

## Digital Dermatoglyphic and ABO Blood Groups

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### ABSTRACT

**Background:** Finger prints are considered as the best tool of identification. Digital dermatoglyphic has been found useful in forensic medicine and identification purpose. It is useful in medical diagnosis of genetically inherited diseases and in detection of crimes. **Material & Method:** The present study was carried out to understand the genetic relationship if any, among different blood groups using classical dermatoglyphic marker in 292 subjects. Finger print patterns were collected on a white paper using black endorsing ink. Study was done by counting and classifying their ridge pattern, configuration of arches, loops and whorls. The ridges were counted and patterns were identified using glass hand lens. **Results:** Majority of subjects were 33.90% in the study of blood group of O, 30.82% of blood group B, 23.63% of blood group A and 11.64% of blood group AB. The general distribution of pattern of finger print showed high frequency of loops 53.56% whereas whorls were moderate 39.48% and arches were least 6.95% in frequency, was significant ( $p < 0.01$ ) in all blood groups. **Conclusion:** The study suggests that there is an association between finger print pattern and blood groups.

**Key words:** Finger print, dermatoglyphic, ABO blood group, identification.

### INTRODUCTION

Through decades of scientific research, the hand has come to be recognized as a powerful tool in the diagnosis of psychological, medical and genetic conditions. It was in 1926 that Cummins introduced the term "Dermatoglyphic". It the term applied to the study of naturally occurring patterns of the surface of the hand and feet. Cummins found that the configurations of ridge pattern are determined partly by heredity and partly by accidental or environmental influence which produce stress and tension in their growth during foetal life<sup>1</sup>. Finger ridge and ridge pattern are

highly heritable, durable and age independent human traits and have been studied a model quantitative trait in humans for over 80 years<sup>2</sup>. Dermatoglyphic traits are those that are inherited as individual specific traits. They are supposed to play an important role in the human biological research. These traits are useful in both population studies as well as estimating distances between the populations. The dermal ridges originate from foetal volar pads composed of mesenchymal tissue starting at the 6<sup>th</sup> to 7<sup>th</sup> week of development. Ridges become visible at about 3<sup>rd</sup> month and are completed by the 6<sup>th</sup> month of prenatal development<sup>3</sup>. Parkinje for the first time distinguished 9 principal configurations of rugae and sulci present on the terminal phalanges of human hands<sup>4</sup>. Faulds mentioned that the pattern of these papillary ridges remain unchanged in an individuals throughout life<sup>5</sup>. Hersche use fingerprints for personal identification in India<sup>6</sup>. Galton classified the types of finger prints depending upon their primary pattern as loops, whorls and arches<sup>7</sup>. During the past century it

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has been apparent that different populations reveal wide variations in the frequency of papillary patterns on the finger ball and also wide variations in the blood groups. These two characters also usefully employed for study of ethnic variation, genetic and human biology<sup>8</sup>. So in the present study inter correlative relation between dermatoglyphics and blood groups have been tackled. It can be used as corroboratory evidence to establish the identity of a person.

## MATERIAL AND METHODS

Total 292 subjects were selected to complete the study mainly comprised medical students, and staff member of medical college. For taking dermatoglyphic, ink method suggested by Cummins<sup>1</sup> was used. Black endorsing ink was spread on the hands and the smeared palm and fingers of both hands were printed on a white plain paper. Primary patterns Loops, Whorls and Arches were observed along with the total ridge counting with the help of a powerful hand lens. Screening was done on white plain paper containing prints with the aid of magnifying glass. Different patterns were identified and classified into Loops, Whorls and Arches as in (figure1). Interpretation of patterns was carried out according to Cummins<sup>1</sup>. The parameter analyzed include, pattern frequency, total finger ridge count and individual finger print patterns.

## RESULTS

Majority of subjects were belonged to blood group O (33.90%) followed by blood group B (30.82%), blood group A (23.63%) and blood group AB (11.64%) (Table-1). Loops were the most common pattern, registering 53.56% frequency in the study, followed by Whorls 39.48% and Arches 6.95% as in (Table-1).

Frequency of Loops was significantly ( $p < 0.01$ ) highest in all subjects of ABO blood group followed by Whorls and Arches. Incidence of Loops varied from 48.08% to 61.76% among different blood groups, of which blood group AB showed highest Loops (61.76%). Whorls showed

moderate frequency varying from 24.11% to 46.66% among, O blood group showed highest 46.66%. Arches were ranging from 5.25% to 14.11% among, AB group showed highest 14.11% as in (Table-1).

Pattern of individual finger in different blood groups showed significantly ( $p < 0.01$ ) with high frequency of Loops in middle and little finger among all blood groups. Blood group O showed (middle finger-58.58%, little finger-72.72%), blood group-B (middle finger-66.66%, little finger-76.11%), blood group-A (middle finger-68.11%, little finger-74.63%) and blood group-AB (middle finger-72.05%, little finger-85.29%). Whorls were more in thumb and ring finger among all blood groups except in O blood group where it high in index finger. Arches were more in index and middle finger among all blood groups, and are less than 10% in remaining fingers (Table 2).

