

CHAPTER I: INTRODUCTION

Fingerprints are natural patterns formed by friction on epidermal ridges (raised) and furrows (recessed), which appear on the pads of fingers and thumbs. Though these epidermal ridges are found on fingers, palms, and soles, they are popularly called just fingerprints. They have never been observed repeating in any human being in the history of Dactylography.^[2]

Dactyloscopy is a Greek term which means identification of individuals is a Greek term which means identification of individuals by means of examination of the lines on the tips of the fingers.^[5]

The number of ridges intervening between the delta and the core is known as ridge count the technical employees of federal bureau of investigation count each ridge which crosses or touches and imaginer line drawn from the delta to the core.^[7]

The fingerprints as evidence are most significant in terms of forensic investigation because of the following features of fingerprints; unique; the ridge pattern of each finger has as individuality of its own permanent. The fingerprint of an individual does not change from birth to core.^[3]

Forensic scientists have used fingerprints in criminal investigation as a means of identification for centuries, fingerprint. Identification is one of the most important criminal investigation tools due to two features; their persistence and their unique. Persons fingerprints do not change over time.^[1]

The process of counting the ridges is that touches or cross the line of count drawn between the delta and core of loop patterns. A white space must always intervene between the delta and first ridge to be counted. ^[4]

Dactylography is the process of taking impressions of the fingers and thumbs on an unglazed white paper and examining them with a magnifying lens all

through fingerprints have been noted and used since antiquity a 25years burst of activity that to secure adsorption 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 the feet of human bear friction ridge skin. These areas are characterised by complicated pattern of hills and valleys”, the hills are called ridge and valleys fingerprint. ^[6]

Fingerprints are very typical for a human being although considered as an infallible method of identification. It has severe limitation for forensic individualization. The ridge patterns of fingerprints develop in the intrauterine life and remain the same until death before being altered by decomposition. Moreover fingerprints are made up of number of easily recognizable 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. The ever increasing and changing pattern of crime has made fingerprinting an indispensable tool in the hands of investigating officers. With the inference of the sex of the suspects from prints available at the crime scene, the burden of the investigating officers is reduced. Previous researchers have explored the possibility of genders differentiation using fingerprints. ^[10]

Various scientists have studied about the fingerprint ridge count across the world, but it is the first time in the Patna region and by doing so I have contributed my part in the Forensic Science.

CHAPTER II: LITERATURE REVIEW

M.D Nithin, and B. MANJUNA, et.al.(february2011) studied gender differentiation by finger ridge count among south Indian population. He collected fingerprint from 550 subjects, (275men and women) belonging to south Indian population all with in the age range of 18-65 years. He used BAYERS THEORAM suggests that a fingerprint possessing ridge density $<13 \text{ ridges}/25\text{m}^2$ are most likely to be of male origin. Results show that women have a significantly higher ridges count than men.

Richard Jonathan o. Taduran and Anna Katrina v. Tadeo, (2016) studied sex determination from fingerprint ridge density and white line counts in Filipions. He collected ridge density from three different areas –distal radial area, distal ulnar areas, and proximal areas as well as white line counts from fingerprints of 200 males and 200 females Filipions were collected and analysed statically. He used $16\text{ridges}/25\text{m}^2$ or more in radial area and $15\text{ridges}/25\text{m}^2$ or more in ulnar area being more likely to be female, whereas, $13\text{ridges}/25\text{m}^2$ or less in radial areas and $12\text{ridges}/25\text{m}^2$ or less in ulnar area. Results of this study show sex differences in Filipino fingerprints and support the observation of previous studies that females have finger ridge than males.

Richard Jantz (1977) studied and race differences in finger ridge count correlations. He collected samples from Negroes and Caucasians and compared race and sex by used ridge count of finger print. He collected 5 samples from sub-Saharan Africa one African bank three European, one American white and one from India. The samples of European ancestry showed no consistent sex difference in mean correlation, although female American whites. Significantly exceed males. The Negro samples and in the Paris of India males showed higher average correlations than females.

Spence M.A. Elstan R.C. Namboodiri k.k. studied evidence for a possible major gene effect in absolute finger ridge count. He collected samples from both Caucasian and Japanese populations are analysed by fitting a mixture of normal

distribution, utilizing maximum likelihood estimation. The results are homogeneous over all subsets of the data.

