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Finger Dermatoglyphic Patterns In Relation To Blood Group Of The Birim-North Population Of Ghana

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Abstract: ***Among the most common type of physical eveidence encountered usally in many crime scenes are fingerprints and blood. This study was conducted in the Birim-North District, Ghana on 400 subjects of which 215 were females and 185 were males. All ten fingertip impressions of subjects were obtained by ink method and classified into Arches, Loops and Whorls. The fingertip impressions and their associations with blood group of subjects were analyzed statistically using chi-square test. Results showed that, majority of the subjects (54.3%) in the study were of blood group O followed by blood group A (21.3%), B (20.8%) and AB (3.8%) respectively, of whom 95.0% were Rh-positive and 5% being Rh-negative. In terms of ABO-Rh blood group, majority of the subjects belonged to blood group O-positive with AB-negative being the rarest. Over 60.00% of all primary fingerprint pattern types were loop, 31.75% were whorl, while 8.07% were arch. In all ABO-Rh blood groups, loop had higher percentages compared to whorls and arches, except in B-negative subjects where whorls predominated. It is concluded that there is association between fingerprints and blood group (ABO and ABO-Rh) (P<0.05). Therefore, studying fingerprints and blood group further deep may help in prediction of blood groups based on fingerprint pattern available and vice versa and thus enhancing the accuracy of using fingerprints for answering forensic human identification questions in the population.***

Keywords: ***Fingerprint patterns, ABO blood group, Rhesus (Rh) blood group, Dermatoglyphics, ABO-Rh blood group, loop, whorl, arch.***

I. INTRODUCTION

Individual identification is adecisive and an urgent task in forensic investigation. Law enforcement agencies are now inundated with request to provide sufficient evidence that would lead to the linking of a perpetrator to a crime or identifying disaster victims, thus it becomes imperative to make use of any physical characteristics that would help identify a suspect of an offence or a victim (Srilekha *et al.*, 2014). Some methods used for human identification are fingerprinting, dactyloscopy, DNA, palatal rugae pattern, anthropometry, age estimation, and blood group differentiation among others (Kannan and Mathiharan, 2007). For a physical characteristic to be used as an identification marker, it should be very unique and permanent. Finger prints, lip prints and blood groups are biological characteristics that are persistent from birth to death of an individual (Srilekha *et al.*, 2014).

The human palms and fingers have ridges (raised lines) and furrows (depressions) on their surfaces. So do the soles and toes. The set up (arrangements) of the ridges and furrows form patterns called prints which are unique for every individual and are stable throughout the life of the individual. Even the fingerprints of monozygotic twins differ (Bushra and Devanand, 2014).The study of the arrangements of ridges and furrows of palms and toes is referred to as Dermatoglyphics (Cummins and Mildo, 1961).

Another extremely important biological record that remains unchanged during the entire life of a person is the blood group, discovered by Karl Landsteiner in 1901. According to Pattanayak (2006), determining the blood group of a person from the samples obtained at the site of crime

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alone or along with other trace evidence(s) can play a very vital role to settle different criminal problems definitely and conclusively and thus help identify a person.

A correlative study between fingerprints and blood groups may reveal interdependence since both show ethnic and genetic variation (Otoo and Bozotti, 1968). The aim of this study was to study the relationship between the distribution of different primary fingerprint patterns with blood group and gender.

