Fingerprints as an Alternative Method to Determine ABO and Rh Blood Groups

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ABSTRACT

Introduction: Blood grouping is conventionally done with invasive method by taking blood samples. The objective of this study is to determine blood group with uninvasive procedure by taking fingerprints of the participants and know the associations between their fingerprints and blood groups.

Methods: Seven hundred participants of both genders with no any age limitation from Manipal Teaching Hospital and Manipal College of Medical Sciences were randomly selected. The blood grouping was done by cross reacting blood sample with the antibodies. The fingerprints were taken with the help of stamp pad imprinting the finger ridges over A4 size white papers. The loop, whorl and arch patterns were studied.

Results: O+ve blood group 224 (32%) was most prevalent among 700 participants. The loop pattern was highly distributed 3708 (53%) in all blood groups except in A-ve blood group with highest distribution of whorl 20 (40%). The mean comparisons of specific fingerprint in total and also in individual fingers with different ABO and ABO-Rh blood groups showed no any statistical association with P>0.05. However, the loop distribution in individual finger was highest in right middle finger (M) of B-ve blood group 5 (10%). The whorl distribution in individual finger was highest in right index (I), left thumb (T) and left ring (R) fingers of AB+ve blood group 20 (5.5% each). Similarly, the arch distribution was highest in right index fingers of A-ve blood group 3 (6%).

Conclusions: The mean comparison of different fingerprints with ABO and Rh blood groups showed no significant statistical association concluding fingerprints cannot be used for blood grouping.

Keywords: *arch; blood group; fingerprints; loop; whorl.*

INTRODUCTION

Blood grouping is the classification of blood based on the inherited antigenic substances on the Red Blood Cell's surface.[1] A total of 33 human blood group systems have been recognized.[2] Clinically 'ABO' and 'Rhesus' blood groups are more likely to cause blood transfusion reactions.[3]

Fingerprint is an impression left by the friction ridges of a human finger which do not change throughout life.[4] Theyaredivided by Henry Classification System into loop, whorl and arch, which constitutes 60–65%, 30–

35% and 5% respectively.[5]

Studies showed high loop distribution in blood group A+ve and O+ve,[6-8] high whorl distribution in blood group AB(Rh +ve and –ve),[7]and high arch in A-ve and AB+ve blood groups.[8] A significant association between fingerprints and blood groups was reported.[6,8,9]

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This study aims to find the association of blood groups with fingerprints in Nepalese population.

METHODS

This cross-sectional study was carried out in Manipal Teaching Hospital and Manipal College of Medical Sciences after getting ethical clearance from the Institutional Review Committee in between June and August of 2017. A total of 700 samples from students, faculties and patients were included of any age and gender. The participation was done by verbally informed consent. The blood grouping was done by conventional invasive procedure in which the blood sample was taken by finger pricks under aseptic conditions followed by reacting it with antibodies anti-A, anti-B and anti-Rh in the glass slides. The presence of agglutination to specific antibody will determine the presence of corresponding antigen in the surface of red blood cell of that individual which gave the blood group of the participants. The fingerprints of all ten fingers of the participants were taken by the help of stamp pad that imprinted the fingerprints over clear A4 size white papers. The whorl, loop and arch pattern among the fingers were thus interpreted.

Participants if had permanent scars on their fingers or with any hand deformities due to injury or had any unwillingness were excluded from the study.The data were entered in SPSS-16 and the descriptive analysis was done. The association between blood groups and fingerprints were calculated by comparing mean among various groups by one way anova test considering $P > 0.05$ as not significant; $P < 0.05$ as significant and $P < 0.001$ as highly significant taking confidence interval of 95%.

RESULTS

Male participation was 607 (86.7%) in 700 samples and the remaining was female. O+ve was the highly prevalent blood group among male participants whereas A+ve was highly prevalent blood group in female participants. The primary fingerprint pattern was loop followed by whorl and arch in total as well as gender distribution of subjects (Table 1).

Table 1. Distribution of Blood Groups and Fingerprints in the participants (n = 700).

Variables		Gender		
		Male n(%)	Female n(%)	Total n(%)
Blood group	O+ve	195(32.2%)	29(31.2%)	224(32%)
	A+ve	187(30.8%)	31(33.3%)	218(31.1%)
	B+ve	183(30.2%)	23(24.8%)	206 (29.4%)
	AB+ve	29(4.8%)	7(7.5%)	36(5.1%)
	O-ve	5(0.82%)	1(1.07%)	6(0.85%)
	A-ve	5(0.82%)	0(-)	5(0.71%)
	B-ve	3(0.49%)	2(2.15%)	5(0.71%)
	AB-ve	0(-)	0(-)	0(-)
	Total	607(86.7%)	93(13.3%)	700(100%)
Finger Prints	Arch	748 (12.37%)	79(8.5%)	827(11.8%)
	Loop	3171 (52.2%)	537(57.7%)	3708(52.9%)
	Whorl	2151 (35.4%)	314(33.7%)	2465(35.2%)

The comparison of mean of total arch, loop and whorl in different blood groups showed no any statistically significant association of fingerprint with blood groups [P>0.05].Similarly, there was no significant association of mean of loop, whorl and arch with Rh+ve and Rh-ve cases (Table 2).

