

# A comparative sex wise study of fingerprints in relation to toe prints

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## Abstract

**Background:** Fingerprints as evidence in the court of law is undoubtedly the most accepted evidence till date. Similar to fingerprints, dermal ridge pattern of toes are also unique and permanent and specific for each individual. This present work is first of its kind where attempt has been made to analyze their correlation in pattern distribution and also with gender. **Methods:** A number of 140 cases out of 156 total cases have been taken into consideration among the medical students and patients of all age group attending Manipal Teaching Hospital. The distribution of fingerprint pattern and toe print pattern of both the hands and feet was studied to see any correlation existed with each other in the same individual and its relationship with sex was evaluated and analyzed statistically. **Results:** Out of four varieties of finger print pattern as per order of frequency of occurrence, loop, whorl, arch and composite are found respectively. There is no similarity in the distribution of pattern in both the hands of an individual and also no gender wise differentiation between the distribution of pattern of fingerprint and toe print. **Conclusion:** There is neither gender wise nor hand wise alteration in the formation of pattern of dermal ridges. Similarly there is also no gender wise discrepancy between distributions of pattern of toe print too. There is no direct link of presence of particular pattern in hand and toe pulp in same individual.

**Keywords:** Finger prints, Gender, Toe prints

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## INTRODUCTION

### Background

Dactylography is the process of taking the impressions of papillary ridges of the finger tips for the purpose of identification of a person. The patterns of these ridges on the finger tips are absolutely constant and unchangeable. The patterns of no two hands or even of identical twins do resemble each other. This pattern can never be altered throughout life except by destruction of true skin.<sup>1</sup>The ridges appear on the fingers first, then on the palm or sole. The ridges do differentiate earlier in the hands than in the feet. Fingerprints and toe prints are genotypically

determined. The papillary dermal ridges and furrows on the finger and toes develop at 16-25 weeks of intrauterine life and individual peculiarities of the pattern form by the arrangement and distribution of these ridges and furrows. These ridges and furrows by their arrangement form different patterns which are absolutely constant and persist throughout life. They are arch, loop, whorl and composites. It is not inherited and do not have family pattern. The print patterns of the skin of the toes are as distinctive, individualistic and permanent as those of fingers. No matter how much the feet may grow the lines will grow with them, and the pattern will remain unchanged.<sup>1</sup>Similar to finger prints, skin pattern of toes are distinctive and permanent and can tell identity as well.<sup>2</sup> Though like fingerprints the toe prints are also specific for each individual. Any correlation of the pattern with each other is not yet established. Due to its constancy and specific individuality this patterns left at the scene of crime gives an immense effective clue about the suspects of the crime.

### MATERIALS AND METHODS

This prospective study consisting of 156 cases was carried out during the period of 2012-2013 among the medical students and from patients of all age group attending Manipal Teaching Hospital. A total number of 140 cases (Male=68, Female=72) were dealt with and subjects having scars on their fingers and toes following injury, worn finger or toe prints , extra webbed fingers or bandaged fingers, birth defect or any other abnormality was not included as part of the study. Each subject was asked to wash their hands and feet with soap and water and dry them using a towel. The individual was then asked to press the pulp area of each fingertip of both the hands on the stamp pad and transfer the fingerprint impression of plane type on an unglazed plain paper. Similarly the toe print impression was obtained from each individual by pressing the toes on the stamp pad directly where all the toes covered the stamp pad area. The toe impression was then transferred on an unglazed plain paper. The fingerprint impression and toe print impression were then studied using a hand magnifying

glass. The distribution of fingerprint pattern and toe print pattern of both the hands and feet were studied accordingly to find out whether any correlation existed with each other in the same individual or not and also its relationship with sex was evaluated and analyzed statistically.

### RESULTS

The findings were recorded and tabulated as per different findings .Table No 1(a)shows different patterns of finger prints found in both the sexes separately. Here the findings of different patterns of both hands of male and female have been recorded along with their percentage. In left hand loops comprised of 57.14% when combined together in male and female. The whorl consisted of 24.14% and arch 17.14%. In right hand of both male and female loops were found to be 58.08%, whorls 24.32% and arches 15.57%. In both the hands the composite pattern was found to be negligible in number i.e. 1.58% and 2.4% respectively.