The number of Radial Loops on left side was high in all blood groups except B where it is high on right side. The occurrence of Radial Loops was more in index finger of all blood groups (Table-3).

## DISCUSSION

Bharadwaja A et al<sup>9</sup> revealed that there was an association between distribution of finger print pattern and blood groups. The general distribution of the primary finger print was of the same order in individuals with all blood groups, with high frequency of Loop, followed by Whorls and Arches. The frequency of Arches were more in blood group-AB. Distribution pattern in individual finger had high frequency of Loops in thumb and little finger, whereas ring finger had more Whorls. The index and middle finger presented higher incidences of Arches in subjects of ABO blood groups. Individual of blood group AB had high frequency of Whorls in thumb, index and ring fingers while middle and little finger showed more number of Loops<sup>9</sup>.

Ekerette P. et al observed the most prevalent digital ridge pattern type was Ulnar Loops followed by Whorls, Arches and the least prevalent was Radial Loops. Ulnar Loops were

50.09% and Radial Loops 1.13%. Ulnar Loops were the most predominant pattern 44.9% followed by Whorls 31.2%, Arches 11.3% the least were the Radial Loop 1.4%. They also studied sex difference in the study and stated that Loops were higher 50.1% in females than males 49.6%. Male had higher value of pattern intensity index 15.13 than the females 11.88<sup>10</sup>.

Prithvi R et al observed the association of blood group type with finger print pattern in different cohorts. In Northern cohort, about 10% of the participants with blood group O were having whorls while a maximum of 19% were with blood group A in the west cohort. Similarly, while 21% participant of the North cohort with blood group O had loops (ulnar+ radial), 26% of the South cohort with blood O were found associated with loops. Arch pattern was almost rare in each cohort<sup>3</sup>.

Nayak SK. & Patel S observed number of whorls more than the loops in I finger of all blood groups, I and IV fingers of persons with groups O, B, A. The highest percentage of whorls occurred in I 53.125 and II 53.125 fingers of AB group whereas in IV O-59.23, B-58.37, A-55.325 fingers of all other groups. The III finger of all groups possess the lowest number of whorls A-26.52, B-25.375, O-26.59, and AB-25.00. The percentage of loops more than whorl in III finger of all groups and II, III, V fingers of group O, B and A persons. The commonest occurrence of loop happens to be in finger V and III; the percentage of loop was lowest in IV finger of all groups except AB group where II finger was at the bottom. The number of radial loop on the left side was more in B, A, O

group persons whereas in AB group it was equally distributed<sup>8</sup>.

In the present study we observed frequency of Loops was significantly ( $p < 0.01$ ) highest in all subjects of ABO blood group followed by Whorls and Arches. Incidence of Loops varied from 48.08% to 61.76% among different blood groups of whom blood group AB showed highest Loops 61.76%. Whorls showed moderate frequency varying from 24.11% to 46.66% among, O blood group showed highest 46.66%. Arches were ranging from 5.25% to 14.11% among, AB group showed highest 14.11% as in (table 3).

Pattern of individual finger in different blood groups showed significantly ( $p < 0.01$ ) high frequency of Loops in middle and little finger of all blood groups, blood group O showed (middle finger-58.58%, little finger-72.72%), B (middle finger-66.66%, little finger-76.11%), A (middle finger-68.11%, little finger-74.63%) and AB (middle finger-72.05%, little finger-85.29%). Whorls were high in thumb and ring finger of all blood groups except in O blood group, Whorls were high in index finger also, O (thumb-61.11%, index finger-54.04%, ring finger-62.11%), B (thumb-57.22%, ring finger-54.44%), A (thumb-55.07%, ring finger-51.44%) and AB (thumb-38.23%, ring finger-33.82%). Arches were high in index and middle finger in all blood groups, in remaining fingers it is less than 10%, O (index finger-10.60%, middle finger-10.60%), B (index finger-17.22%, middle finger-7.22%), A (index finger-13.04%, middle finger-11.59%) and AB (index finger-32.35%, middle finger-17.64%) as in (table 2).

