



## Qualitative analysis fingertip patterns in ABO blood group

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### ABSTRACT

The inheritance of the dermatoglyphic patterns is polygenic. The genetic basis of the blood group is well established. The correlation between the dermatoglyphic patterns and the ABO blood group is studied by some workers in different populations. In the present study, the correlation between dermatoglyphics and ABO blood group is studied in the Marathwada Region of Maharashtra. The qualitative data included fingertip patterns and three indices. It was observed that, the Arch pattern is more common in blood group O both in male and female. Ulnar loop is most common in the blood group AB. Simple whorl and double loop whorl patterns are less frequent in blood group AB. Accidentals were not recorded in blood group A while blood group O show highest percentage of accidentals. Dankmeijer's index was highest in blood group AB and lowest in blood group B.

**Keywords:** Dermatoglyphics, Fingertip patterns, ABO blood group.

### INTRODUCTION

Dermatoglyphics has long been recognised as a scientific and valuable method for medicolegal, anthropological and genetic studies. The dermatoglyphic patterns have become increasingly important in medicine, particularly in conditions due to chromosomal abnormalities. The heredity of most dermatoglyphic features conforms to a polygenic system, with individual gene contributing a small additive effect<sup>1</sup>.

The ABO blood groups were discovered by Karl Landsteiner in 1901. Further studies on the ABO blood group system, by the other workers, suggested that the blood groups were inherited. But, the exact manner of inheritance of the ABO blood group was revealed by Bernstein (1924)<sup>2</sup>.

As the inheritance of dermatoglyphic patterns is polygenic and also the ABO blood group inheritance is demonstrated.<sup>3</sup> The co-relation may exist between the dermatoglyphic patterns and the ABO blood group. Few studies have been done so far to study this co-relation. The present study is carried out to find, if there is any

significant co-relation between the epidermal ridge patterns on fingertips with the ABO blood group.

### MATERIALS AND METHODS

The present study has been carried out on 328 healthy individuals (181 males and 147 females). Normal healthy individuals were selected for the study and the data was collected under two separate headings.

1. ABO blood group: The individuals were grouped into four blood groups – A, B, AB and O.
2. Finger prints: The Finger tip prints were taken by using the ink method. The prints obtained were studied by using a hand lens and a needle. Following parameters were studied-

Qualitative analysis:

1. Finger tip patterns: The finger tip patterns were classified (Galton 1862)<sup>4</sup> as follows-
  - i) Arch: Two types of arches
    - a) Simple arch
    - b) Tented arch
  - ii) Loop: Two types of loops
    - a) Ulnar loop

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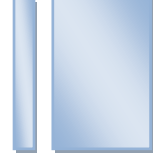
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- b) Radial loop
- iii) Whorl: Two types of whorls
  - a) Simple whorl
  - b) Double loop whorl
- iv) Accidental: These are complex patterns in which two or more patterns are combined in one area.

Indices: From the data obtained, following indices were derived

- i) Pattern intensity index: It combined value of the whorl and loop patterns.

$$= \frac{2 \times (\% \text{ of whorls} + 1) + \% \text{ of loops}}{10}$$

- ii) Dankmeijer’s index (arch/whorl index): It gives the relative percentage of arches compared with the percentage of whorls.

$$= \frac{\% \text{ of arches}}{\% \text{ of whorls}} \times 100$$

- iii) Furuhashi’s index: It gives the relative percentage of whorls compared with the percentage of loops.

$$= \frac{\% \text{ of whorls}}{\% \text{ of loops}} \times 100$$

The data obtained was tabulated separately for male and female and was statistically analysed by using Chi-square test and Anova test.

**RESULTS**

The distribution of A, B, AB and O blood groups among the 328 individuals in the present study is as shown in Table 1.

I. Qualitative analysis

A. Fingertip Patterns

1. Arch – Blood group O shows highest percentage of arches both in male and female (2.81% in male and 3.98% in female) (Table 2).
2. Radial loop - Males of blood group AB show highest frequency of radial loops (3.33%) while females of blood group B show highest frequency of radial loops (2.0%) (Table 2).
3. Ulnar loop – Blood group O shows the highest frequency of ulnar loops both in male and female (62.92% in male and 70.00% in female) (Table 2).
4. Simple whorl – Blood group O shows the highest frequency of simple whorls both in male and female (38.28% in male and 32.96% in female) (Table 2).
5. Double loop whorl – In male blood group O shows highest percentage of double loop whorls (3.75%) while female blood group B shows the

highest percentage of double loop whorls (4.22%)(Table 2).

6. Accidentals – Blood group O shows highest percentage of accidentals both in male and female (1.25% in male and 1.67% in females)(Table 2).

**Table 1 Distribution of A, B, O, and AB blood groups**

Blood group	Male		Female		Total	
	No.	%	No.	%	No.	%
A	47	25.97	34	23.13	81	24.69
B	46	25.41	45	30.61	91	24.74
O	64	35.36	54	36.74	118	35.37
AB	24	13.26	14	09.52	38	11.58
<b>Total</b>	<b>181</b>	<b>100</b>	<b>147</b>	<b>100</b>	<b>328</b>	<b>100</b>

Table 2 Distribution of fingertip patterns in A, B, O and AB blood group

Fingertip pattern	Percentage of fingertip patterns in Blood group							
	A		B		O		AB	
	Male	Female	Male	Female	Male	Female	Male	Female
Arch	2.34	2.94	1.74	2.00	2.81	3.89	2.50	2.85
Radial loop	2.13	1.47	3.04	2.00	2.81	1.85	3.33	1.43
Ulnar loop	57.02	61.18	60.8	62.44	51.0	56.11	62.92	70.00
Simple whorl	35.32	31.18	7	28.67	9	32.96	27.92	24.29
Double loop whorl	3.19	3.23	5	4.22	8	3.52	2.50	1.43
Accidental	--	--	1.09	0.67	1.25	1.67	0.83	--

7. Pattern intensity index: Blood group O shows highest pattern intensity index (13.99 in male and 13.29 in female)(Table 3).