Table 2. Total fingerprint distributions and its mean comparison in different blood group systems.

Blood Group System Arch n (%) Loop n (%)		Whorl n (%)	Fingerprint patterns in all fingers	
ABO System A + ve	O + ve	252(11.3%)	1170(52.2%)	818(36.5%)
	220(10.1%)	1173(53.8%)	787(36.1%)	
B + ve	309(15%)	1081(52.5%)	670(32.5%)	
AB + ve	28(7.7%)	192(53.3%)	140(38.8%)	
O-ve	6(10%)	39(65%)	15(25%)	
A-ve	11(22%)	19(38%)	20(40%)	
B-ve	1(2%)	34(68%)	15(30%)	
AB-ve	-	-	-	
Total	827(12%)	3708(53%)	2465(35%)	
	Mean	1.17 ± 1.91	5.30 ± 2.86	3.53 ± 2.86
	P	0.065	0.602	0.813
	Rh + ve	809(12%)	3616(52%)	2415(35%)
Rh System	Mean	1.17 ± 1.91	5.29 ± 2.86	3.53 ± 2.88
	Rh-ve	18(11.25%)	92(57.5%)	50(31.25%)
	Mean	1.12 ± 1.99	5.75 ± 2.88	3.12 ± 2.02
	P	0.9	0.5	0.5

The maximum number of loops was seen in left small (S) finger of O + ve blood group. However, the percentagewise loop distribution was highest in right middle fingers of B-ve blood group. There was statistically no any association between mean of loop in individual finger when compared with different blood groups (Table 3).

Table 3. Loop distribution and its mean comparison in individual fingers with the blood groups.

Blood Group	Right					Left					Total
	T n/%	I n/%	M n/%	R n/%	S n/%	T n/%	I n/%	M n/%	R n/%	S n/%	n/%
O + ve	103	100	144	90	142	115	96	129	97	154	1170
	4.6	4.5	6.4	4.1	6.3	5.1	4.3	5.8	4.3	6.8	52.23
A + ve	99	110	131	92	138	123	107	130	92	151	1173
	4.5	5.0	6	4.2	6.3	5.6	5.0	6.0	4.2	7.0	53.80
B + ve	97	94	124	83	126	107	101	133	84	132	1081
	4.7	4.5	6.0	4.0	6.1	5.1	5.0	6.4	4.0	6.4	52.47
AB + ve	18	12	22	17	28	14	16	24	14	27	192
	5	3.3	6.1	4.7	7.7	3.8	4.4	6.6	3.8	7.5	53.3
O-ve	5	3	5	2	3	5	5	5	3	3	39
	8.3	5	8.3	3.3	5	8.3	8.3	8.3	5	5	65

A-ve	0	2	3	0	3	3	2	2	2	2	19
	-	4	6	-	6	6	4	4	4	4	38
B-ve	2	3	5	2	4	4	3	4	3	4	34
	4	6	10	4	8	8	6	8	6	8	68
AB-ve	-	-	-	-	-	-	-	-	-	-	
Mean	7.0±2.2	7.1±2.1	6.6±2.2	7.2±2.1	6.5±2.3	6.7±2.3	6.9±2.3	6.6±2.3	7.3±2.1	6.3±2.4	
P	0.68	0.33	0.39	0.65	0.14	0.49	0.27	0.17	0.72	0.11	

The maximum number of whorls was seen in right ring finger of O+ve blood group. The percentagewise whorl distribution was highest in right index, left thumb and left ring fingers of AB+ve blood group. There was statistically no any association between mean of whorls in individual fingers when compared with different blood groups (P>0.05) (Table 4).

Table 4. Whorl distribution and its mean comparison in individual fingers with the blood groups.

Blood Group	Right					Left					Total
	T n/%	I n/%	M n/%	R n/%	S n/%	T n/%	I n/%	M n/%	R n/%	S n/%	n/%
O + ve	102	94	53	119	60	85	80	66	109	50	818
	4.5	4.2	2.3	5.3	2.7	3.8	3.6	3	4.8	2.2	36.5
A + ve	106	77	60	112	60	73	79	58	113	49	787
	4.8	3.5	2.8	5.1	2.8	3.3	3.6	2.6	5.1	2.2	36.1
B + ve	92	69	47	101	54	68	64	36	98	41	670
	4.5	3.3	2.3	5	2.6	3.3	3.1	1.7	4.8	2.0	32.5
AB + ve	17	20	12	18	6	20	14	8	20	5	140
	4.7	5.5	3.3	5	1.6	5.5	3.8	2.2	5.5	1.4	38.8
O-ve	1	2	1	3	2	0	1	1	2	2	15
	1.6	3.3	1.6	5	3.3	-	1.6	1.6	3.3	3.3	25
A-ve	5	0	0	4	1	2	1	1	3	3	20
	10	-	-	8	2	4	2	2	6	6	40
B-ve	3	2	0	3	1	1	1	1	2	1	15
	6	4	-	6	2	2	2	2	4	2	30
AB-ve	-	-	-	-	-	-	-	-	-	-	
Mean	5.1±2.6	5.8±2.4	6.5±2.4	5.2±2.5	6.3±2.4	5.5±2.6	6.0±2.4	6.6±2.3	5.4±2.5	6.3±2.3	
P	0.53	0.65	0.91	0.85	0.70	0.82	0.31	0.85	0.42	0.80	

