) while the least was AB (11.75%). Over 91% of these population were Rh (D) positive while over 8% were Rh (D) negative. The other genetic traits were observed in frequencies; attached earlobe (57.25%), bent little finger (27.5%), widow's peak (34.25%), hitchhiker's thumb (65.75%), tongue rolling (54.25%), tongue flipping (23%), cleft chin (24%), mid-digital hair (42%), dark eye colour (31%) and polydactyly (26.75%). Association analysis showed the presence of association between gender and all the traits excepting widow's peak ($\chi^2 = 19.7$, $p = 0.000$), cleft chin ($\chi^2 = 11.5$, $p = 0.000$) and polydactyl ($\chi^2 = 12.2$, $p = 0.000$). ***Conclusion:*** Recessive traits were much more prevalent in the sampled population. The results obtained established baseline data for this population, and it can be used for medically, legally and also for anthropological studies.

Keywords: Morphogenetic traits, association study, blood groups, rhesus factor, serological trait.

1.0 INTRODUCTION

Morphological and physiological traits are physical or physiological characters that are genetically inherited by an organism from both parents. These traits can be found in different populations of living organisms and are generally referred to as anthropogenetic or morphogenetic traits (Ebeye *et al.*, 2014). These traits are the source of variation in living organisms, and they help to distinguish between organisms of the same species. Some of these traits are due to the effect of single gene and are usually inherited in simple Mendelian pattern in autosomal dominant or autosomal recessive fashion (Adekoya *et al.*, 2020; Ebeye *et al.*, 2014). While some traits are affected by more than one gene and are said to be polygenic (Adekoya *et al.*, 2020). Many of these traits are expressed differently in different populations and are very important in the understanding of human evolution and diversity (Pandey *et al.*, 2013). They are also useful in blood transfusion and determination of paternity (Seber, 1985), as well as crime detection (Kim *et al.*, 2017).

The determination of human blood group and genotype is based on the principle of Agglutination. Agglutination or clumping of blood together occurs when blood/ cellular antigens react with its corresponding antibody at their antigenic/ binding sites to form a large antigen-antibody complex (Kooffreh *et al.*, 2015). The objective of this study is to investigate

the distribution pattern and prevalence of selected morphogenetic traits and their inheritance patterns among the students of Federal Polytechnic Ile-Oluji, Ondo State, Nigeria.

2.0 MATERIALS AND METHOD

Study Design

This study adopted a descriptive research design and data were collected by visual observations.

Population of Study

The study was carried out in a heterogeneous population of Federal Polytechnic Ile-Oluji, Ondo State Nigeria.

Sample and Sampling Techniques

Ethical approval was obtained and a total of four hundred (400) National Diploma students (219 males, 181 females) with ages ranging between 17 and 25 were randomly selected for the study. Informed consent was also obtained from the students before they were allowed to take part in the survey.

Determination of Serological Traits

Blood Collection: Blood samples were collected from the thumb, through finger-prick sampling with fresh sterile blood lancet, after wiping with cotton wool dipped in methylated spirit. The blood collected was allowed to drop on clean white tiles.

Determination of ABO blood group and Rh (D) blood phenotype: The ABO and Rh (D) blood grouping was carried out using the tile-technique according to Kooffreh *et al.*, (2015). The tests were conducted by adding a drop of antisera A (Anti A), antisera B (Anti B) and antisera D (Anti D) on the blood samples and mixed with glass rods. The tile was shaken for a few seconds, incubated and examined macroscopically. Result of the agglutination reaction was recorded as shown in Table 1.

Table 1: Agglutination Reaction

Tests			**Inference**
Anti-A plus blood sample	Anti-B plus blood sample	Anti-D plus blood sample	
-	-	+	O^+
-	-	-	O^-
+	-	+	A^+
+	-	-	A^-
-	+	+	B^+
-	+	-	B^-
+	+	+	AB^+
+	+	-	AB^-

+: Agglutination or clumping of the anti-serum with the blood sample,
-: Compatibility between the anti-serum and the blood sample

Determination of Genetic Traits of Simple Inheritance

Morphogenetic traits present on participants were determined by visual observation using various standard techniques (Table 2).