**Table No 1(a):** Distribution of different pattern of finger prints in male and female

Fingers	LEFT				RIGHT			
	Loops	Whorl	Arches	Composite	Loops	whorl	Arches	Composite
Thumb: Male	41(61.9%)	14(20.58%)	10(14.70%)	03(4.41%)	30(44.11%)	22(32.35%)	12(17.64%)	04(5.88%)
Female	34(74.22%)	26(36.11%)	11(15.27%)	01(1.38%)	36(50%)	26(36.11%)	08(11.11%)	02(2.77%)
Index finger- Male	39(57.35%)	13(19.11%)	15(22.05%)	01(1.47%)	40(58.82%)	17(25%)	10(14.70%)	01(1.47%)
Female	30(41.66%)	28(38.88%)	12(16.66%)	02(2.77%)	30(41.66%)	23(31.94%)	14(19.44%)	05(6.94%)
Middle finger - Male	47(69.11%)	09(13.235%)	10(14.70%)	02(2.94%)	50(73.52%)	12(17.64%)	05(7.35%)	01(1.47%)
Female	39(54.16%)	18(25%)	15(20.83%)	Nil(0%)	50(69.44%)	06(8.33%)	15(20.83%)	01(1.38%)
Ring finger- Male	40(58.82%)	20(29.41%)	06(8.82%)	02(2.94)	37(54.41%)	25(36.76%)	05(6.75%)	01(1.47%)
Female	39(54.16%)	19(26.38%)	14(19.44%)	Nil(0%)	44(61.11%)	16(22.22%)	12(16.66%)	Nil(0%)
Little finger - Male	45(66.17%)	14(20.58%)	09(13.23%)	Nil(0%)	43(63.25%)	13(19.11%)	12(17.64%)	Nil
Female	46(33.88%)	08(11.11%)	18(25%)	Nil(0%)	46(63.88%)	10(13.88%)	16(22.22%)	Nil(0%)
Total Number	400(57.14%)	169(24.14%)	120(17.14%)	11(1.58%)	406(58.08%)	170(24.32%)	109(15.57%)	15(2.14%)

**Table No 1(b)** depicts the comparison of toe prints of both the feet of male and female. The findings showed loops to be highest in both side of the toes whereas arch was the second highest in number and whorls the third in number in contrast to the hand ridge patterns.

**Table No 1(b):** Gender wise distribution of pattern of Toe prints

**Left**

**Right**

Toe prints	Pattern of Toe prints			
	Loop	Whorl	Arch	Composite
Great Toe: Male	48(70.58%)	03(4.41%)	16(23.52%)	01(1.47%)
Female	48(66.6%)	07(9.27%)	15(20.83%)	02(2.77%)
Second Toe: Male	40(58.82%)	03(4.41%)	24(35.29%)	01(1.47%)
Female	48(66.6%)	03(4.16%)	21(29.16%)	NIL(0%)
Third Toe: Male	35(51.47%)	08(11.76%)	20(29.41%)	05(7.35%)
Female	37(51.38%)	09(12.5%)	25(34.72%)	01(1.38%)
Fourth Toe: Male	32(47.05%)	01(1.47%)	35(51.47%)	NIL(0%)
Female	27(37.5%)	03(4.16%)	41(56.94%)	01(1.38%)
Fifth Toe : Male	16(23.52%)	NIL(0%)	52(76.47%)	NIL(0%)
Female	18(25%)	NIL(0%)	54(75%)	NIL(0%)
Total Percentage	349 (49.85%)	37(5.28%)	303(43.28%)	11(1.57%)

Toe prints	Pattern of Toe prints			
	Loop	Whorl	Arch	Composite
Great Toe: Male	53(77.94%)	02(2.94%)	13(19.11%)	NIL(0%)
Female	48(66.66%)	05(6.94%)	19((26.38%)	NIL(0%)
Second Toe: Male	46(64.64%)	03(4.4%)	19(27.94%)	NIL(0%)
Female	45(62.5%)	NIL(0%)	25(34.72%)	02(2.77%)
Third Toe: Male	43(63.23%)	10(14.70%)	15(22.05%)	NIL(0%)
Female	44(61.11%)	03(4.16%)	23(31.94%)	02(2.77%)
Fourth Toe: Male	39(57.35%)	02(2.94%)	27(39.70%)	NIL(0%)
Female	27(37.5%)	1(1.38%)	43(59.72%)	01(1.38%)
Fifth Toe : Male	24(35.29%)	02(2.94%)	42(61.76%)	NIL(0%)
Female	23(31.94%)	NIL(0%)	49(68.05%)	NIL(0%)
Total Percentage	392(56.0%)	28(4.0%)	275(39.28%)	05(0.71%)

