Original Article

Fingerprint patterns in relation to gender and blood group among students of Delta State University, Abraka, Nigeria

Dennis. E.O. Eboh

Department of Anatomy and Cell Biology, Faculty of Basic Medical Sciences, College of Health Sciences, Delta State University, Abraka, Nigeria

Abstract

Introduction: Fingerprint patterns are genotypically determined and remain unchanged from birth till death. **Purpose of the study:** The purpose of this study was to determine fingerprint patterns in relation to gender and blood group among students of Delta state University, Abraka, Nigeria. **Materials and Methods:** A total of 490 subjects, aged 17-30 years were drawn using the systematic random sampling technique. The blood group of each subject was obtained from the records in the medical laboratory register of the Health Centre of the University. **Results:** Fingerprints of each subject were obtained using endorsing ink and plain white paper. Female had higher percentage of loop and whorl while male had higher percentage of arch. There was no significant association between gender and finger print patterns. Within the respective ABO blood groups, loop had higher percentages compared to arch and whorl. There was no significant association between finger print patterns and ABO blood group. Within the respective Rhesus blood groups, loop had higher percentages compared to arch and whorl. There was significant association between finger print patterns and Rhesus blood group. Within the respective ABO-Rhesus blood groups, loop had higher percentages compared to arch and whorl, except in blood group O negative where whorl has higher percentage. There was significant association between finger print patterns and ABO-Rhesus blood group. **Conclusion:** The study showed that fingerprints, gender and ABO blood groups can only be used independently to identify an individual.

Key words: Blood groups, fingerprint, gender, identification

INTRODUCTION

Human identification is the recognition of an individual based on some physical characteristics peculiar to the individual. It involves functional or psychic, normal or pathological characteristics that define an individual. Human identification is necessary for personal, social and legal reasons (Limson and Julian 2004). Some methods of personal identification include anthropometry, dactyloscopy, DNA fingerprinting, sex determination, estimation of age, measurement of height, post-mortem reports, differentiation by blood groups (Tsuchihashi 1974; Vahanwala 2005), hand writing and bite marks. In addition, an evolving method of individual identification is lip prints, the study of which is termed cheiloscopy (Eboh 2012, Eboh and Nwajei 2012).

Fingerprint is an impression of the curved lines of skin at the end of a finger that is left on a surface or made by pressing an inked finger onto paper. It has a unique characteristic, mark or pattern that can be used to identify somebody or something (Encarta 2009). The study of fingerprints

Address for correspondence:
Dr. Dennis E.O. Eboh,
Department of Anatomy and Cell Biology, Faculty of Basic Medical Sciences, College of Health Sciences, Delta State University, P. M.B. 1, Abraka, Nigeria.
E-mail: drebohdennis@yahoo.com

Access this article online	
Quick Response Code:	Website: www.jecajournal.com
	DOI: 10.4103/1596-2393.127969

is called dermatoglyphics (Cummins 1926). It has been reported that the characteristic patterns of epidermal ridges are differentiated in their definitive forms during the third (3rd) and fourth (4th) months of foetal life (Cummins and Kennedy 1940). Fingerprint patterns are genotypically determined and remain unchanged from birth till death (Vij 2005). Some of the earliest works on the use of fingerprints for personal identification were carried out in India so many years ago (Herschel 1916, Herschel 1880).

Bloterogel and Bloterogel (1934) expressed a correlation between physical characters and blood groups. In 1929, Hahne reported that blood group O is associated with more loops and fewer whorls than blood group A (Seema *et al*. 2012). Herch (1932) found high frequency of loops in blood group A. Gowda and Rao (1996) in their study on Gowda Saraswat Brahmin community of south Kannada district (Karnataka) reported high frequency of loops with moderate whorls and low arches in the individuals of A, B and O blood group.

Studies (Mehta and Mehta 2011, Bharadwaja *et al*. 2004, Herch 1932, Gowda and Rao 1996, Kshirsagar *et al*. 2001, Mahajan *et al*. 1986) have shown that the distribution of the primary fingerprint patterns is the same for the different ABO blood groups (A, B, AB and O):loop had the highest percentage, followed by whorl and the least was arch. Studies have also reported a significant association between fingerprint patterns and blood groups (Bharadwaja *et al*. 2004; Mehta and Mehta 2011). In contrast, Odokuma *et al*. (2008) reported that there was no significant association between thumb print patterns and ABO blood groups.