Table 2: Morphogenetic characters studied

Character description	**Code**	**Procedure**	**Inheritance Pattern**
Widow's peak	WP	Evaluated by observing for the presence or absence of V shaped (curved) point in the hairline in the center of the forehead.	Dominant
Cleft chin	CC	Evaluated by observing for the presence or absence of Y shaped dimple in the middle of the chin.	Dominant
Polydactyl	PD	Evaluated by observing for the presence or absence of one or more extra fingers.	Dominant
Mid digital hair	MD	Evaluated by observing for the presence or absence of hair on the middle segment of one or more fingers.	Dominant
Thumb	TH	Evaluated by observing for the ability/ inability of the thumb to bend backward (hitchhiker's) beyond the normal range of motion.	Recessive
Earlobe attachment	EL	Evaluated by observing for the presence/ absence of projection of the lower portion of the human ear below the antitragus. Free ear lobe is controlled by a dominant gene.	Dominant

Character description	Code	Procedure	Inheritance Pattern
Tongue rolling	TR	Evaluated by observing for the ability/ inability to roll the lateral edges of the tongue upwards into a tube	Dominant
Tongue flipping	TF	Evaluated by observing for the ability/ inability to fold the lateral edges of the tongue inwardly	Dominant
Eye colour	EC	Evaluated by observing for the colour of the pigmentation of the iris.	Dominant (Dark Brown> Brown>Green>Blue)
Little finger	LF	Evaluated by observing for presence/ absence of bending of the pinky finger towards the ring finger	Dominant

Statistical Analysis

The data obtained from this study were expressed in simple percentages. Chi-square analysis was used to test for statistically significant associations between observed allelic and genotypic frequency to that expected under the H-W equilibrium. The allele frequencies of A, B, and O blood group genes and rhesus factor were also calculated under Hardy-Weinberg (H-W) assumptions.

3.0 RESULTS & DISCUSSIONS

Morphogenetic traits distribution in the studied population showed that 54.75% (n = 219) are males while the rest are females. The result of serological tests (Table 3) for the ABO blood phenotypes showed that blood group O exhibited the highest frequency 47% (n = 188), followed by A 22.75% (n = 91), B 18.5% (n = 74) and AB 11.75% (n = 47). Chi square analysis revealed no association ($p>0.05$) at 0.05 significance level between gender and blood group in this study. This result contrasts with that of Nwaopara *et al.*, (2008) who reported a higher prevalence (63.73%) of blood group O among residents of Ekpoma, Edo State, Nigeria. It also corroborates that of Kooffreh *et al.*, (2015) who reported a slightly higher prevalence (55.2%) of blood group O among residents of Calabar, Cross River State Nigeria. Rhesus phenotype result showed that 81% (n = 324) of the population are Rh (D) positive while 19% (n = 76) were Rh (D) negative. Comparatively, it was also observed that there was a higher proportion of rhesus positive in males than females. Chi square analysis revealed no association ($p>0.05$) at 0.05 significance level between gender and rhesus factor in this study. This result agrees with that of Umoyen *et al.*, (2021) who reported a much higher incidence (93.17%) of rhesus factor among the Ibibio and Ananng ethnic groups in Akwa Ibom State, Nigeria. It also agrees with that of Agrawal *et al.*, (2014) who also reported a much higher prevalence (94.61%) of rhesus factor across different regions of India.

The results of morphogenetic traits presented in table 4 showed that widow's peak was observed in 34.25% of the population studied and males accounted for about 24% of this population. Chi square analysis revealed a significant association ($p<0.05$) between gender and widow's peak in this study. This result revealed that males are likely to develop widow's peak compared to females. This result agrees with that of Umoyen *et al.*, (2021) who similarly reported a lower prevalence (33.42%) of widow's peak. However, their study reported the prevalence of widow's peak in females rather than males, among the Ibibio and Ananng ethnic groups in Akwa Ibom State, Nigeria. The result also agrees with that of Ebeye *et al.*, (2014) who reported slightly lower prevalence (31.25%) of widow's peak among the Esan ethnic groups, Edo State, Nigeria. The frequency distribution of tongue rolling showed that more than half of the studied populations (54.25%) are rollers and males made up a larger percentage (31.5%) of this population. Chi square analysis revealed no association ($p>0.05$) between gender and ability to roll tongue in this study. This result agrees with that of Nwaopara *et al.*, (2008) who reported a higher incidence (51.81%) of tongue rollers among residents of Ekpoma, Edo State.

