

CHAPTER I: INTRODUCTION

An impression or mark made on a surface by a person fingertip, able to be used for identifying individuals from the unique pattern of wholes and lines on the fingertips.^[2]

Use for fingerprints is help investigators link one crime scene to another involving the same person. Fingerprint identification also helps investigator to track a criminal record, their previous arrests and convictions, to aid in sentencing, probation, parole and pardoning decisions.^[5]

Fingerprint ridge density is defined as the ridge count corresponding to a defined fingerprint area, in the present study an attempt has been made to identifying the sex of a person in a central Indian population using thumb print ridge density.^[6]

Due to the nature of perpetually and distinctive, fingerprints are understood the most important tool for identification of an individual ever increasing frequency of crime has made fingerprints an indispensable tool for identification and gender discrimination based on ridge density.^[2]

Fingerprints are very typical for a human being. Although considered as an infallible method of identification. It has severe limitation for forensic individualisation. The ridge pattern of fingerprints develops in the intra uterine life and remains the same until death before being altered by decomposition. Moreover, fingerprints are made up of a number of easily recognisable features that permit them to be classified and field for later reference. It is now an established fact that these patterns are unique and specific to a particular individual. Thus it is possible to identify not only criminals but also victims of Patna and unidentified corpses using this technique.^[6]

The ever increasing and changing pattern of crime has made fingerprinting indispensable tool in the hands of investigating officers. With the inference of the sex of the suspect from prints available in the crime scene, the burden of the

investigating officers is reduced. Previous researcher has explored the possibility of genders differentiations using fingerprints.^[8]

Dactylography is the process of taking impressions of the fingers and thumbs on an unglazed white paper and examining them with a magnifying lens, although fingerprints have been noted and used since antiquity, 25 years a burst of activity that secured adoption of their use for identification began about 1880s. New notifications and applications have continued to the present. No two fingers are found to have identical prints and it is an over whelming mathematical probability that not two ever will be found to match. It has long been recognized that the fingers, palm of the hands and soles of feet of human bear friction ridge skin. These areas are characterised by a complicated pattern of hills and valleys”, the hills are called ridge and the valleys furrows.^[9]

Various scientists have studied about the fingerprint ridge density across the world, but it is the first time in the Patna region and this project focuses on collecting the fingerprint ridge density in Patna region.

CHAPTER II: LITERATURE REVIEW

Richard Jonathan O.Taduran, and Anna Atrina.V.Tadeo Ktal (April, 2016) studied Sex determination from fingerprint ridge density and white line counts in Filipinos. He collected ridge density from three different areas are Distal Radial Area, distal ulnar area and proximal area. He collected fingerprint from 200 males and 200 females. He used 16ridges\25 mm² or more in radial and 15 ridges\25mm² or more in ulnar area being more lightly to be female whereas 13ridges\25 mm² or less in radial area and 12ridges\25 mm² or less in ulnar area where more likely to be male. The result of this study show sex difference in Filipino fingerprint and supports the observation of previous studies that female have Finger ridge more than male.

Altayeb Abdulla Ahmed and Samah Osman (August 2016) studied topological variability and sex differences in fingerprint ridge density in a sample of the Sudanese Population .The data used for this study were prints of all 10 fingers of 200 Sudanese Arab individuals (100 men and 100 women) aged between 18 and 28 years .fingerprint ridge density was assessed for three different areas (radial ulnar and proximal) for all 10 fingers of each subject significant variability was found between the area (<0.01). Women showed similar patterns of densities with distal areas being denser than proximal once.

Angeles Sanchez-Andres and Jose Antonio Barea. (September 2018) studied impact of aging on finger on fingerprint ridge density anthropometry and forensic implications in sex inference. In this study, a sample of 213 adults of both sexes from a Spanish native population of different age ranges 18to30 years old.(junior group) and 50 to 66 years old (senior group) was used. Ridge density was assessed in three counting areas of the distal phalanx of each finger (radial, ulnar and proximal) height, weight, and a set of anthropometric measurements for both hands were also taken. Our results show that ridge density in higher in female than male throughout adulthood and decreases with aging in the radial and ulnar areas. But not in the proximal region. Thus a relationship between hand dimensions and ridge density was found.

Pattanwit Soanboon (2016) studied determination of sex difference from fingerprint ridge density in Northeastern Thai Teenagers. He collected fingerprints from 353 unrelated volunteers (191 males and 162 females). And classified in to three groups a (total subject) group B (14-18 years old) and group c (18-24 years old).females exhibit higher ridge density value with increasing age was also detected. The ridge density threshold for discrimination of sexes, computed based on Bayes Theorem was achieved in all groups and counting enabling its use in forensic investigation.