J.E. Dipierri and, E Gutierrez Redomero (2018) studied the asymmetry of dermatoglyphic finger ridge counts and the geographic attitude of the jujenean population in North West Argentina. (140 males and females and 170 females) aged 18-20 years. From three localities in Jujuy province-abra pampa (3484m above the sea level), Humahuaca (2939m above the sea level), and Sansalvador de jujuy (1260m above sea level). Only the diversity index showed significant differences by locality in males, which suggest a substantially different genetic component in Abra pampa male samples.

Richard L Jantz, and Douglas W Osley (1977) studied factor analysis of finger ridge counts in blacks and whites. He collected samples from an American black and an African black sample. He used both radial and ulnar counts for each finger. The independence of the thumb was also demonstrated. There was considerable intersample consistency, although some evidence of sex and race variation was observed.

Sarah B Holt (1959) studied the correlations between ridge counts on different fingers estimated from a population sample from 100 males and 100 females the sexes being taken separately, range from 0-32k 0.09, between counts on digit right and left in females, to 0.87 and 0.02, between these on digit right and left in males. Results was, the correlations tended to be higher in males than in females.

YS Kusumya, BV Babu, et.al.(2002) studied finger ridge counts correlations among four tribes of Andhra Pradesh, the present paper reports the distribution of finger ridge count correlations among four tribal populations from Andhra Pradesh India, Vizag, Dulia, Manne Dora and Manzai Mali and examines the intra and inter population variation. Higher correlations are recorded in left hands compared to right hands but they are not significant. Result in all tribes, the correlations between right hands fingers are relatively higher among women when compare to men. Regarding inter populations variation dulia men differ significantly from men of Manne Dora and Manzai Mali tribes and Kotia women also different from the women of the Manne Dora significantly.

Sarah B Holt. *Annals of eugenics* (1953) studied genetics of dermal ridges inheritance of total finger ridge count, the work of eugenicists was often pervaded by prejudice against racial ethnic and disabled groups. The online publications of this material of scholarly research purposes are not an endorsement of those views or a promotion of eugenics in any way.

Roopa Ravindranath, IM Thomas (1995) studied finger ridge count and fingerprint pattern in maturity onset diabetes mellitus. He collected fingerprint samples from the 150 maturity onset diabetes mellitus patients and compared to 120 controls. Significant findings were; in males, with both hands combined and separately, an increase in radial and ulnar loops and arches decreases in whorls. In females and increase in ulnar loops and a decrease in whorls in the left hand was observed.

CHAPTER III: AIM AND OBJECTIVES

Aim:

To study the difference between fingerprint ridge count in male and females in Patna City.

Objective:

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

CHAPTER IV: MATERIALS AND METHODOLOGY

Materials:

1. Black inkpad
2. Roller
3. Fingerprint slip
4. Consent Paper
5. Magnifying glass
6. Pencil
7. Measuring scale

FINGERPRINT / PALM PRINT SLIP

DATE: _____ PHOTO: _____
NAME OF THE PERSON: _____ (PRINT) NAME OF _____
AGE: _____ (PRINT) _____

RIGHT HAND

THUMB	INDEX	MIDDLE	RING	LITTLE

LEFT HAND

THUMB	INDEX	MIDDLE	RING	LITTLE

PALM PRINTS

LEFT HAND	RIGHT HAND

Thumb Thumb

NAME OF THE EXPERT/ I/O: _____ SIGNATURE OF THE EXPERT/ I/O: _____

Figure I: Fingerprint slip



Figure II: 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 within the age group of 18-40 years. The purpose of the study was explained and verbal informed consent was taken from all the subjects individually. The materials used for this study were black inkpad, fingerprint slip, magnifying glass, pencil, measuring scale and consent paper.

The subjects were asked to wash and dry their hands to remove dirt and grease. They were asked to keep their hand relaxed and not to try to help in rolling the fingers as this may cause smudging. The level of the print take strip was placed in such a way that there was no strain or pressure on the fingers. It was placed at the edges of the table, so that the subject's fingers which are not being printed will not interfere with the manipulation of other fingers in the printing process. It was placed at a sufficient height to allow the subject's forearm to assume a horizontal position when fingers are inked.

Excessive pressures on the fingers while inking the recording was avoided then the fingers were rolled from nail to nail over the print take strip, taking care to ink the complete ridges pattern of distal phalanx and upper portion of the middle phalanx.