8. Dankmeijer's index: The index is highest in blood group AB (5.23 in male and 6.08 in female),

while it is lowest in blood group B (5.23 in male and 6.08 in female)(Table 3).

9. Furahata's index: Furahata's index is highest in blood group O (77.89 in male and 62.94 in female) and lowest in blood group AB (42.92 in male and 35.99 in female)(Table 3).

Table 3 Indices in A, B, O and AB blood group.

Blood group	Male/ Female	Index		
		pattern intensity	Dankmeijer's	Furahata's
A	Male	13.82	6.08	65.12
	Female	12.76	9.34	50.24
B	Male	13.24	5.23	52.04
	Female	13.22	6.08	50.02
O	Male	13.99	6.69	77.98
	Female	13.29	10.65	63.94
AB	Male	12.90	8.22	45.92
	Female	12.48	11.11	35.99

## DISCUSSION

In the present study, highest percentage of arches was observed in blood group O while the percentage of arches was lowest in blood group B. Similar observation was made by Mahajan<sup>5</sup>, but Nayak and Patel<sup>6</sup> recorded lowest percentage of arches in blood group O (Table 4).

The ulnar loop pattern was most common in blood group AB in the present study while blood group O showed ulnar loops least frequently.

Table 4 Comparison of percentage of arches

Study	% of arches in blood group			
	A	B	O	AB
Nayak and Patel (1973)	3.36	3.18	1.84	3.12
Mahajan (1986)	2.00	1.30	2.44	2.35
Present study	M-2.34	M-1.74	M-2.81	M-2.50
	F-2.94	F-2.00	F-3.89	F-2.85

Simple whorl and the double loop whorl patterns showed lower percentage in blood group AB as compared with the other blood groups. Similar observations were made by Nayak and Patel (Table 5).

**Table 5 Comparison of percentage of total whorls**

Study	% of total whorls in blood group			
	A	B	O	AB
Nayak and Patel (1973)	39.09	40.52	41.08	40.63
Mahajan (1986)	M-47.35 F-27.30	M-32.10 F-25.43	M-41.45 F-36.89	M-29.00 F-26.76
Present study	M-38.51 F-31.47	M-33.26 F-32.89	M-42.03 F-36.48	<b>M-30.42</b> <b>F-25.71</b>

The accidentals were not recorded in blood group A while, blood group O showed highest percentage of accidentals.

In the present study, the values of pattern intensity index are highest in blood group O and lowest in blood group AB. Similar findings are

recorded by Nayak and Patel. Mahajan has also recorded lowest value of pattern intensity index in blood group AB but his findings differ for highest values. (Table 6)

**Table 6 Comparison of percentage of pattern intensity index**

Study	Pattern intensity index in blood group			
	A	B	O	AB
Nayak and Patel (1973)	13.7	13.73	13.92	11.05
Mahajan (1986)	M-15.22 F-12.62	M-13.28 F-12.60	M-14.08 F-15.28	M-12.86 F-12.28
Present study	M-13.82 F-12.76	M-13.24 F-13.22	M-13.99 F-13.29	<b>M-12.90</b> <b>F-12.48</b>

The values of Dankmeijer's index are highest in blood group AB and lowest on blood group B in

the present study. Our findings correlate with those of Mahajan (Table 7).

**Table 7 Comparison of percentage of Dankmeijer's index**

Study	Dankmeijer's index in blood group			
	A	B	O	AB
Nayak and Patel (1973)	8.54	7.84	4.47	7.67
Mahajan (1986)	M-4.22 F-10.98	M-4.04 F-5.94	M-5.88 F-7.90	M-8.03 F-11.25
Present study	M-6.08 F-9.34	M-5.23 F-6.08	M-6.69 F-10.65	<b>M-8.22</b> <b>F-11.11</b>

In the present study, the Furahata's index is higher on blood group O and lower in blood group AB. Nayak and Patel recorded lowest values of Furahata's index in blood group A and highest

values in blood group AB. Mahajan recorded highest values of Furahata's index in blood group A and lowest values in blood group AB male and blood group B female (Table 8)

**Table 8 Comparison of percentage of Furahata's index**

Study	Furahata's index in blood group			
	A	B	O	AB
Nayak and Patel (1973)	67.89	71.97	71.96	72.23
Mahajan (1986)	M-85.20	M-48.19	M-73.80	M-42.23
	F-39.22	F-35.07	F-67.10	F-38.30
Present study	M-65.12	M-52.02	M-77.98	M-45.92
	F-50.24	F-50.04	F-62.94	F-35.99

Thus, the Arch pattern is more common in blood group O both in male and female. Ulnar loop is most common in the blood group AB. Simple whorl and double loop whorl patterns are less frequent in blood group AB. Accidentals were not

#### CONCLUSION

The fingertip patterns and the indices show difference in the distribution among the ABO blood groups. The ABO blood groups and the dermatoglyphic patterns are separately correlated with various medical disorders and

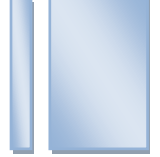
recorded in blood group A while, blood group O show highest percentage of accidentals. Dankmeijer's index is highest in blood group AB and lowest in blood group B.

diseases. The Present study correlates fingertip patterns with blood groups. Hence, in further studies the combined association between the fingertip patterns plus ABO blood groups and the medical diseases can be studied.

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