Table 3: Frequency distribution of ABO/Rh blood group by gender in studied population

Blood groups	Male (Obs.)	Phenotypic Freq. (%)	Female (Obs.)	Phenotypic Freq. (%)	Total Obs. Freq	Phenotypic Freq. (%)	Expected Freq.	Allelic Freq.	χ^2	P Value
A	55	60.44	36	39.56	91	22.75	91	0.228	3.37	0.34
B	35	47.3	39	52.7	74	18.5	101	0.253		
AB	28	59.57	19	40.43	47	11.75	20	0.049		
O	101	53.72	87	46.28	188	47	188	0.470		
Rh (D) +	184	56.79	140	43.21	324	81	324	0.81	2.86	0.09
Rh (D) -	35	46.05	41	53.95	76	19	76	0.19		

Nigeria. Though, it contrasts with that of Nwosu *et al.,* (2022) who reported a lower prevalence (46.96%) of tongue rollers among staff and scholars of Gregory University Uturu, Abia State Nigeria. The frequency distribution of tongue flippers showed that only a small proportion (23%) of the population are flippers and the proportion of flippers are almost similar among males and females. Chi square analysis revealed no association (p>0.05) between gender and ability to flip tongue in this study. This result also agrees with that of Umoyen *et al.,* (2021) who reported a much lower prevalence (9.21%) of tongue flippers among the Ibibio and Ananng ethnic groups in Akwa Ibom State, Nigeria. But it contrasts with that of Igbeneghu *et al.,* (2016) who reported a prevalence of 79.2% of tongue flippers among Yoruba students of Ladoke Akintola University of Technology, Osogbo, Nigeria. The frequency distribution of ear lobe attachment showed that 57.25% of the population possessed attached earlobe, while 42.75% had free earlobe, and males made up a larger percentage (32.25%) of this population. Chi square analysis revealed no association (p>0.05) between gender and ear lobe attachment in this study. This result agrees with that of Anibor *et al.,* (2021) who reported a slightly higher prevalence (61.72%) of attached earlobe among members of Ika speaking communities in Delta State, Nigeria. The result contrasts with that of Ebeye *et al.,* (2014) who reported lower prevalence (31%) of attached earlobe among the Esan ethnic groups, Edo State, Nigeria.

Table 4: Frequency distribution of Morphogenetic traits by gender in studied population

Traits	Male (Obs)	Phenotypic Freq. (%)	Female (Obs.)	Phenotypic Freq. (%)	Total Obs.	Phenotypic Freq. (%)	χ^2 Value	P-Value
	Widow's peak							
Curved	96	24.0	41	10.25	137	34.25	19.7	0.000
Straight	123	30.75	140	35.0	263	65.75		
	Tongue rolling							
Roller	126	31.5	91	22.75	217	54.25	2.1	0.15
Non-roller	93	23.25	90	22.5	183	45.75		
	Tongue flipping							
Flipper	47	11.75	45	11.25	92	23.0	0.65	0.42
Non-flipper	172	43.0	136	34.0	308	77.0		
	Earlobe							
Free	90	22.5	81	20.25	171	42.75	0.54	0.46
Attached	129	32.25	100	25.0	229	57.25		
	Thumb							
Hitchhiker's	148	37.0	115	28.75	263	65.75	0.72	0.40
Straight	71	17.75	66	16.5	137	34.25		
	Cleft chin							
Present	67	16.75	29	7.25	96	24.0	11.5	0.000
Absent	152	38.0	152	38.0	304	76.0		
	Mid digital hair							
Present	98	24.5	70	17.5	168	42.0	1.50	0.22
Absent	121	30.25	111	27.75	232	58.0		
	Polydactyl							
Present	74	18.5	33	8.25	107	26.75	12.2	0.000
Absent	145	36.25	148	37.0	293	73.25		
	Little finger							
Bent	62	15.5	48	12.0	110	27.5	0.16	0.69
Straight	157	39.25	133	33.25	290	72.5		
	Eye colour							
Dark Brown	61	15.25	63	15.75	124	31.0	3.57	0.17
Brown	158	39.5	117	42.55	275	68.75		
Blue	0		1		1	0.25		