II. MATERIALS AND METHODS

Self inking pad, magnifying lens, white paper (A4 sheet) ,blood grouping antiserum (A,B and D), white tile, syringe and needles, EDTA blood collection tubes, blood samples, cotton wool, torniquets, were the materials used. The research protocol was approved by the Ethics Committee of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology, Ghana. A total of 400 subjects comprising 215 females and 185 males aged between 18-55 years who gave voluntary consent were drawn using the simple random sampling technique. The nature, purpose and procedure for obtaining sample for the study were expalined to subjects before acquisition of both fingerprint and blood samples. Venous blood was obtained for the determination of ABO and Rhesus blood groups. Subjects were instructed to wash their hands and made to dry them using paper towel. The subject was asked to press the fingertip of each finger of the left hand on the Self-inking pad provided. They were then asked to press their fingertips gently on the plain paper to make an impression of their fingertips. The same procedure was followed for the fingers of the right hand too. After taking the imprints, the subjects were asked to wash their hands using soap and water to remove prints. Each fingerprint was assigned a number (1, 2, 3, 4 and 5 for the thumb, index, middle, ring and little fingers, respectively). The printed sheets were coded, and information regarding sex, ABO as well as Rh blood groups was recorded on the sheets. The fingerprint patterns were then studied and identified as being loop, whorl or arch with the aid of a magnifying lens and recorded on a data sheet. Subjects who have scars or deformities on any of their fingers were excluded from the study. Chi square was used to analyse data and test were considered significant when P value < 0.05.

III. RESULTS

Table 1 shows the distribution of male and female subjects according to their ABO blood group. Most of the subjects from the study belonged to the blood group O (54.3%). Blood group A subjects were 85 (21.3%) and 83(20.8%) were in blood group B with AB blood group being 15 (3.8%). Blood group AB was seen more among males (5.4%) as compared to females (2.3%), while blood group O was seen more among females (56.3%) compared to males (51.9%). However, the percentage of blood groups A and B in both genders were almost equal (21.6% and 21.1% respectively for male and 20.9% and 20.5%, respectively for female).

ABO Blood group	Male		Female		Total	
	Frequency	percent	Frequency	Percent	Frequency	Percent
A	**40**	21.6	**45**	20.9	**85**	21.3
B	**39**	21.1	**44**	20.5	**83**	20.8
O	**96**	51.9	**121**	56.3	**217**	54.3
AB	**10**	5.4	**5**	2.3	**15**	3.8
Total	**185**	100	**215**	100	**400**	100

Table 1: The distribution of male and female subjects according to ABO blood group

Table 2 shows the distribution of male and female sexes according to Rh blood groups. Rh-positive contributed 380 (95.00%) of subjects while Rh-negative were 20 (5.00%). The male subjects had lower proportion (3.8%) of Rh-negative.

Rh Factor	Male		Female		Total	
	Frequency	percent	Frequency	percent	Frequency	percent
Positive	178	96.20	202	93.95	380	95.00
Negative	7	3.80	13	6.05	20	5.00
Total	185	100	215	100	400	100

Table 2: Distribution of male and female sexes according to Rh blood group

The distribution of basic fingerprint patterns of both hands of subjects is shown in Figure 1. In both hands of male and female subjects the commonest basic fingerprint pattern was the loop. Total number of loop found in all the digits was 2407 (60.20%). Additionally, in all fingertips of both right and left hands, whorls were 1270 (31.70%) and arches were 323 (8.10%).

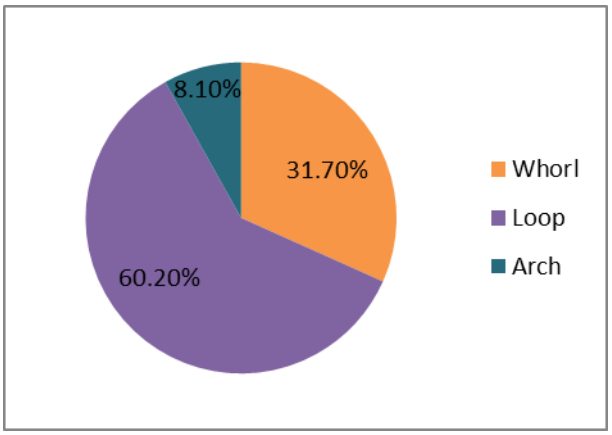

Figure 1: Percentage distribution of the basic fingerprint patterns in both hands of subjects

Figure 2 shows the distribution of primary fingerprint patterns according to ABO-Rh in the left hand of both male and female subjects. Loop was highest in ABO-Rh blood groups; whorls and arches follow respectively, with the exception in subjects of blood group B- where whorl (76.00%) was more. ABO-Rh blood group B- and AB- subjects had no arch pattern in any finger of the left hand.