Prateek and Keerthi (2010) reported that females have higher frequency of loops and arches compared to males with higher frequency of whorls. Odokuma *et al*. (2008) reported there was no significant association between gender and thumb print patterns.

The spate of crime in our society is on the increase, yet available tools for crime detection seem not to be improving proportionately to combat the emerging challenges. With regard to forensic human identification, fingerprints and blood samples or stains may be the only evidence at a crime scene. The major problem this study intends to address is:Is there a significant association between fingerprint patterns and gender as well as blood group?

Research works have been carried out on digital dermatoglyphics and blood groups independently. However, studies focusing on association between fingerprints and gender as well as blood groups have not been undertaken to this extent in this population. The purpose of this study was to determine fingerprint patterns in relation to gender and blood group among students of Delta state University, Abraka, Nigeria. This will serve as an important aid in sex and blood group determination and vice versa, thus, enhancing the authenticity of fingerprints in investigation of crimes and criminals.

MATERIALS AND METHODS

The descriptive survey method of the quantitative design was used. The newly admitted students of the 20011/2012 academic session in the Delta state University, Abraka, formed the study population.

Sample, Sampling Technique and Data Collection

A total of 490 subjects, aged 17-30 years (mean ± SD = 21.14 ± 3.11), were drawn using the systematic random sampling technique, from students undergoing medical screening at the University Health Centre, Delta State University, Abraka, Nigeria. The ABO and Rhesus blood groups of each subject were obtained from the records in the medical laboratory register. Other data recorded were sex and age of the subject.

The fingerprints of each subject were obtained using endorsing ink and plain white paper. Stamp pad was uniformly soaked with endorsing ink. Each finger was placed on the stamp pad and then transferred to the plain paper and rolled gently from side to side to obtain clear complete print. The prints were analysed based on Cummins method (Cummins 1926; Cummins and Midlo 1943). The three primary ridge patterns were identified and recorded in a data sheet [Figure 1].

Ethical Issues

Prior to data collection, the subjects were informed of the nature and purpose of the study and only those who gave voluntary consent participated in the study. Accordingly, the Research and Ethics Committee of the College of Health Sciences, Delta State University, Abraka, approved the research protocol.

Data Analysis

Figure 1: The three primary fingerprint patterns (From left to right: Arch, Loop and Whorl)

The data were subjected to statistical analysis using frequency distribution and chi square, with the aid of the Statistical Package of Social Sciences (SPSS) version 16. A P value < 0.05 was considered statistically significant.

RESULTS

In this study, of the 490 subjects that participated, 51.8% were females while 48.2% were males. Results showed the dominant ABO blood group in the population was group O (55.9%), followed by group A (22.4%), group B (20.4%) and then group AB (1.2%). Results also showed that Rh+ was the dominant Rhesus factor (97.8%). When ABO-Rh blood group was considered, the prevalence was in the following order:O+ (54.9%), A+ (21.6%), B+ (20.0%), AB+ (1.2%), O- (1.0%), A- (0.8%) and B- (0.4%). The general distribution of primary finger ridge patterns showed that the dominant finger ridge pattern was loop (55.8%), followed by whorl (28.6%) and then arch (15.7%).

Table 1 shows cross tabulation of the chi square test between gender and ABO blood group. Female had higher percentage of blood group O and B while male had higher percentage of blood group A. There was no significant association between gender and blood group ($P > 0.05$).

Table 2 shows cross tabulation of the chi square test between gender and Rhesus blood group. Within the respective blood groups, females had higher percentages compared to males. There was no significant association between gender and Rhesus blood group ($P > 0.05$).

Table 3 shows cross tabulation of the chi square test between gender and ABO-Rh blood group. Within the respective blood groups, females had higher percentages compared to males. There was no significant association between gender and ABO-Rh blood group ($P > 0.05$).

Table 4 shows cross tabulation of the chi square test between gender and fingerprint patterns. Within each fingerprint pattern, female had higher percentage of loop and whorl while male had higher percentage of arch. There was no significant association between gender and fingerprint patterns ($P > 0.05$).

Table 5 shows cross tabulation of the chi square test between fingerprint patterns and ABO blood group. Within the respective blood groups, loop had higher percentages compared to arch and whorl. There was no significant association between fingerprint patterns and ABO blood group ($P > 0.05$).