**Table 2:** Distribution of percentage of pattern of fingerprint in individual sexes

Sex Distribution	No of cases	Total% of cases	No &% of whorl	No &% of Arch	No &% of Composite	No &% of Loop
Male	68	48.57	159 (23.38%)	94 (13.82%)	15 (2.20%)	412 (60.58%)
Female	72	51.42	180 (25.00%)	135 (18.75%)	11 (1.52%)	394 (54.26%)

**Table 3:** Distribution of percentage of pattern of toe prints in individual sexes

Sex Distribution	No of cases	Total% of cases	No &% of whorl	No &% of Arch	No &% of Composite	No &% of Loop
Male	68	48.57	34 (5.0%)	263 (38.67%)	08 (1.17%)	375 (55.14%)
Female	72	51.42	31 (4.30%)	315 (43.75%)	9 (1.25%)	365 (50.69%)

From the above tables it is noted that loops consisted of highest percentage in both the hands and feet of both the sexes i.e. 60.58% in male and 54.26% in female and whorls were the second highest in occurrence, the composite pattern were the least to contribute in finger pulp pattern .However toe prints shows loops to be highest, followed by arch and composite being minimum in both the sexes.

**Table 4:** Comparison of distribution of Fingerprints with Toe prints

Pattern	Finger prints			Toe prints		
	Male(68) 48.57 %	Female(72) 51.42%	Average	Male(68) 48.57 %	Female(72) 51.42%	Average
Loops	60.58%	54.16%	57.37%	55.14%	50.69%	52.91%
Whorls	23.38%	25.0%	24.19%	5.0%	4.30%	4.65%
Arches	13.82%	18.75%	16.28 %	38.61%	43.75%	41.18%
Composite	2.20%	1.52%	1.86 %	1.17%	1.25%	1.21 %

From Table No 4 loops were the highest number of pattern found in both dactylography and toe print.. The distribution of pattern of finger prints and Toe prints showed the frequency to be in the same order in both finger and toe prints of both the sexes.

## DISCUSSION

The loops were found to be maximum in number i.e. 57.14% in left hand and 58.08% in the right hand of both the sexes combinedly.<sup>4,5</sup> The next highest pattern observed was whorl comprising of 24.14% and 24.32% in left and right hand respectively. Arches were the third highest in frequency in both genders i.e. 17.14% and 15.57% in left and right hand respectively. This is in accordance with the study conducted by.<sup>5,6</sup> None of the authors referred here studied about Toe prints. But the present study showed that in toe prints in males, frequency of loops were 55.29% and in females it is 50.69%, whereas the finger print shows 60.58% in male and 54.7% in female. The Table No 4 compares the distribution of pattern of finger prints and toe prints and shows the frequency to be in the same order in both finger and toe prints of both the sexes. According to P. Rastogi and K.R Pillai, distribution of pattern of fingerprints among male and female showed the arches to be the third highest in frequency<sup>5</sup> and the general distribution of fingerprint pattern in all the fingers of both hands showed loops to be the highest, followed by whorls and arches which is in accordance with the present study.<sup>4,5,6</sup>

## CONCLUSION

The findings from this study concludes that there is neither sex wise difference nor hand wise difference in the formation of pattern of dermal ridges. Similarly there is no sex wise differentiation between distributions of different toe print .

In order of frequency it is the loop which is highest, the whorl and arch are next in succession, whereas composite is the least in number in Dactylography. But in the present study toe print showed loop to be the highest and arch the next in the frequency of occurrence however there is no specific variation in both side toes and in both sexes.

There is no direct link of presence of particular pattern in hand and toe pulp in same person. The toe print pattern study is more required to bring accuracy of conclusion as no work has been done in this context.

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