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

Oboakoh Isaac
MSc Forensic Science, Department of Biochemistry and
Biotechnology, Kwame Nkrumah University of Science and
Technology, Ghana

Victoria P. Dzogbefia
Professor of Biochemistry, Department of Biochemistry and
Biotechnology, Kwame Nkrumah University of Science and
Technology, Ghana

Abstract: Among the most common type of physical evidence encountered usually 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 a decisive 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 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. Fingerprints, 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
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, tourniquets, 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 explained to subjects before acquisition of both fingerprint and blood samples.

Venous blood was obtained for the determination of ABO and Rh blood groups. Subjects were instructed to wash their hands using soap and water to remove prints. The fingerprint impressions, the subjects were asked to wash their hand followed for the fingers of the right hand too. After taking the impression of their fingertips. The same procedure was repeated for the left hand. 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 in the left hand of both male and female subjects had no scars or deformities on any finger. However, the percentage of blood groups A and B in males was more. Blood group AB was seen more among males (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).

<table>
<thead>
<tr>
<th>Blood group</th>
<th>Frequency</th>
<th>Male</th>
<th>Percentage</th>
<th>Female</th>
<th>Percentage</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>40</td>
<td>21.6</td>
<td>45</td>
<td>20.9</td>
<td>85</td>
<td></td>
<td>21.3</td>
</tr>
<tr>
<td>B</td>
<td>39</td>
<td>21.1</td>
<td>44</td>
<td>20.5</td>
<td>83</td>
<td></td>
<td>20.8</td>
</tr>
<tr>
<td>O</td>
<td>96</td>
<td>51.9</td>
<td>121</td>
<td>56.3</td>
<td>217</td>
<td></td>
<td>54.3</td>
</tr>
<tr>
<td>AB</td>
<td>10</td>
<td>5.4</td>
<td>5</td>
<td>2.3</td>
<td>15</td>
<td></td>
<td>3.8</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Rh Factor</th>
<th>Frequency</th>
<th>Male</th>
<th>Percentage</th>
<th>Female</th>
<th>Percentage</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>178</td>
<td>96.2</td>
<td>202</td>
<td>93.95</td>
<td>380</td>
<td></td>
<td>95.00</td>
</tr>
<tr>
<td>Negative</td>
<td>7</td>
<td>3.8</td>
<td>13</td>
<td>6.05</td>
<td>20</td>
<td></td>
<td>5.00</td>
</tr>
</tbody>
</table>

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%).

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).

![Figure 1: Percentage distribution of the basic fingerprint patterns in both hands of subjects](image-url)

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.
Table 4 shows cross tabulation of the chi squared 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).

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 occurred 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 fingerprint 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 thumbprint 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