After the right hand fingers were inked, the fingers were rolled in an appropriate position on the proforma. The fingers were rolled away from body of the person. After the ridge counts were done individually for all the 10 fingers, the mean value was calculated. Data was analysed statistically using SPSS (statistical programme for social science).

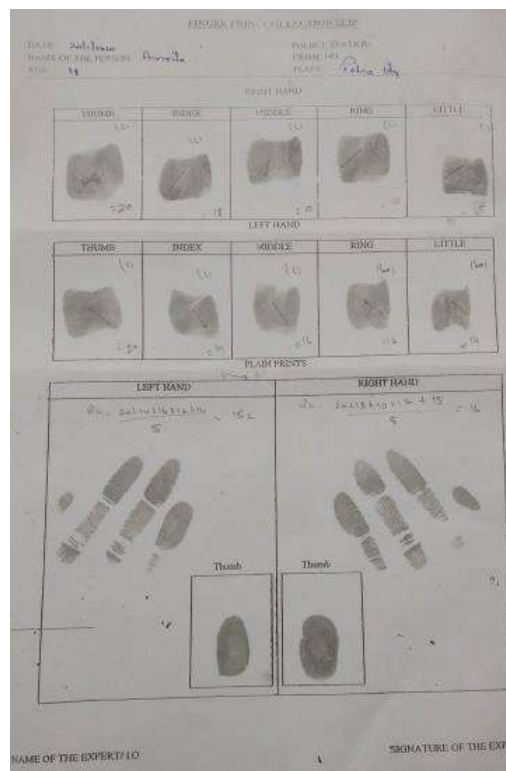


Figure III: Fingerprint of Female

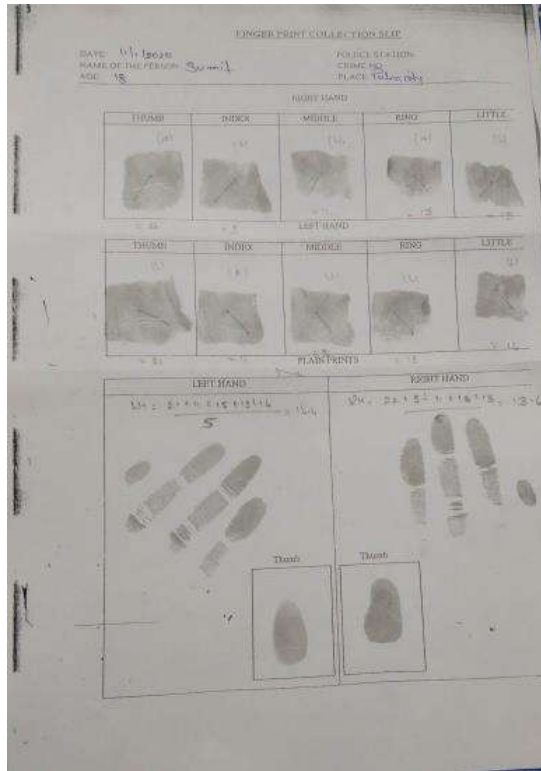


Figure IV: Fingerprint of Male

CHAPTER V: OBSERVATION AND CALCULATION

Table 1: Ridge count of Male's fingerprints:

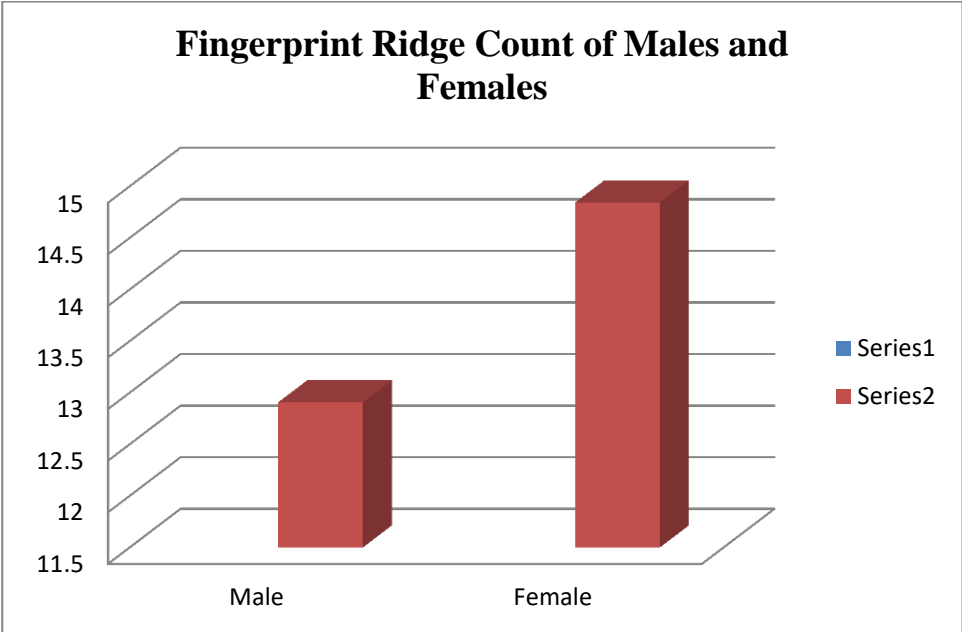
Sample	Age	Right Hand					Left Hand					Average	Total Average
		RT	RI	RM	RR	RL	LT	LI	LM	LR	LL		
1	18	9	12	14	21	9	16	12	16	14	14	13.7	12.906
2	18	20	12	16	10	8	11	13	12	14	10	12.6	
3	18	21	15	14	12	10	13	14	18	16	12	14.5	
4	18	21	16	18	12	13	18	12	14	16	4	14.4	
5	24	0	0	10	16	8	20	0	0	16	6	6.6	
6	25	20	16	20	18	14	21	17	18	20	14	17.8	
7	38	16	8	8	16	12	16	13	10	14	10	12.3	
8	25	0	9	10	18	8	0	6	11	16	10	8.8	
9	18	16	14	10	12	8	12	10	16	11	13	12.2	
10	18	14	10	14	9	8	12	6	12	12	10	10.7	
11	18	16	8	5	12	8	10	5	9	2	14	9.9	
12	19	18	5	12	14	8	18	4	6	14	6	10.5	
13	18	21	18	10	18	18	22	6	8	20	20	16.1	
14	18	16	14	18	20	10	24	10	12	16	11	15.6	
15	18	14	12	8	8	12	14	12	8	10	12	11	
16	18	12	13	16	16	14	11	14	18	18	16	14.8	
17	20	22	15	22	22	20	19	22	22	24	22	10	
18	18	22	19	20	20	12	18	22	20	23	12	18.8	
19	20	10	18	10	8	10	16	12	8	12	10	11.4	
20	23	20	15	16	20	14	20	22	18	16	14	17.5	
21	18	18	8	10	20	16	10	8	18	22	14	14.4	
22	24	13	8	12	18	16	18	8	20	16	18	14.7	

23	18	8	12	14	6	7	16	14	14	18	14	12.3
24	20	18	12	14	14	12	14	14	12	14	13	13.7
25	20	21	20	15	14	15	16	15	15	19	12	14.1
26	20	21	20	15	14	15	16	15	15	19	12	16.2
27	18	20	9	12	8	8	14	12	12	8	7	11
28	35	18	12	14	23	21	16	12	16	8	8	14.8
29	18	22	9	11	13	13	21	11	15	19	16	15
30	18	22	12	16	14	12	20	10	18	18	6	15.8
31	18	14	14	9	18	18	14	20	18	16	12	15.3
32	18	11	12	10	9	6	10	16	14	12	9	10.9
33	18	6	14	12	8	18	12	16	14	14	6	12
34	18	19	12	20	20	16	20	8	18	24	12	16.9
35	28	0	11	8	14	10	0	6	8	12	8	7.7
36	18	19	18	24	20	18	20	18	22	20	19	19.8
37	18	20	15	14	18	14	20	10	14	16	14	15.5
38	18	12	8	5	6	8	12	8	9	8	8	8.4
39	19	20	18	8	8	6	12	18	12	14	14	13
40	22	8	11	0	0	6	0	0	0	8	10	4.3
41	19	14	6	12	8	5	14	6	6	5	17	7.3
42	24	6	12	10	12	10	14	10	8	14	13	10.9
43	20	13	8	7	6	8	12	9	7	10	8	8.8
44	20	20	10	14	16	19	0	14	10	18	12	13.3
45	18	19	8	16	16	15	12	12	18	12	14	14.2
46	19	14	9	7	16	11	15	16	7	13	9	11.7
47	20	10	9	12	10	6	20	12	14	12	6	11.1
48	18	16	11	10	12	9	19	12	7	14	16	12.6
49	19	21	9	15	16	9	18	14	11	14	12	13.9
50	21	22	21	14	14	12	15	21	16	16	14	16.5

