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Research Article

ELUCIDATING THE LINKAGE OF BLOOD GROUPS WITH SELECTED HUMAN MORPHOGENETIC TRAITS IN DINDIGUL OF TAMILNADU ETHNICITY

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ABSTRACT

Study of the inheritance pattern of human traits is one of the significant methods for analyzing the genetic history of a population. It has an important role in the determination of the chance of occurrence of genetic traits in the family or in the society. Therefore an attempt was made to determine the relevance of blood groups and the morphogenetic traits such as height, weight, hitchhiker's thumb, cleft little finger and handedness among 240 selected girl participants of three sampling sites in Dindigul town, Tamilnadu. On analysis, results revealed that the O+ve and B +ve blood group individuals were found to inherit more dominant traits such as height above 150 cm, weight below 55 kg, straight position of thumb, cleft less little finger and right handedness (R Pattern) which were found to be favourable characteristics in the sampled individuals. The prevalence of these dominant morphogenetic traits were registered as 71.6%, 65%, 70%, 78% and 81.6% were found to express more frequently in the population. The bent thumb, clefted little finger and left handedness (L Pattern) which were found to be recessive traits were recorded in O-ve, B-ve, A+ve and A1+ve in higher incidence rate. The O-ve and B-ve blood group participants inherited many of the observed recessive traits. We conclude from our study that the expression of dominant and recessive characters may vary and depend on the interplay of multiple alleles and other genetic factors.

Keywords: Morphogenetic traits, Multiple alleles, blood Groups, Dominant, Recessive characters.

1. INTRODUCTION

Genetic variability is the characteristics of living beings particularly in human beings. They exhibit different morphogenetic traits which distinguish their phenotype. Mendelian traits are passed down to the next generation by dominant and recessive alleles of one gene. Polygenic traits are non-Mendelian because their alleles are located on more than one gene which allows for more alleles and phenotypes [1]. Some of the polygenic traits in humans include height, weight, eye shape, eye colour, eyebrow pattern, hitchhiker's thumb, cleft little finger and handedness with varying degrees of variations [2]. Indeed, marked inter-individual variability in genetic and non-genetic factors have been said to possess that ability to influence the disposition of many polygenic traits [3].

Certain characteristics of an individual are resulted by multiple alleles. The most common example of multiple alleles is the human blood group. One of the key characteristic features of multiple alleles is that all the alleles that are responsible for a characteristic of an individual lie on the same locus in the homologous chromosome [4]. Several epidemiological studies have reported that the distribution of different ABO blood groups vary markedly among the populations of different geographical areas reflecting anthropometric indices in various racial differences [5].

However, there is the fact that establishing genetic mechanisms on morphogenetic traits with variable frequency in different populations is useful in evaluating and analyzing genetic driven evolutionary forces [6]. There are limited studies that focussed on the association between blood groups and polygenic traits. Therefore an attempt was carried out to study the potential relation between the multiple alleles of ABO blood groups with morphogenetic traits among the selected participants of Dindigul town of Tamilnadu ethnicity, which may contribute to analyse the underlying genetic which can be considered for future studies.

2. MATERIAL AND METHODS

A cross sectional descriptive survey study was conducted using a structured questionnaire data sheet among the selected participants aged between 18-22 years of three different sampling areas, East street, West street and North street in Dindigul town. Two hundred and forty apparently healthy young girls who were selected in the study area were subjected to screening for the ABO blood groups following the standard protocol after obtaining informed consent for participation. They were subjected to analyse five different morphogenetic traits such as height, weight, hitchhiker's thumb, cleft little finger and handedness. A data sheet which included the individual's name, age, blood group, polygenic traits based on the phenotypic expression of the individual were recorded. The test survey on polygenic traits was conducted in the month of September 2020 after getting ethical permission from the concerned research committee. The observed morphogenetic traits were recorded and tabulated accordingly.

2.1. Blood group analysis

The ABO blood grouping test is based on the principle of haemagglutination reaction. Blood was collected from the selected participants using sterilized techniques and the blood group was determined by using specific antibodies, to confirm the presence or absence of corresponding agglutinogens on the surface of the red blood cells and recorded accordingly [7].

2.2. Height

Height was measured using standardized procedures by measurement devices and calibrated in centimetre. A calibrated stadiometer was used to measure the subjects' height in meters with participants standing barefooted and upright on the base of the stadiometer. Height was measured without shoes to nearest 0.1 cm with a meter.

2.3. Weight

Weight was measured by standard procedure using digital weight machine and calculated in kg. The participants were asked to stand in the upright position and weight was recorded to the nearest 0.5 kg using a weight measuring scale.