Table 6 shows cross tabulation of the chi square test between fingerprint patterns and Rhesus blood group. Within the respective Rhesus blood groups, loop had higher percentages compared to arch and whorl. There was a significant association between fingerprint patterns and Rhesus blood group ($P < 0.05$).

Table 7 shows cross tabulation of the chi square test between fingerprint patterns and ABO-Rhesus blood group. Within the respective ABO-Rhesus blood groups, loop had higher percentages compared to arch and whorl, except in blood group O- where whorl has higher percentage. There was a significant association between fingerprint patterns and ABO-Rhesus blood group ($P < 0.05$).

Table 1:Distribution of ABO blood group with regards to gender

ABO blood group	Gender (%)		Total (%)
	Female	Male	
B	510 (51.0)	490 (49.0)	1000 (100.0)
O	1510 (55.1)	1230 (44.9)	2740 (100.0)
AB	30 (50.0)	30 (50.0)	60 (100.0)
A	490 (44.5)	610 (55.5)	1100 (100.0)
Total	2540 (51.8)	2360 (48.2)	4900 (100.0)

χ^2= 3.55, df=3, P=0.314

Table 2:Distribution of Rhesus blood group with regards to gender

Rhesus factor	Gender (%)		Total (%)
	Female	Male	
RH-	70 (63.6)	40 (36.4)	110 (100.0)
RH+	2470 (51.6)	2320 (48.4)	4790 (100.0)
Total	2540 (51.8)	2360 (48.2)	4900 (100.0)

χ^2= 0.628, df=1, P=0.428

Table 3:Distribution of Rhesus blood group with regards to gender

Blood group	Gender (%)		Total (%)
	Female	Male	
A+	460 (43.4)	600 (56.6)	1060 (100.0)
A-	30 (75.0)	10 (25.0)	40 (100.0)
B+	510 (52.0)	470 (48.0)	980 (100.0)
B-	0 (.0)	20 (100.0)	20 (100.0)
AB+	30 (50.0)	30 (50.0)	60 (100.0)
O+	1470 (54.6)	1220 (45.4)	2690 (100.0)
O-	40 (80.0)	10 (20.0)	50 (100.0)
Total	2540 (51.8)	2360 (48.2)	4900 (100.0)

χ^2=8.47, df=6, P=0.21

Table 4:Distribution of finger ridge patterns with regards to gender

Fingerprint	Gender (%)		Total (%)
	Female	Male	
Arch	373 (48.6)	395 (51.4)	768 (100.0)
Loop	1447 (52.9)	1286 (47.1)	2733 (100.0)
Whorl	720 (51.5)	679 (48.5)	1399 (100.0)
Total	2540 (51.8)	2360 (48.2)	4900 (100.0)

χ^2=4.71, df=2, P=0.10

Table 5:Distribution of finger ridge patterns within ABO blood groups

ABO blood group	Fingerprint (%)			Total (%)
	Arch	Loop	Whorl	
B	171 (17.1)	548 (54.8)	281 (28.1)	1000 (100.0)
O	432 (15.8)	1504 (54.9)	804 (29.3)	2740 (100.0)
AB	8 (13.3)	38 (63.3)	14 (23.3)	60 (100.0)
A	157 (14.3)	643 (58.5)	300 (27.3)	1100 (100.0)
Total	768 (15.7)	2733 (55.8)	1399 (28.6)	4900 (100.0)

χ^2=7.36, df=6, *P*=0.289

Table 6:Distribution of finger ridge patterns within Rhesus blood groups

Rhesus factor	Fingerprint (%)			Total (%)
	Arch	Loop	Whorl	
RH-	8 (7.3)	60 (54.5)	42 (38.2)	110 (100.0)
RH+	760 (15.9)	2673 (55.8)	1357 (28.3)	4790 (100.0)
Total	768 (15.7)	2733 (55.8)	1399 (28.6)	4900 (100.0)