The frequency distribution of thumb flexibility assessment showed that a sizable percentage (65.75%) of the population possessed hitchhiker's thumb with males having a higher proportion (37.0%) of this trait. Chi square analysis revealed no association (p>0.05) between gender and thumb flexibility in this study. This result contrasts with that of Adekoya *et al.,* (2020) who reported a slightly lower prevalence (53.5%) of straight (single jointed) thumb among students at the University of Lagos, Nigeria. It also contrasts with the result of Onyije *et al.,* (2012) who reported higher prevalence (67.7%) of straight thumb among residents of Bayelsa State, Nigeria. The frequency distribution of chin assessment showed that only a small proportion (24%)

of the population possessed cleft chin and males accounted for more than double the number of students with the observed trait. Chi square analysis revealed a significant association ($p<0.05$) between gender and chin indentation in this study. This result revealed that males are likely to develop cleft chin compared to females. This result corroborates that of Anifowoshe *et al.,* (2018) who reported a slightly higher prevalence (30.5%) of cleft chin among students at the University of Ilorin, Nigeria. It also agrees with the result of Umoyen *et al.,* (2021) who reported a slightly higher prevalence (28.08%) of cleft chin among the Ibibio and Ananng ethnic groups in Akwa Ibom State, Nigeria. The frequency distribution for the presence of mid digital hair showed that 42% of the population possessed mid digital ear and males made up a larger percentage (24.5%) of this population. Chi square analysis revealed no association ($p>0.05$) between gender and presence of mid digital hair in this study. This result agrees with that of Adekoya *et al.,* (2020) who reported a slightly lower prevalence (35.3%) of mid digital hair among students at the University of Lagos, Nigeria. But it contrasts with the extremely high prevalence (92.0%) of mid digital hair reported by Kooffreh *et al.,* (2015) among residents of Calabar, Cross River State Nigeria. The frequency distribution for the presence of polydactyl showed that 26.75% of the population possessed one or more extra finger(s) and males made up more than twice the number of students with the observed trait in the population studied. Chi square analysis revealed a significant association ($p<0.05$) between gender and presence of extra fingers in this study. This result revealed that males are more likely to develop polydactyl compared to females. This result contrasts with that of Adekoya *et al.,* (2020) who reported a lower prevalence (6.8%) of polydactyl among students at the University of Lagos, Nigeria. However, their report also revealed the prevalence of polydactyl among male students compared to their female counterpart. The frequency distribution of little finger assessment showed that majority of the population (72.5%) possessed straight, rather than bent, little finger and males represented a larger proportion (39.25%) of those possessing straight little finger. Chi square analysis revealed no association ($p>0.05$) between gender and shape of little finger in this study. This result agrees with that of Anifowoshe *et al.,* (2018) who similarly reported extremely high prevalence (71.2%) of straight little finger among students at the University of Ilorin, Nigeria. It also agrees with the extremely high prevalence (92.9%) of straight little finger reported by Onyije *et al.,* among residents of Bayelsa State, Nigeria. The frequency distribution of eye colour assessment showed that 68.75% of the population possessed brown eye colour while 31% showed very dark/black eye colour, while one student even possessed blue eye colour. Chi square analysis revealed no association ($p>0.05$) between gender and eye colour in this study. This result agrees with that of Chadha and Sandhu (2013) who reported black eye colour ranging from 30% to 63.33% among Bhagat and Batwal castes in Kashmir. The results from this study showed that recessive traits were much more prevalent among the sampled population for both morphogenetic and serological traits with the exception of rhesus factor for which most of this population exhibited the prevalence of the dominant trait. The variations observed between the results obtained from this study compared to others might be due to genetic variations among the sampled populations due to ethnic, geographic and regional differences.

CONCLUSION

It can be concluded from this study that most members of the studied population expressed recessive morphogenetic and serological traits, excepting rhesus factor. These results therefore express baseline data for this population, and this can be utilized for medical purposes as well as for forensic pathology, for population diversity and anthropological purposes.

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