2.4. Hitchhiker's thumb

Thumb can be straight or curved Hitchhiker's developmental pattern. If the thumb is bent backwards it is noted as hitchhikers thumb. Straight thumbs can be seen as nearly a straight line and may contain a slight arch when viewed from the side.

2.5. Cleft little finger

Little fingers range from perfectly straight to curved inwards at a sharp angle. In some people the little finger bends in towards the ring fingers, while in other people they are straight.

2.6. Handedness-Crossing of palms

Subjects were asked to interlock their fingers of two palmar surfaces. In a related interlocking of fingers, if the left thumb is found over right, it is known as L type, and when right thumb is over left, it is known as R type. They observed the interlocking pattern and noted their results.

2.7. Statistical analysis

After data collection a primary consolidation was done. Appropriate graphical representation and statistical analysis for Anova was applied by using IBM SPSS software version.

3. RESULTS AND DISCUSSION

A blood group type is a classification of blood, based on the presence and absence of antibodies and inherited antigenic substances on the surface of red blood cells (RBCs) [8]. The "phenotypes" are produced by the interaction of the genotype and the environment [9]. Polygenetic inheritance describes the inheritance of traits that are determined by polygenes and have many possible phenotype characteristics that are determined by interactions with several alleles. The ABO blood group system is known to be one of such genetic make up for many morphogenetic traits in humans such as skin color, eye color, hair color, ear lobe, height and weight with varying degree of variations [1]. On analysis of the blood group, the frequency of O +ve group is higher followed by the B +ve group indicating their dominance (Table 1) in three different sampling streets of Dindigul. Following it A+ve, A1+ve, were found to register their incidence and the negative blood groups were found to record with least occurrence rate.

Human height is a quantitative characteristic that is controlled by multiple genes and environmental factors [3]. In the study analysis, the height of the selected participants with different blood groups showed that more number of individuals of above160 cm were

observed among the B+ve and A +ve subjects followed by O positive participants. The number of individuals with height below 145 cm were observed in A+ve, B+ve, O+ve, but more percentage was recorded in B-ve, O- blood groups (Table 2). Results showed that significant height was observed with B+ve and O+ve blood group individuals, where growth pattern inherited the dominant trait for height in the observed sampled population. Indeed, marked inter-individual variability in multiple allelic factors have been said to possess the ability to influence the disposition of many polygenic traits [10].

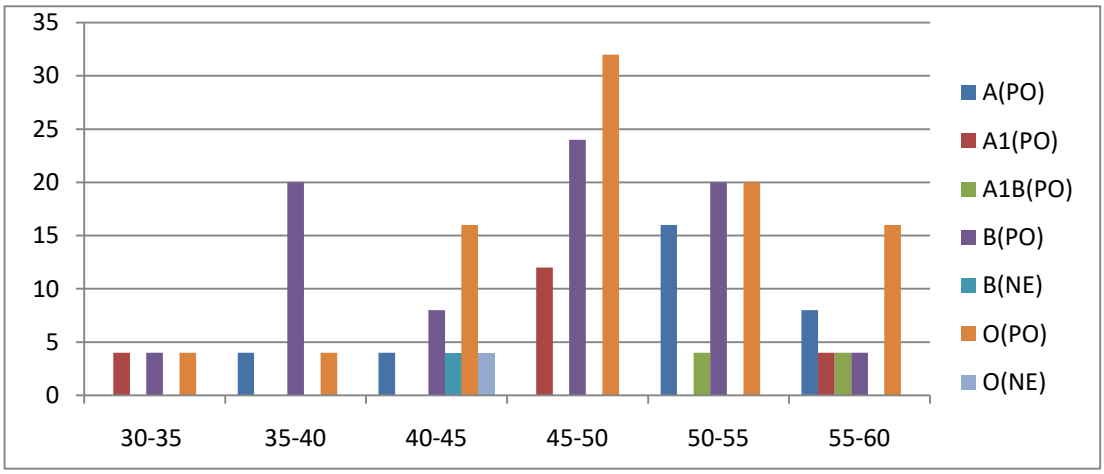
Table 1: Analysis of different types of blood groups in selected participants

Three study areas in Dindigul	Blood Group Types							Total Number
	A(PO)	A1(PO)	A1B(PO)	B(PO)	B(NE)	O(PO)	O(NE)	
East Street	12	12	4	28	-	32	-	88
West Street	8	8	4	24	-	40	-	84
North Street	12	-	-	28	4	20	4	68
Total	32	20	8	80	4	92	4	240