χ^2=8.75, df=2, *P*=0.013

Table 7:Distribution of finger ridge patterns within ABO-Rhesus blood groups

Blood group	Fingerprint (%)			Total (%)
	Arch	Loop	Whorl	
A+	154 (14.5)	619 (58.4)	287 (27.1)	1060 (100.0)
A-	3 (97.5)	24 (60.0)	13 (32.5)	40 (100.0)
B+	171 (17.4)	533 (54.4)	276 (28.2)	980 (100.0)
B-	0 (0)	15 (75.0)	5 (25.0)	20 (100.0)
AB+	8 (13.3)	38 (63.3)	14 (23.3)	60 (100.0)
O+	427 (15.9)	1487 (55.1)	780 (29.0)	2690 (100.0)
O-	5 (10.0)	21 (42.0)	24 (48.0)	50 (100.0)
	768 (15.7)	2733 (55.8)	1399 (28.6)	4900 (100.0)

χ^2=23.17, df=12, *P*=0.026

DISCUSSION

In the present study, there was no significant association between gender and fingerprint pattern ($P > 0.05$). Males had higher percentage of arches (51.4%) while female recorded higher percentages of loop (52.9%) and whorl (51.5%). In a related study among 200 medical students of Kasturba Medical College, Mangalore, Prateek and Keerthi (2010) reported that frequency of loops as well as arches is greater in females as compared to a higher frequency of whorls in males. In a related study carried out among Delta state University students, Abraka, Odokuma *et al*. (2008) reported that there was no significant association between gender and thumb print patterns. The present study after using larger sample size and all five fingers, confirms the observation of Odokuma *et al*. (2008).

The general distribution of the primary fingerprint patterns was the same for the different ABO blood groups (A, B, AB and O): Loop had the highest percentage, followed by whorl and the least was arch. This agrees with the findings observed by Mehta and Mehta (2011), Bharadwaja *et al*. (2004), Herch (1932), Gowda and Rao (1996), Kshirsagar *et al*. (2001), Mahajan *et al*. (1986).

Similarly, the general distribution of the primary fingerprint patterns was the same for Rhesus positive and Rhesus negative individuals:loop had the highest percentage, followed by whorl and the least was arch. These same findings were reported by Mehta and Mehta (2011), Kshirsagar *et al*. (2003), Mahajan *et al*. (1986).

The distribution of the primary fingerprint patterns in individuals with the ABO-Rhesus blood groups was the same for A+, A-, B+, B-, AB + and O+:loop had the highest percentage, followed by whorl and the least was arch. However, in blood group O-, whorl had the highest percentage followed by loop and the least was arches. There was a significant association between fingerprint patterns and ABO-Rhesus blood group ($P < 0.05$). These findings agree with Prateek and Keerthi (2010). It also agree with Bharadwaja *et al*. (2004) in the cases of blood group A+, A-, B+, B-, AB+ and O+. It disagrees with Bharadwaja *et al*. (2004) as they reported that loop was highest in blood group O- and AB- which was absent in the present study. In a related study in Libya, Farouz *et al*. (2012) reported that Rh+ve cases of blood group A and O loops incidences were the highest (52% and 54.3%, respectively) then whorls (33.4% and 30.6%, respectively), while in blood group B whorls were predominant in both Rh+ve and Rh-ve cases.

In this study, there was no significant association between fingerprint patterns and ABO blood group ($P > 0.05$). However, there is a significant association between fingerprint patterns and Rhesus blood group, and between fingerprint patterns and ABO-Rhesus blood group ($P < 0.05$).

In a related study, Bharadwaja *et al*. (2004) reported a significant association between fingerprint patterns and blood groups. Also, Mehta and Mehta (2011) reported that there was an association between distribution of fingerprint (dermatoglyphic) pattern and blood groups.

Kshirsagar *et al* (2003) reported that the distribution of fingerprint patterns in A, B, AB and O blood groups was not statistically significant. In a study carried out among Delta state University students, Abraka, Odokuma *et al*. (2008) also reported that there was no significant association between thumb print patterns and ABO blood groups.

Based on the results of this study, it is hereby concluded that the prediction of gender of a person is not possible on the basis of the person's fingerprint pattern. The prediction of ABO blood group of a person is not possible based on the

person's fingerprint pattern. Nevertheless, the prediction of Rhesus and ABO-Rhesus blood group of a person is possible based on the fingerprint pattern of the individual. Consequently, fingerprints, gender and ABO blood groups can only be used independently to identify an individual.

ACKNOWLEDGEMENTS

The author is indeed grateful to Miss Edu Omonigho, for her wonderful assistant role at the stage of data collection. Thanks go to the Medical Director and members of staff of the Delta State University Health Services, for permission, and assistance while the study lasted.