Table 5. Arch distribution and its mean comparison in individual fingers with the blood groups.

Bloodgroup	Right					Left					
	T	I	M	R	S	T	I	M	R	S	Total
	n/%	n/%	n/%	n/%	n/%	n/%	n/%	n/%	n/%	n/%	n/%
O + ve	19	30	27	15	22	24	48	29	18	20	252
	0.8	1.3	1.2	0.6	0.9	1	2.1	1.3	0.8	0.9	11.25
A + ve	13	31	27	14	20	22	32	30	13	18	220
	0.6	1.4	1.2	0.6	0.9	1	1.4	1.3	0.6	0.8	10.09
B + ve	17	43	35	22	26	31	41	37	24	33	309
	0.8	2.0	1.7	1.0	1.3	1.5	1.9	1.8	1.2	1.6	15
AB + ve	1	4	2	1	2	2	6	4	2	4	28
	0.3	1.1	0.5	0.3	0.5	0.5	1.6	1.1	0.5	1.1	7.7
O-ve	0	1	0	1	1	1	0	0	1	1	6
	-	1.6	-	1.6	1.6	1.6	-	-	1.6	1.6	10
A-ve	0	3	2	1	1	0	2	2	0	0	11
	-	6	4	2	2	-	4	4	-	-	22
B-ve	0	0	0	0	0	0	1	0	0	0	1
	-	-	-	-	-	-	2	-	-	-	2
AB-ve	-	-	-	-	-	-	-	-	-	-	
Mean	4.5±2.6	3.6±2.3	4.3±2.2	5.1±2.3	5.0±2.0	3.7±2.3	3.5±2.2	4.2±2.2	4.9±2.2	4.5±2.3	
P	0.77	0.93	0.78	0.82	0.78	0.93	0.97	0.74	0.54	0.97	

The maximum number of arch was seen in left index finger of O + ve blood group. The percentagewise arch distribution was highest in right index fingers of A-ve blood group. There was statistically no any association between mean of arch in individual finger when compared with different blood groups (P > 0.05) (Table 5).

DISCUSSION

In this study, O + ve was the most prevalent blood group in 700 participants with no any subject with AB-ve blood group. The predominance of O + ve blood group in Nepalese student had also been previously reported.[10] However; the female participants in this study had A + ve blood group with the highest distribution. The distribution of loop fingerprint was the highest followed by whorl and arch in general and according to the blood groups as well which was consistent with previous studies.[6,11,12] The exception to finding was seen in A-ve blood group participants where whorl was predominating to loop followed by arch in this study. Similar exception was seen in AB-ve blood group and O-ve blood group in Indian population.[6,11] Loop was predominating in both gender which contrasts with the literatures.[1,9,12]

All the fingerprints were highly distributed in O + ve blood group which may correlates with the fact that maximum participants in this study have O + ve blood group. However, percentagewise loop distribution was highest in right middle fingers of B-ve blood group. The percentagewise whorl distribution was highest in right index, left thumb and left ring fingers of AB + ve blood group and percentagewise arch distribution was highest in right index fingers of A-ve blood group. Similar increase percentage of whorls in AB blood groupand arch in A-ve blood grouphave been found previously.[6,8]

The mean of total loops when compared with different blood groups showed no any statistical association with $P > 0.05$. Similar was the result when mean of total whorls and arches compared with different blood groups. This result contrasts with the studies which claimed association of fingerprint with blood group.[6,8,13] However, no such association was also reported in ABO blood group system.[9] Also, the mean comparison of fingerprints in individual fingers with different blood group was done. There was no any statistical association when mean of fingerprint in individual finger was taken as well. The study also showed that the mean of loop, whorl and arch has no any statistical association when compared with Rh positive and Rh negative blood group. This result also contrasts with the previous findings which showed association of fingerprint with Rhesus blood group.[9]

This study has focussed on the patterns of fingerprints only. However, if the study was done with total ridge count present in fingers, the result may be different and more valuable.

CONCLUSIONS

This study finds no association of blood groups with fingerprints among participants. However, further researches with account of many other blood groups and higher techniques to identify fingerprints may highlight some new perspectives regarding the topic.

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Conflict of Interest: None.

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