E.Gutierrez-Redomero (2011) studied sex differences in fingerprint ridge density in the matacomataguayo population. The sample studied for this research consisted of 99 males and 110 females, between 6 and 25 years old, which amount to a total of 2090 fingerprints. Ridge count was carried out on distal radial and distal ulnar and as proximal regions of each finger to explore the RD Patterns in order to identify similarities and difference among samples, areas, age groups and sexes. RD Decreases with age and at all ages. RD was higher on the distal area followed by the proximal sides. Females were found to have higher RD than males when older than 12 years, but not when younger.

Vinod C. Nayak, Pratik Rastogi, et.al. studied sex differences from fingerprint ridge density in the Indian Population. He collected 100males and 100 females fingerprint sample revealed that significant sex differences occur in the fingerprint ridge density. He used 12 ridges/25mm² or less is found to be more likely to be of males and mean ridge count of more. The 12 ridges/25mm² is more likely to be of female origin.

Haleoktem and Fikert Altunary (2015) studied sex differences in fingerprint ridge density in a Turkish young adult population; A Sample of Basket University. In this studied a sample of 118 of women, 88men, a total of 206 students aged between 17 and 28years old by means of simple inking method. He used the ridges of finger print were counted diagonally on square measuring 5mm*5mm on radial, ulnar and inferior areas. The ridge density was significantly greater in women in every region in all fingers.

Kewal Krishan, Chitrabala Ngangom (2012) studied sex differences in fingerprint ridge density in a north Indian adult population. He collected ridge density from

radial, ulnar, and lower areas of a fingerprint in a north Indian Population. A total of 194 individuals (97 males and 97 females) aged between 18 and 25 years were included in the study and fingerprints were collected from each finger of the participants. Thus a total of 1940 fingerprints were obtained and epidermal ridges were counted in the radial, ulnar, and lower areas of each fingerprint. The radial and ulnar areas are the 5mm*5mm areas on the radial and ulnar side of the central core respectively. The results indicate that the females tend to have a significantly higher ridge density than males.

Neeti Kapoor and Ashish Badiye (2015) studied sex differences in the thumbprint ridge density in a central Indian Population. This study was conducted on 200 subjects (100 males and 100 females) in the age group of 18 to 30 years. Ridges density on the right and left hand thumb prints were determined using a newly designed layout and analysed statistically the result showed that females tend to have a higher thumbprint ridges density in both the area examined, individually and combined.

Maria C Alonso et.al (2013) studied topological variability of fingerprint ridges density in a sub-saharan population sample for application in personal identification. Study material was obtained from the fingerprint impressions of 100 male sub-saharan subjects aged between 18 to 48 years old. The results were compared with those obtained from a Spanish population sample. Sub-saharan males presented lower ridge density than Spanish males in the distal region of all fingers, whereas difference in the proximal region were only observed some fingerprint

CHAPTER III: AIM AND OBJECTIVES

Aim:

To study of the difference of fingerprint ridge density between males and females

Objectives:

- To identify variations in ridge density of males.
- To identify variations in ridge density of females.
- To identify variations in ridge density according to age.

CHAPTER IV: MATERIALS AND METHODOLOGY

Materials:

1. Black ink Pad
2. Roller
3. Fingerprint slip
4. Magnifying glass
5. Pencil
6. Measuring scale
7. Consent paper

The image shows a standard fingerprint slip form. At the top, there are fields for 'NAME OF THE SUBJECT', 'ADDRESS', 'AGE', and 'SEX'. Below this is a section for 'LEFT HAND' and 'RIGHT HAND', each with five columns labeled 'THUMB', 'INDEX', 'MIDDLE', 'RING', and 'LITTLE'. At the bottom, there are two boxes for 'LEFT HAND' and 'RIGHT HAND' prints, and a line for 'SIGNATURE OF THE SUBJECT'.

Figure 1: Fingerprint Slip



Figure 2: Magnifying glass

Methodology:

The study was conducted in Patna city, Bihar, India. In this study 100 subjects (50 males and 50 females) were randomly picked from Patna city population all with in the age group of 18-40 years. The subjects were asked to wash their hands clean. For the collection of fingerprint i used black inkpad. The subject were asked to apply their finger bulbs on the ink pad and then transfer them on to the paper regular pressure was applied and all 10 rolled finger prints were obtained. The materials used for this study were black inkpad, fingerprint slip, roller, magnifying glass, pencil, measuring scale and consent paper.

A $5\text{mm}^2 \times 5\text{mm}^2$ was drawn on a transparent film and placed on the fingerprint samples in the chosen area. The epidermal ridge from one corner of the square to the diagonally opposite corner were counted. Dots were not counted. Forks were counted as two ridges excluding the handle and a lake was counted as two ridges. This value represented the number of ridges in 25mm^2 area and reflected the ridge density value.