(PO)- Positive (NE) - Negative

Table 2: Analysis of height in selected participants with different blood groups

Blood Group	Total Number of Participants	135-140 cm	140-145 cm	145-150 cm	150-155 cm	155-160 Cm	160-165 cm
A(PO)	32	-	2	10	8	4	8
A1(PO)	20	1	1	2	12	4	-
A1B(PO)	8	-	1	3	3	1	-
B(PO)	80	1	6	14	21	22	16
B(NE)	4	1	2	1			-
O(PO)	92	2	7	20	36	23	4
O(NE)	4	-	3	1	-		-
TOTAL	240	5	22	51	80	54	28



WEIGHT IN KG

Fig.1: Analysis of weight in selected participants with different blood groups

It is evident that the weight of selected participants with different blood groups revealed that more number of participants with normal weight (45- 55 kg) were recorded among the O positive and B positive blood group individuals. Likewise more numbers of under-weight subjects with lower then below 45 kg were recorded among A1 positive and A positive blood group individuals (Fig.1). Results showed that good built physic was observed with B+ve and O+ve blood group participants which showed an inheritance of dominant

favourable trait in the observed sampled population. In the present analysis, the findings of average weight and slightly obese individuals among B+ve and O+ve blood group population coincide with the study conducted among the students in Sargodha District [11]. He reported that the prevalence of obesity (BMI ≥ 30) with 13.7%, 9%, 4.8%, and 2.2%, was observed with relevance to O+ve, B+ve, A+ve and AB participants respectively. They found a higher incidence rate of good strength among the children with blood group O as compared to children with the other blood groups [11]. The study of hitchhikers, finger position and handedness revealed that the straight thumb, cleft less little finger and right handedness (R Pattern) were found to be dominant in O+ve blood group individuals [12]. The prevalence of these dominant morphogenetic traits were registered as 71.6%, 65%, 70%, 78% and 81.6% in the sampled population. Results showed the inheritance of recessive traits of bent thumb, cleft little finger and L Pattern left handedness in O negative group participants. It shows that some typical dominant characters were not expressed but the expression of recessive character was prevalent in the negative blood group subjects (Table 3). In this regard, the results showed that certain morphogenetic traits combination patterns were not represented in the population thereby suggesting that such combinations may be rare and hence become an important phenomenon that requires consideration in human variation [13]. Therefore, Polygenic inheritance expresses possible phenotypic characteristics that are determined by polygenes through the interactions of multiple alleles.

Table 3: Analysis of hitchhiker's thumb, cleft finger position, handedness among the selected participants with different blood groups

Blood Group	Number of participants	Hitch Hikers Thumb		Little Finger Position		Handedness	
		Straight	Bent	Cleft	No Cleft	L – Pattern (Left)	R- Pattern (Right)
A(PO)	32	26	6	8	24	8	24
A1(PO)	20	15	5	6	14	-	20
A1B(PO)	8	6	2	1	7	1	7
B(PO)	80	54	26	20	60	22	58
B(NE)	4	-	4	3	1	2	2
O(PO)	92	76	16	32	60	19	73
O(NE)	4	1	3	4	-	3	1
TOTAL	240	178	62	74	166	55	185

Table 4: The results of ANOVA for the subjects sampled in the cross sectional survey according to their blood groups

Source of variation	Number of squares	Degree of freedom	Average of squares	The calculated value of (f)	Level of significance
Between groups	9.3	2	3.62	8.1	0.01
Within groups	17.9	3.8		3.46	
Total	27.2	5.8		11.5	

ANOVA was applied to justify whether such variations are statistically significant among the sampled individuals. From the results it is clear that occurrence of selected morphogenetic traits varied significantly ($F = 11.5$, $df = 2$, $p=0.01$) with the blood groups. Statistical findings indicate that the inheritance of dominant morphogenetic traits were observed in O and B positive blood group individuals (Table 4) which were found to be favourable for the human population.

4. CONCLUSION

This cross sectional descriptive survey study is therefore an attempt to determine the interplay between multiple alleles and selected morphogenetic traits like height, weight, hitchhiker's thumb, cleft little finger and handedness. On analysis, morphogenetic traits amongst the subjects showed significant results which differ in accordance with their blood groups. Out of the 240 selected participants, the prevalence of O +ve, B+ve was dominant than other groups. Negative groups like O-ve and B -ve were reported in very few participants. The O+ve and B+ve blood group participants were found to possess dominant traits that were favourable to the subjects. The negative group participants inherited many of the recessive traits. The key finding of this study is participants with negative

blood groups were found to be shorter, more in weight, L pattern handedness, hitchhikers thumb along with clefted fingers.

Therefore, if we examine many individuals in a particular population, we will be able to see a gradation in the degree of difference. Although it may appear like a small predictive study, the results from this kind of study may play an important role in 'predictive human screening' for clinical purposes. The findings of this study therefore serve as one of important contributions on predicting human traits interconnecting with multiple alleles for further research findings.

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Conflict of interest

The author declares that there is no conflict of interest.

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