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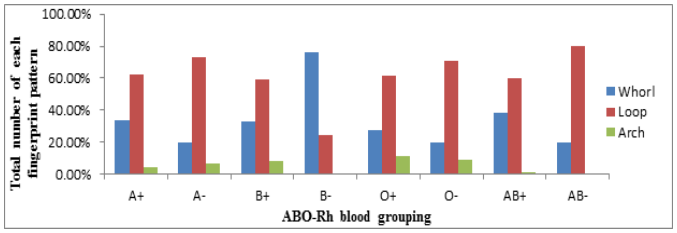

Figure 2: Distribution of primary fingerprint patterns according to ABO-Rh in the left hand of both male and female subjects

Figure 3 shows distribution of primary fingertip patterns according to ABO-Rh Blood groups in right hand of subjects. Here again, the Loop pattern had highest frequency in all ABO-Rh subjects; whorls and arches followed respectively, except in subjects of B- where whorl pattern was more (72.0%). Again B- subjects had no arch in any finger of the right hand.

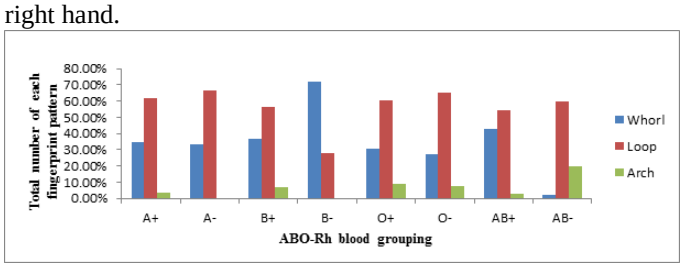

Figure 3: Distribution of primary fingertip patterns according to ABO-Rh Blood groups in right hand of subjects

Figure 4 shows general distribution of fingertip patterns according to ABO-Rh groups in both right and left hands of subjects. The Loop pattern had the most numbers in all the ABO-Rh groups with whorl and arch patterns following respectively, with the exception of subjects of ABO –Rh blood group B- where the occurrence of the whorl pattern were more in Rh-negative subjects (74.0%).

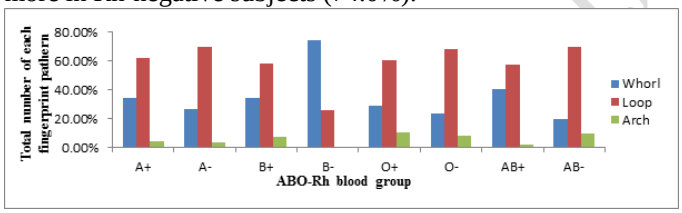

Figure 4: General distribution of fingertip patterns according to ABO-Rh groups in both right and left hands of subjects

Cross tabulation of the chi square test between ABO-Rhesus Blood Group and primary fingerprint patterns is shown below in Table 3. There was a significant association between ABO-Rhesus and fingerprint pattern ($p < 0.05$).

		Fingerprint Patterns			
		Whorl	Loop	Arch	Total
Blood group	A+	279(34.02%)	507(61.83%)	34(4.15%)	820(100%)
	A-	8(26.67%)	21(70.00%)	1(3.33.00%)	30(100%)
	B+	268(34.36%)	452(57.95%)	60(7.69%)	780(100%)
	B-	37(74.00%)	13(26.00%)	0(0.00%)	50(100%)
	O+	593(28.79%)	1252(60.77%)	215(10.44%)	2060(100%
	O-	26(23.64%)	75(68.18%)	9(8.18%)	110(100%)
	AB+	57(40.71%)	80(57.14%)	3(2.15%)	140(100%)
	AB-	2(20.00%)	7(70.00%)	1(10.00%)	10(100%)
	Total	1270(31.75%)	2407(60.18%)	323(8.07%)	4000(100%)

Chi- sq, X2 = 97.26 df=14 p = 0.000

Table 3: Blood group (ABO-Rh) and Fingerprint Patterns Cross tabulation

Table 4 shows cross tabulation of the chi squarer test between gender and fingerprint patterns. Females had higher percentage of arch pattern whereas males had higher percentage of loop. Both males and females contributed almost equal percentages of whorl pattern (31.78%) respectively). There was a significant association between gender and fingerprint pattern ($p<0.05$).