Table 1: Ridge count of Female's fingerprints:

Sample	Age	Right Hand					Left Hand					Average	Total Average
		RT	RI	RM	RR	RL	LT	LI	LM	LR	LL		
1	18	14	14	16	13	12	8	10	14	12	10	12.3	14.842
2	28	14	10	12	12	10	16	10	8	14	10	11.6	
3	18	20	18	10	17	15	20	14	16	12	14	15.6	
4	29	21	20	12	16	16	18	16	18	18	16	17.1	
5	23	18	22	16	14	16	20	22	22	18	20	18.8	
6	18	17	12	14	14	12	16	18	15	22	12	15.2	
7	18	22	8	20	22	16	24	22	18	14	10	17.6	
8	30	10	8	16	20	0	22	14	12	16	0	11.8	
9	24	18	10	12	16	10	18	20	14	12	12	15.6	
10	19	16	20	22	16	18	26	22	18	20	16	19.4	
11	20	18	16	12	18	14	22	18	16	10	12	15.6	
12	26	12	18	12	10	12	14	16	8	12	12	12.6	
13	25	20	12	14	14	16	22	16	14	18	15	16.1	
14	35	19	10	10	12	12	14	8	10	16	18	12.9	
15	30	24	10	18	20	16	18	20	18	16	14	17.4	
16	35	16	22	20	22	14	22	24	16	18	14	18.8	
17	21	20	22	18	18	16	20	22	18	18	19	19.1	
18	18	20	12	14	12	10	22	18	14	10	6	13.8	
19	28	18	10	14	14	12	8	20	16	18	12	14.2	
20	29	18	16	18	20	8	24	14	12	16	10	15.6	
21	25	16	5	12	14	9	18	9	10	12	8	11.3	
22	18	12	11	8	10	11	10	10	9	16	10	10.7	
23	38	18	14	11	16	13	18	12	11	14	10	13.7	
24	18	26	22	22	16	14	24	18	26	22	14	20.4	
25	18	12	4	10	14	12	8	10	10	12	15	10.7	

26	20	18	10	11	12	14	12	14	13	10	18	13
27	20	16	13	9	10	7	16	10	14	20	6	12.1
28	18	18	8	8	10	8	10	8	16	18	10	11.4
29	18	12	8	8	12	6	8	8	8	14	6	9
30	28	12	16	12	12	10	10	14	8	14	12	12
31	22	20	18	10	14	12	14	12	8	10	8	12.6
32	38	14	12	14	14	8	16	10	8	14	6	11.6
33	36	14	10	14	12	12	14	12	10	16	8	12.2
34	18	14	8	14	10	8	18	14	14	12	10	12.2
35	25	12	8	12	8	8	18	8	10	12	8	10.4
36	40	18	16	12	14	16	20	10	18	20	0	14.4
37	18	24	20	14	14	12	20	14	16	18	14	16.6
38	29	16	12	18	22	9	20	15	22	20	15	16.9
40	22	14	20	18	14	14	16	14	14	16	12	16
41	25	16	14	16	12	16	26	14	16	18	12	16
42	32	16	16	18	20	10	14	16	12	18	12	15.2
43	25	16	14	16	13	12	12	14	12	18	14	14.1
44	25	14	14	16	18	12	18	12	13	22	12	15.1
45	40	22	17	16	16	14	20	20	18	20	16	17.9
46	28	26	20	22	18	16	24	20	24	16	14	20
47	18	18	16	10	22	12	18	20	16	14	10	15.6
48	19	25	20	18	22	14	16	20	18	14	12	17.9
49	18	22	8	20	22	16	24	22	18	14	10	17.6
50	30	18	16	20	14	12	20	22	22	20	14	17.8



Graph 1: Graph of Total Average of Fingerprint Ridge Count of Males and Females

CHAPTER VI: RESULT AND CONCLUSION

Result:

In the present study the average of ridge count for male in the age group 18 yrs. to 40 yrs. is calculated as 12.906 and the average of ridge count for female in the age 18 yrs. to 40 yrs. is 14.842.

Conclusion:

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

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

CHAPTER VI: REFERENCES

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