REFERENCES

1. Bharadwaja A., Saraswat P.K., Aggarwal S.K., Banerji P., Bharadwaja S. (2004). Pattern of fingerprints in different ABO blood groups. J Indian Acad Forensic Med 26 (1):6-9.
2. Bloterogel H., Bloterogel W. (1934). Blutgrype and Dactylogramm:Konstitutions Merk Male Der Poliomyelitis. Krapan Zt Rehsf Hindrih 1934;56:143-63.
3. Cummins H. (1926). Palmar and Plantar Epidermal Ridge Configuration (Dermatoglyphics) in Europeans and Americans. Am J Phys Anthrop 179:741-802.
4. Cummins H., Kennedy R.W. (1940). Physiological Examination of visual organ and of the cutaneous system. Am J Crim Law Criminol 31:343-56.
5. Cummins H., Midlo C. (1943). Finger Prints, Palms and Soles. An introduction to Dermatoglyphics. The Blankson Company, Philadephia. p. 9.
6. Eboh D.E. (2012). A study of morphological patterns of lip prints among the yoruba people in Okitipupa, South-Western Nigeria. Afr J Trop Med Biomed Res 1 (4):29-36.
7. Eboh D.E., Nwajei M.O. (2012).Cheiloscopy in relation to ethnicity, gender and monozygotic twins in South-Southern Nigeria. J Exp Clin Anat 11 (2):1-7.
8. Encarta (2009). Microsoft Encarta Dictionary. 1993-2008 Microsoft Corporation.
9. Fayrouz I.N., Farida N., Irshad A.H. (2012). Relation between fingerprints and different blood groups. J Forensic Leg Med 19 (1):18-21.
10. Gowda M.S., Rao C.P. (1996). A study to evaluate relationship between dermatoglyphic features and blood groups. J Anat Soc India 45: 39.
11. Herch M. (1932). Papillarmuster Bei Engeotorenen Der Loyalty Inschm, Berichungan Swischen Papillarmuster and Bluntgrainppen Beidiessen an Liner Dentschem Verglei Chsgrmppe Ztschr F Rasseh Physio 5: 163-8.
12. Herschel W.J. (1880). Skin furrows of the hand. Nature 23 (578):76.
13. Herschel W.J. (1916). The Origin of Finger-Printing. Oxford University Press, Oxford. p. 16.
14. Kshirsagar S.V., Burgul S.N., Kamkhedkar S.G., Maharastra A. (2003). Study of fingerprint patterns in ABO blood group. J Anat Soc India 52 (1):82-115.
15. Limson K.S., Julian R. (2004). Computerized recording of the palatal rugae pattern and an evaluation of its application in forensic identification. J Forensic Odontostomatol 22: 1-4.
16. Mahajan A.A. (1986). Dermatoglyphics and ABO blood group. Thesis submitted for MS Anatomy, Aurangabad.
17. Mehta A.A., Mehta A.A. (2011). Palmar dermatoglyphis in ABO, RH Blood groups. Int J Biol Med Res 2 (4):961-4.
18. Odokuma E.I., Igbigbi P.S. Emudianughe T.S. (2008). A study of thumb print patterns and ABO Blood group distribution. J Exp Clin Anat 7 (1):22-6.
19. Prateek R., Keerthi R.P. (2010). A study of fingerprints in relation to gender and blood group. J Indian Acad Forensic Med 32 (1):11-4.
20. Seema M.A., Gandhi D., Singh M. (2012). Dermatoglyphics-Study and Review of literature. Novel Sci Int J Med Sci 1 (6):191-8.
21. Tsuchihashi Y. (1974). Studies on personal identification by means of lip prints. Forensic Sci 3: 233-48.
22. Vahanwala S. (2005). Study of lip-prints as an aid for sex determination. Med Leg Update 5: 93-8.
23. Vij K. (2005). Textbook of Forensic Medicine and Toxicology. 3rd ed. Elsevier, New Delhi. 89-91.

How to cite this article: Eboh DE. Fingerprint patterns in relation to gender and blood group among students of Delta State University, Abraka, Nigeria. J Exp Clin Anat 2013;12:82-6.

Source of Support: Nil, **Conflict of Interest:**None declared.