JECA

J. Expt. & Clin. Anat. 7 (1) 22-26 (2008)

A Study of Thumb Print Patterns and ABO Blood Group Distribution

***E.I. ODOKUMA , P.S. IGBIGBI, T.S. EMUDIANUGHE**

Department of Anatomy, Delta State University, Abraka. Nigeria.

*Author for correspondence

ABSTRACT

The aim of this study was to establish a possible relationship between thumb print pattern and ABO blood group distribution. The study involves two hundred and nine-two volunteers comprising 159 female and 133 male. The blood group and finger print patterns were determined using standard techniques. Results obtained revealed that gender was not significantly related with ABO blood group patterns. Gender comparisons with finger print pattern also showed no significant relationship. Comparisons between ABO blood group pattern and thumb print pattern showed no significant relationship $P > 0.05$. The above finding indicated that these characteristics were independent of each other and may be used independently in the process of identification.

Key words: Blood group, Thumb print, Gender.

Dermatoglyphic studies have established that digital ridges form well defined patterns which are apparently conservative in their evolution and are therefore reliable for establishing and confirming the historical relationships between populations (Penrose 1968, Arieta et al 1987).Their notably variable characteristics are not duplicated in any two persons even in monozygotic twins yet they are permanent and therefore useful as a means of identification. This diversity, however, falls within a pattern of limits that permit systematic classification (Galton 1888).

Arch **Whorl** **Loop**

Fig 1: Classification of fingerprints

Galton (1892) classified finger print pattern into three forms; arches, loops and whorls (Fig 1). He was also noted to have investigated relationships of print patterns in siblings and lower animals awakening its anthropological significance (Antonok 1975). Since the germ layers arise from a single source, the epimere, it is likely that tissues that arise from same germ layers will have similar characteristics. This may further confirm the theory that all somatic cells arise from a single clone of cells formed soon after fertilization. Only specific regions are, however, selectively expressed by different clones of cells as these clones expand to form tissues. The result is that genetic characteristics are usually conserved but may be expressed randomly. Relationships could therefore exist in tissues depending on the proximities of the different gene units located in a single chromosome or relationships between chromosomes located in different tissues. Dermatoglyphic traits have been related to several other physical parameters to facilitate identification and possible relationship in racial studies. Boyd (1963) used dermatoglyphic studies to confirm blood groups. Bloterogel and Bloterogel (1934) expressed a correlation between physical characters, and blood groups. In his study of blood groups, Hahne (1929) asserted that blood group O was associated with loops and less so with whorls than blood group A. Hersh (1932) found a higher frequency of loops in blood group A. Rao et al (1996) emphasized high frequency of loops with moderate whorls and low arches in the individuals of A, B, and O blood groups. They also found significantly greater number of loops in Rhesus positive and whorls in Rhesus negative subjects.

The aim of this study therefore was to establish a possible correlation between derivatives of ectodermal and mesodermal germ layers by comparing the frequency patterns of their derivatives (thumb print pattern and ABO blood group system). Furthermore, the distribution of ABO blood group, finger print patterns and occurrence of sexual dimorphism in digital prints in the sample population will be obtained.

MATERIALS AND METHODS

The study involved two hundred and ninety two student volunteers of Delta State University, Abraka campus. The school is located in the central senatorial district of Delta state. The orderly nature of the University environment formed a most suitable site for this study. Individuals of any age were suitable subjects since Dermatoglyphics undergo no morphological change with growth and advancing age. However, infants were not favoured only from the standpoint of printing technique. Their hands were difficult to manage and the ridges were so delicate that prints made by the usual method were often mere smudges.If members of same families were represented in the collection, it was desirable to exclude close relatives, for they may bring into the series familial peculiarities, which by their frequency mask the true traits (Cummins 1931).

Sexual variation had been shown as a factor in Dermatoglyphic hence the prints were separated along gender lines and only the right thumb used (Igbigbi et al 1994). All the selected subjects were apparently healthy able-bodied volunteers whose parents and grand parents were from the tribe indicated in the study. The subjects were also asked individually if there were any non tribal contribution to their ancestry for as far back as they knew, and anyone who gave a positive answer was excluded.

Data collected was classified according to type of ridge pattern. This represents a qualitative measurement of general ridge configuration on the apical palmar surface of the digits. These Ridge Patterns are generally subdivided into three classes. These include arches, loops and whorls (Galton 1892, Cummins and Midlo 1961, Penrose 1968). The definition of each class is dependent on the number of tri-radii present in a configuration. A tri-radius is defined as "the center of a delta-shaped junction of three regions, each containing curved streams of approximately parallel ridges. Arch is defined as the lack of a triradius and an exception to the simple arch is the tented arch. The loop pattern has a single triradius. Unlike the arch, the typical loop consists of a field of parallel ridges that turn, in direction, through a central angle of 180". The core of a typical loop is composed of either a single ridge or a ridge line which turns back on itself and forms two adjacent ridges. A whorl pattern is defined by the presence of two, and or more, triradii. It appears as a double loop "whose cores form a spiral or concentric, circular or elliptical pattern". Typically one or more ridges turn through a central angle of 360'.Each of these three classes of ridge configuration is termed a ridge pattern (Penrose 1968).

The methodology utilized did not deviate from the normal and accommodated all that have been learned about Dermatoglyphic variations and also provided some degree of compatibility that allowed for comparison with previously published data (Meier 1980).