		Gender		
		Male	Female	Total
Fingerprint Patterns	Whorl	588(31.78%)	682(31.72%)	1270(31.75%)
	Loop	1142(61.73%)	1265(58.84%)	2407(60.18%)
	Arch	120(6.49%)	203(9.44%)	323(8.07%)
	Total	1850(100%)	2150(100%)	4000(100%)

Chi-Sq., X^2=12.139 df= 2 p = 0.002

Table 4: Fingerprint Patterns and Gender Cross tabulation

IV. DISCUSSION

In this study, the general distribution pattern of the primary fingerprint was high frequency of loop (60.2%), moderate whorl (31.7%) and low arch (8.1%). Similar outcomes were presented by Awuah *et al.* (2017), Verma *et al*. (2015), Ekanem *et al*. (2014), Eboh, (2013), Mehta and Mehta (2011), Bharadwaja *et al*. (2004). Most subjects were in ABO blood group O (54.3%); blood groups A (21.3%) and B (20.8%) followed respectively with AB contributing the minimum (3.8%). Rhesus (D)-positive subjects were 95% while Rhesus (D)-negative subjects were 5%. In a related work, Eboh (2013), reported blood group O (55.9%) followed by group A (22.4%) group B (20.4) and then group AB (1.2%). The results of Eboh (2013) studies also showed that Rh-positive (97.8%) was the dominant Rhesus blood group with Rh-negative (2.20%) being the least occurring. However, results of this present work differ compared to the studies of Verma *et al.* (2015), and Desai *et al*. (2013), where the predominant ABO blood type was B. Blood types O, A and then AB followed in that order. Verma *et al*. (2015), reported B being 41.5%, O being 26.0%, A being 18.0%, and AB being 9.0% in their studies conducted among 200 medical students (in Rohtak, India) of which 113 were females and 87 males while Desai *et al*. (2013), in their studies (conducted in Hubli-Dharwad of Karnataka, India), also reported B (35%), O (34%), A (19.5%), and AB (6.5%).

Among residents of the Birim-North District, loop pattern occured the most in subjects of ABO blood groups. Whorls and arches then followed respectively. These are in agreement with the studies conducted by several other workers like Verma *et al*. (2015), Ekanem *et al*. (2014), Eboh (2013), Desai *et al*. (2013), Mehta and Mehta (2011), Bharadwaja *et al*. (2004).

The primary fingertip pattern distribution was the same for all ABO-Rh groups. Loop had the highest percentage, followed by whorl and the least was arch. However, in blood group B- whorl predominated followed by loop and then arch being the least. There was a significant association between fingerprint patterns and ABO-Rhesus blood group, $P<0.05$. These findings agree with those of Verma *et al.* (2015), and Eboh (2013), except that in both studies the incidences of

whorls were highest in blood group O- subjects. The findings of Bharadwaja *et al*. (2004), is at variance with this study with regards to blood group B- where the loop was found to be highest. Mehta and Mehta (2011) also reported an association between fingertip pattern distribution and ABO blood groups. In contrast, a study conducted in Nigeria by Odukuma *et al*. (2008) reported the absence of significant association between thumb print patterns and ABO blood groups.