Value was obtained for all 10 fingers and the mean was calculated. This mean represented a single data point for that particular individual.

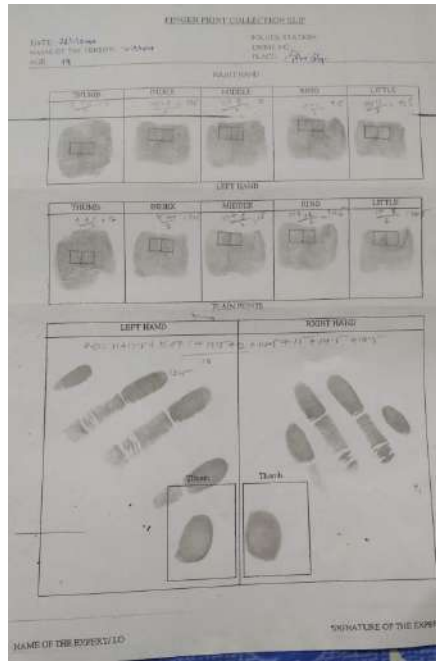


Figure 3: Fingerprint of Male

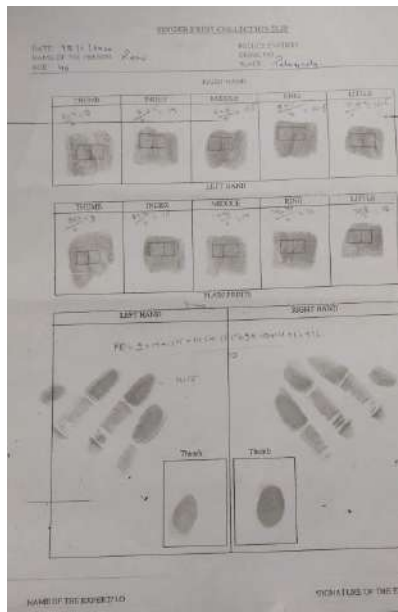


Figure 4: Fingerprint of Female

CHAPTER V: OBSERVATION AND CALCULATION

Male

SAMPLES	AGE	RIGHT HAND	LEFT HAND	AVERAGE	TOTAL AVERAGE
1	18	16.5	17.1	16.8	11.544
2	18	7.5	11.9	9.7	
3	18	11.2	9.8	10.2	
4	19	14.4	15.5	14.9	
5	18	10.5	10.9	10.7	
6	18	12	14.4	13.2	
7	19	13.7	12.5	13.1	
8	24	11.7	12.6	12.15	
9	19	12.5	10.9	11.7	
10	19	12.9	13.7	13.3	
11	20	13.4	13.8	13.6	
12	18	13.3	13.8	13.5	
13	18	14.5	5.2	12.9	
14	18	14.9	16	15.4	
15	24	4.4	5.5	4.95	
16	28	11.5	11	11.25	
17	25	12.4	14.3	13.3	
18	18	2.1	13.3	12.5	
19	25	13.2	8.9	11.05	
20	38	14	16.2	14.1	
21	18	8.6	12.2	10.4	
22	20	14.7	16	15.35	
23	24	10.3	13.1	11.7	
24	23	18	18	18	
25	18	17.6	20.3	18.95	
26	18	19.22	17.9	18.4	
27	18	12.1	3.8	5.7	
28	18	10.5	16.5	13.5	
29	20	16.6	15	15.8	
30	20	15.7	16.9	16.3	
31	20	3.8	5.4	4.5	
32	22	6.8	5.4	6.1	
33	20	12	11.3	11.65	
34	18	9.4	8.3	8.85	
35	18	8.7	8	7.75	
36	20	8.6	9.5	8.15	
37	20	6.9	7.1	6.4	
38	18	9.8	9	9.4	
39	21	7.8	8.4	8.1	

40	25	10.5	8.1	8.4
41	32	10.9	9.8	11.45
42	40	8.3	8	8.15
43	18	10	9.56	7.85
44	19	10.7	10.9	10.8
45	18	8.2	21.6	17.05
46	35	9	10.1	9.55
47	18	8.1	8.2	7.85
48	18	11.2	11.7	11.45
49	18	10.8	7.9	9.35
50	18	12.4	14.1	12