Data for ABO blood system was obtained from the University Health Center where ABO test are done routinely as part of the registration process for staff and students. The technique involved analysis of blood obtained by venupuncture. The ABO sampling is carried out by the standard rapid tile method (Dacie and Lewis 1995).In this technique,blood sample obtained by venupuncture is placed on a white tile and commercial ABO antigens is used to determine the blood type. Blood that contain antibodies against prepaid sera usually form agglutinations which can be viewed with the aid of good light within two to five minutes. Informed consent was sought and obtained from each respondent involved in this study before the study was carried out. Approval for this investigation was given by the Research and Ethics Committee of the Faculty of Basic Medical Sciences, Delta State University Abraka prior to the commencement of this study.

RESULTS

In Table 1, the frequency and percentage distribution of the digital print patterns are shown. Total loop pattern was 157 (69 male, 88 female).Total Arch pattern was 13 (3 male and 10 female).Total Whorl pattern frequency was 122 (61 male and 61 female).These values were then subjected to chi square analysis and they showed that the values for chi square calculated exceeded that for chi square tabulated at $p=0.99$,$p=0.98$,$p=0.95$. This implies that thumbprint pattern show no dependency on the gender.

Table 1; Relationship between gender and thumb print pattern

Sex	Thumb Print pattern			
	Loop	Arch	Whorl	Total
Male	69	3	61	133
Female	88	10	61	159
Sample size	157	13	122	292

Table 2; Gender and ABO blood group frequency distribution

Gender	ABO Blood Group			
	A	B	AB	O
Male	27	30	2	74
Female	32	32	8	87
Total	59	62	10	161

x^2 P > 0.05, df = 2.8

Table 3; Comparison between blood group and thumb prints pattern.

ABO BLOOD GROUP	Thumb print patterns			
	Loop	Arch	Whorl	Total
A	31(52.5)	2(3.4)	26(44.1)	59
B	40(64.5)	2(3.2)	20(32.3)	62
AB	2(20)	1(10)	7(70)	10
O	84(52.3)	8(5.0)	69(42.9)	161
Total	157 13	122	292	

x^2 10.08

In Table 2, Gender was compared with ABO blood group frequency. The frequency values for blood group A was 59 (male 27, female 32).That for blood group B was 62 (male 30, female 32) and AB, 10 (male 2 and female 8).The values for blood group O was 161 (male 74, female 87). The value of x2 calculated at 2.8 is greater than x2 tabulated at p = 0.05.This implied that no relationship was observed between sex and blood group.

Table 3 shows the comparison between blood group and thumb print patterns, indicating that one's thumb print pattern is not associated with the person's blood group.

DISCUSSION

It was observed that thumb print patterns distribution were very similar to those of previous studies with loops being the most predominant followed by whorl and arch (Odokuma and Igbigbi 2004). Another important finding was the occurrence of greater number of loop and arch patterns in females when compared to their male counterparts. No significant relationship was observed between gender and digital thumb print patterns p>0.05.This result was similar to previous finding as documented by Igbigbi et al (2002) which demonstrated that digital prints may not be useful in determining sexual dimorphism.

ABO blood group distribution showed a predominance of blood group O followed by B and A. AB was the least common. This distribution of ABO blood groups did not differ significantly from those expected under the Hardy-Weinberg equilibrium (goodness of fit y2=6.09, df=3, p=0.1075).This pattern of distribution was also common in most of western Nigeria especially amongst the Binis and Yorubas (Falusi et al 2000) unlike in the northern parts of Nigeria where the B blood group is significantly higher. In the eastern region of Nigeria the B gene has been shown to be much lower (Ademowo et al 2000).This finding was quite useful with regard to ethnic and racial categorization. This may further suggest a possible common descent amongst these various ethnic entities resulting from inter-marriages which was not uncommon amongst these peoples from historic periods.

The results further revealed that no significant relationship existed between gender and ABO blood group as was observed with fingerprint patterns where no sexual dimorphism was apparent. The absence of any relationship has previously been noted by Worlledge et al (1974).

The general distribution of print pattern was similar in each blood group studied with loops being the most common and aches the least common. This was not the case with blood group AB however, where whorl was the most common followed by loops and arches the least. The loop pattern was significantly lower in blood group AB than other groups unlike its arch pattern which was correspondingly higher in other groups. It was however observed that generally, thumb print pattern did not show a statistically significant relationship with ABO blood group patterns unlike

was observed in a previous study (Bharadwaja et al 2004). These relationships may not be unconnected with the presence of distinctly separate genetic relationship for these phenotypic characteristics.

Earlier opinions suggested that the mode of formation of digital prints may be polygenetic involving several genes rather than a single gene confined to one chromosomal pair (Penrose 1968). Certain pathways for determination of gender have implicated a region in the short arm of the X chromosome which was observed to be widely conserved amongst vertebrates Reed et al (1975). Similarly, ABO patterns have also been localized in chromosome 9 which bears the ABO genes (Cook et al 1978). Despite the localization of genes for both characteristics on the same gene, there only appeared to be a small relationship in the frequencies of the measured characteristics. It is also known that though all mammalian cells have the same genetic constitution, their products differ. The reason for the observed differences may have arisen from the fact that while certain genes are active in some cells, they are passive in others. In other words, the genes responsible for red cell antigens are active in red cells but inactive in cells responsible for formation of fingerprints. In different cells were closely related genes are active, the tissues formed will have close structural or functional relationships. This was the likely reason gender was more related to blood groups than with fingerprints as observed in this study.

CONCLUSION

Although both fingerprints and blood groups are both popular in identification, forensic studies and in anthropology world wide, the observed relationship between them indicates that both characteristics should be used independently in an identification process.

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