**Table 1: Showing total number of patterns on fingers in different blood groups**

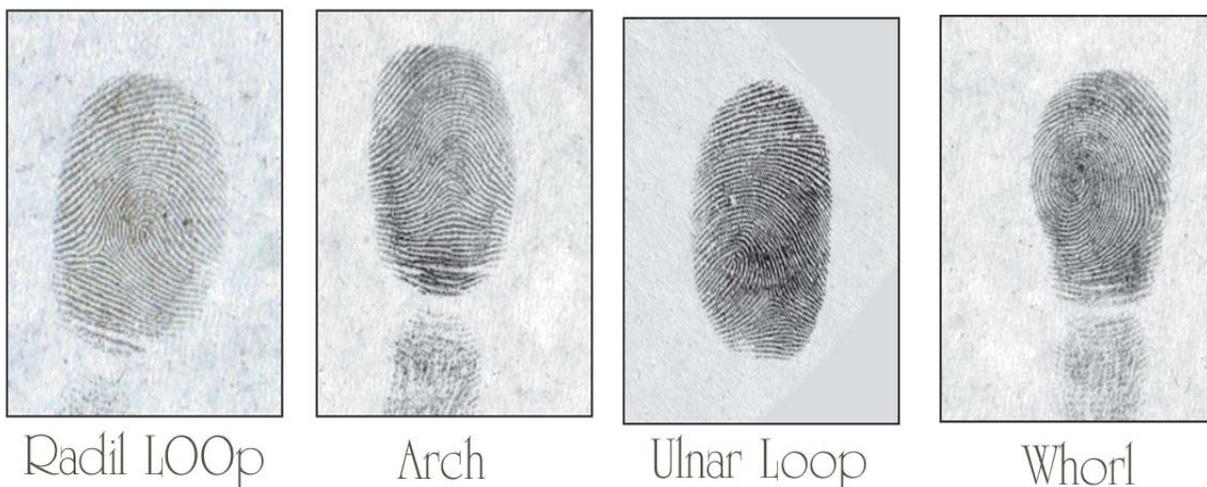
Blood groups	No of cases	Patterns						Total	
		Loops		Whorls		Arches			
O	99	476	48.08%	462	46.66%	52	5.25%	990	33.90%
B	90	488	54.22%	356	39.55%	56	6.2%	900	30.80%
A	69	390	56.52%	253	36.66%	47	6.81%	690	23.63%
AB	34	210	61.76%	82	24.11%	48	14.11%	340	11.64%
Total	292	1564	53.56%	1153	39.48%	203	6.95%	2920	

**Table 2: Showing percentage distribution of pattern in fingers of different blood group**

Blood group	Pattern	Fingers									
		Thumb		Index		Middle		Ring		Little	
O	Loops	75	37.87%	70	35.35%	116	58.58%	71	35.85%	144	72.72%
	Whorls	121	61.11%	107	54.04%	61	30.80%	123	62.12%	50	25.25%
	Arch	2	1.01%	21	10.60%	21	10.60%	4	2.02%	4	2.02%
B	Loops	72	40%	81	45%	120	66.66%	78	43.33%	137	76.11%
	Whorls	103	57.22%	68	37.77%	47	26.11%	98	54.44%	40	20.20%
	Arch	5	2.77%	31	17.22%	13	7.22%	4	2.22%	3	1.66%
A	Loops	58	42.04%	72	52.17%	94	68.11%	63	45.65%	103	74.63%
	Whorls	76	55.07%	48	34.78%	28	20.28%	71	51.44%	30	21.73%
	Arch	4	2.89%	18	13.04%	16	11.59%	4	2.89%	5	3.62%
AB	Loops	32	47.05%	28	41.17%	49	72.05%	43	63.23%	58	85.29%
	Whorls	26	38.23%	18	26.47%	7	10.29%	23	33.82%	8	11.76%
	Arch	10	14.70%	22	32.35%	12	17.64%	2	2.94%	2	2.94%

**Table 3: Showing distribution of papillary pattern in different blood groups on fingers of both hands**

Pattern	Side	Fingers				
		Thumb	Index	Middle	Ring	Little
'O' blood group (99)						
Loops	Right	37	37=34+3	61	35	71
Ulnar+Radial	Left	38	33=26+7	55	36=35+1	73
Whorls	Right	61	53	29	63	27
	Left	60	54	32	60	23
Arch	Right	1	9	9	1	1
	Left	1	12	12	3	3
'B' blood group (90)						
Loops	Right	31=30+1	43=36+7	60	39=38+1	66
Ulnar+Radial	Left	41=40+1	38=33+5	60	39=38+1	71
Whorls	Right	57	33	24	49	23
	Left	46	35	23	49	17
Arch	Right	2	14	6	2	1
	Left	3	17	7	2	2
'A' blood group (69)						
Loops	Right	30=29+1	33=28+5	48=47+1	33	49
Ulnar+Radial	Left	28	39=28=11	46=45=1	30	54
Whorls	Right	37	24	15	34	18
	Left	39	24	13	37	12
Arch	Right	2	12	6	2	2
	Left	2	6	10	2	3
'AB' blood group (34)						
Loops	Right	15=14+1	15=14+1	25	18	29
Ulnar+Radial	Left	17	13=11+2	24	25	29
Whorls	Right	15	9	4	15	4
	Left	11	9	3	8	4
Arch	Right	4	10	5	1	1
	Left	6	12	7	1	1

**Fig 1: Shwoing digital finger print patterns**

The number of Radial Loops on left side was high in all blood groups except B where it is high on right side. The occurrence of Radial Loops was more in index finger of all blood groups as in (table 1).

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