Female

SAMPLE	AGE	RIGHT HAND	LEFT HAND	AVERAGE	TOTAL AVERAGE
1	21	16.5	18.7	17.6	12.532
2	18	6.1	10.6	8.35	
3	28	9.6	13.6	11.6	
4	38	14.4	16.2	15.3	
5	18	17.9	18.6	18.25	
6	20	15.5	15.8	15.65	
7	23	11.5	9.4	10.5	
8	18	15	16.4	15.7	
9	29	13.2	14	13.6	
10	18	13.1	12.6	13.45	
11	25	15.3	12.8	12.55	
12	28	9.1	14.9	13.6	
13	18	9.4	10.9	10.15	
14	20	12.2	13.3	13.85	
15	40	13.7	11.4	12.55	
16	30	7.3	9	8.15	
17	20	5.1	4.8	4.95	
18	35	15.7	12.8	14.2	
19	24	11.6	7.7	13.5	
20	35	11.7	6.6	9.15	
21	26	9.7	9.4	10.15	
22	30	6.6	9.1	8.85	
23	26	9.7	10.5	10.1	
24	19	8	12.4	9.15	
25	26	16.8	18.1	16.1	
26	28	8	5.4	6.7	
27	19	12.4	17.7	15.05	
28	20	14.3	13.8	14.05	
29	21	19.1	20.4	19.75	
30	27	13.7	11.54	12.65	
31	38	6.9	6.5	6.7	
37	18	15.6	13.2	14.4	

38	18	13.5	17.6	15.75
39	18	12.6	13.8	13.3
40	20	14.1	16.4	15.25
41	18	14.2	12.2	13.2
42	18	11.8	11.8	11.8
43	25	10.1	11	10.55
44	18	10.9	10.5	11.7
45	29	12.3	9.8	11.05
46	40	7	10.2	8.6
47	22	10.1	13.5	11.8
48	25	13.2	12.1	12.65
49	29	17.4	16.4	16.9
50	25	12.1	7.5	10.65

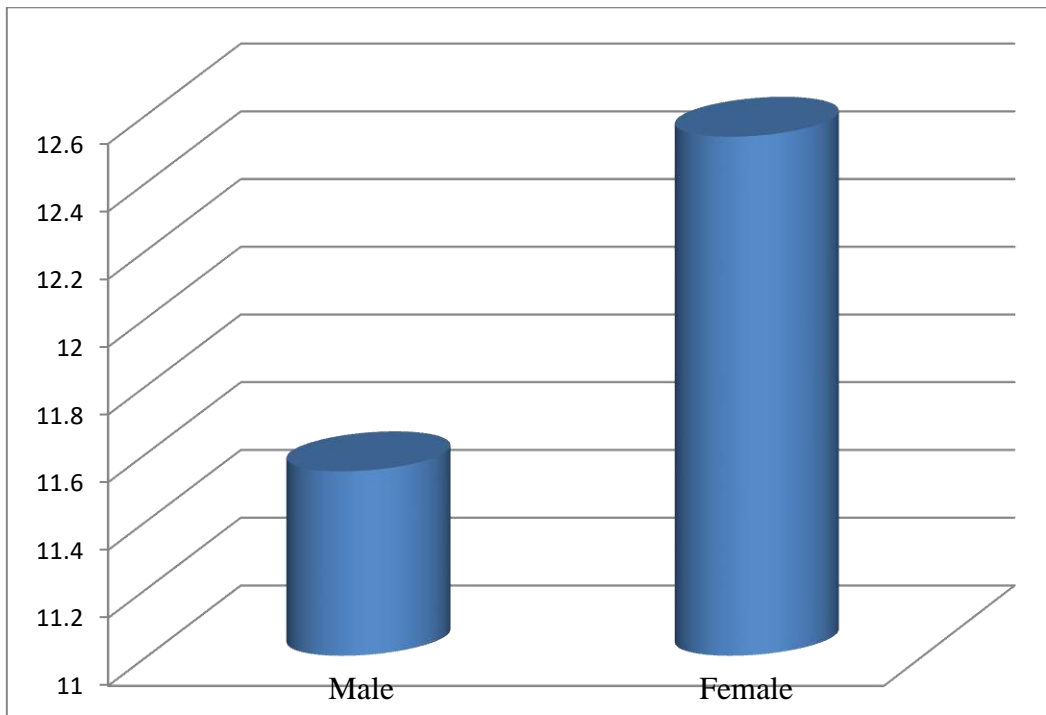


Figure 5: Graph of total average of fingerprint ridge density of male and female

CHAPTER VI: RESULT AND CONCLUSION:

Result:

In the present study, the average of ridge density for male in the age group 18 yrs. to 40 yrs. is calculated as 11.544 and the average of ridge density for female in the age group 18 yrs. to 40 yrs. is 12.532.

Conclusion:

In the present study, the average of ridge density of female is greater than the average of ridge density of male of Patna city. Thus it is concluded that ridge density in fingerprint pattern is the best parameter for identification of sex. The fingerprint ridge density of females is more than that of males.

In the future, this study can be done to differentiate fingerprint ridge density in various age groups and in population of various regions or cities.

CHAPTER VI: REFERENCES

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