There was an association between fingertip patterns and gender ($P<0.05$). Males had higher percentage of loop whereas females had higher percentage of arch. This is similar to the study conducted among 30 African-Americans which revealed that African- American females had more of loop and arch patterns whereas their male counterparts had more whorls (Wang *et al*. 2010). However, Odukuma *et al*. (2008) also reported that there was no significant association between thumbprint patterns and gender in their study conducted among Delta State University students in Nigeria. Similarly, Eboh (2013) reported no significant association between gender and fingerprint patterns.

V. CONCLUSION

The study showed that the commonest type of primary fingerprint pattern observed in the Birim-North District population is loop; followed by whorl and arch being the least in both males and females. Males had higher percentage of loop whereas females had higher percentage of arch. In terms of ABO-Rh blood group O+ predominated and the rarest was AB-. Loops were predominantly observed in blood group A, O and AB in both Rhesus positive and Rhesus negative subjects. Whorls were predominant in blood group B-negative.

From the study, there is an association between the distribution of primary patterns of fingerprint with ABO-Rh blood groups and gender. Therefore, studying the association between the distribution of fingerprint patterns and blood group further deep may help in prediction of blood groups based on fingerprint pattern available.

REFERENCES

[1] Awuah, D., Dzogbefia, V. P., & Chattopadhyay, P.K. (2017). Finger dermatoglyphic of the Asante Population of Ghana. *International Journal of Innovative Research and Advanced Studies*. 4(4),333-336.

[2] Bharadwaja, A., Saraswat , P.K., Agarwal, S.K., Banerji, P., & Bharadwaja, S. (2004). Patterns of fingerprints in different ABO blood groups. *Journal of Forensic Medicine and Toxicology*. 21(2), 49-52.

[3] Bushra, K.,. & Devanand, G. (2014). Cheiloscopy and blood groups: Aid in Forensic Identification, The Saudi Dental Journal. 49(26), 176-180.

[4] Cummins, H. & Midlow C. (1961). Fingerprints Palms and Soles, an Introduction to Dermatoglyphics. *New York, Dover Publication.*

[5] Desai, B., Jaiswal, R., Tiwari, P., & Kalyan, J.L. (2013). Study of fingerprint patterns in relationship with blood group and Gender – a statistical review. Res J Forensic Sci 1(1), 15-17.

[6] Eboh, D.E. (2013). Fingerprint Patterns in Relation to Gender and Blood Group among Students of Delta State University, Abraka, Nigeria. *J Exp Clin Anat* 12, 82-86.

[7] Ekanem, A.U., Abubakar, H., & Dibal, N. (2014). A study of fingerprints in relation to gender and blood group among residents of Maiduguri, Nigeria. *IOSR Journal of Dental and Medical Science.* 13(8), 18-20.

[8] Kannan, K., & Mathiharan, K. (2007) Personal Identity. A Text Book of Medical Jurisprudence and Toxicology. New Delhi, Lexus Nexis.

[9] Mehta, A. A., & Mehta, A. A. (2011). Palmar Dermatoglyphics in ABO and Rh blood groups. *Int. J. Bio. Med. Res*. 2(4), 961-964.

[10] Odukuma, 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),22-26

[11] Otto, P., & Bozotti, M. (1968). Digital Dermatoglyphics and Blood Groups. *Lancet*. 2, 250-251.

[12] Pattanayak, I. (2006). Distribution of A1 A2 B O and Rh Blood Groups among the Rajputs of Uttaranchal. *Anthropologist*. 8(2), 139-140.

[13] Srilekha, N., Anuradha, A., Vijay S.G., & Sabitha, D. R. (2014). Correlation among Lip prints Pattern, Finger print Pattern and ABO Blood Group. *Journal of Clinical and Diagnostic Research*. 3(8), 49-51.

[14] Verma U., Singroha.R. and Malik P. (2015). A study to find correlation between dermatoglyphic patterns and ABO blood groups. *Int J Anat Res*. 3(3), 1293-1297.

[15] Wang, L, &Alexander, C.A. (2010). Study of Fingerprints in Relation to Gender and blood group. *Journal of Indian Academy of Forensic Medicine* 32(1), 11-14.