International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Fingerprint Ridge Density of Male and Female in Puducherry City

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ABSTRACT

A friction of ridge is an elevated area of the epidermis seen on the palm of the hand, the sole of the foot, and the digits(fingers and toes). It is made up of one or more interconnected ridge units of friction ridge skin. the fingertips brush across an uneven surface. To study the difference of fingerprint ridge density between male and female in sahs avmc&h campus Puducherry. the total no of sample : 50 male and female fingerprints under the age between 18-25. A quality of black ink formulated for this purpose (generally black printers ink) Ink roller, inking plate (constructed of glass), ink cleaning supplies, fingerprint recording sheet, magnifying glass, measuring scale (measure the ridge), marker. In the present study the average ridge count is more in female when compared to male.

Keywords: Fingerprint, Measure Ridge Density.

1. INTRODUCTION:

a friction ridge is an eleveted area epidermis seen on the palm on the hand the sole of the foot and the digit (finger and toes).it is made up of one or more interconnected ridge unit of friction ridge skin. The underlying interface between the dermal papillae of the dermis and the interpapillary(rete) pegs of the epidermis is what cause these, which are sometimes reffered to as “epidermis ridges”. These epidermal ridges help to better relay information to sensory neurons involved in the fine texture perception by amplifying vibration that are created, for example, when fingertips brush across an un even surface. Additionally, these ridges might help with gripping uneven surface and enhance surface contact in damp circumstances.

Human fingerprint are detailed, nearly unique, difficult to alter, and durable over the life of an individual making them suit as long-term marker of human identity. They may be employed by police or other authority to identify people who are incapacitated or decreased and thus unable to identity themselves, as in the aftermath of a natural disaster. a fingerprint is formed on any opaque surface and is the impression of the friction ridge on the finger of a human. The matching of two fingerprint is among the most widely used and most reliable biometric techniques. Fingerprint matching considers only obvious features of a fingerprint.

Fingerprint known as dactyloscopy, is the process of comparing two instances of friction ridge skin impression , from human finger or toes or even palm of the hand or sole of the foot to determine whether the impression could come from the same individual. Because friction ridge skin is flexible, no two palm or fingerprints are ever precisely equal in every way; in fact, two impression taken from the same hand right after one another may differ somewhat may differ somewhat from one another.

The process of fingerprint identification, also known as individualization is assessing wheather two friction ridges impression are likely to have come from the same finger, palm toes, or sole.an expert computer system Working under threshold scoring rules, makes this determination.

A fingerprint is an impression left by the friction ridges of a human finger. The recovery of partial fingerprint from a crime scene is a Important method of forensic science. Moisture and grease on a finger result in fingerprints on surface such as glass or metal. It is possible for to intentionally create impression of a complete fingerprint using inks or other materials that are transferred from the skin friction ridges peaks to a smooth surface, like paper although fingerprint card also usually record part of the lower joint area of the fingers, fingerprint record normally contain impression from the pad on the last joint of the fingers and thumbs. Usually black printer ink is rolled over a white background-usually a white card-in order intentionally record the friction. Using a method known as live scan, friction ridges can also be digitally captured, usually on glass plate. the accidental recording on a friction ridges left on an object or wall's surface is known as "latent print". Latent print cannot be seen with the unaided eye, in contrast to "patent print" or "plastics prints, which are visible. Latent print are frequently fragmentary, and in order to be visible, they must be exposed to different light sources, powder, or chemical techniques. There are occasions when a latent print can be seen with a regular flashlight. Material such as sweat oil, grease, ink, or blood on the friction of ridges will transfer to the surface when they come into contact with surface that will be printed on there are many different factor that influence the quality of friction ridge impressions.

A latent print may appear different from any known recording of the same friction ridges due to variety of factors, including the skin's pliability, deposition, pressure, slippage, the material used to create the surface, the surface roughness, and the substance deposited. In fact, the circumstance surrounding each occurrence of friction of ridge deposition are distinct and never occur again. these factor make extensive training necessary for fingerprint examiner. The three fundamental patterns, arch, loop and whorl

- **Arch**: the ridge enter from one side of the finger rise in the center forming an arc, and then exit the other side of the finger. these occurs is about 5% of a encountered fingerprint.
- **Loop**: the ridges enter from one side of a finger, form of curve, and then exit on that same side. These can be see almost 60-70% of the fingerprints that are encountered.
- **Whorl**: ridges form circularly around a central point on the finger. These can be found in about 20-35% of the fingerprint that are encountered.

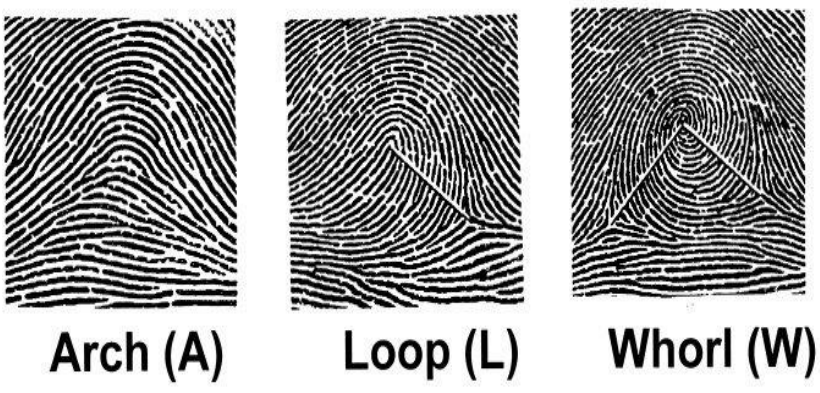


Figure:1

Subcategories of the patterns are

There are two sub-types of arch patterns

Plain arch: Raised ridges characterize this pattern and they extend from one side of the finger to the Other in a continuous fashion. This pattern makes up a mere 5% of the total population, making it the Rarest type.

Tented arch: Similar to the plain arch, the tented arch also has raised ridges flowing in the same Fashion. The distinct difference comes in the pitch of the raised ridge. The tented arch has a sharper Edge compared to the plain arch, which forms a tent like shape.

There are two sub types of loop patterns

Ulnar loop: In this pattern, the ridges turn backward, but they don't make a full turn. To identify an Ulnar loop, you will notice the loops moving

towards the small finger. You will see these turns only if You viewed them on the hand and not on a card.

Radial loop: This pattern is similar to the ulnar loop, but the difference is the turns point toward the Thumb instead of small finger.

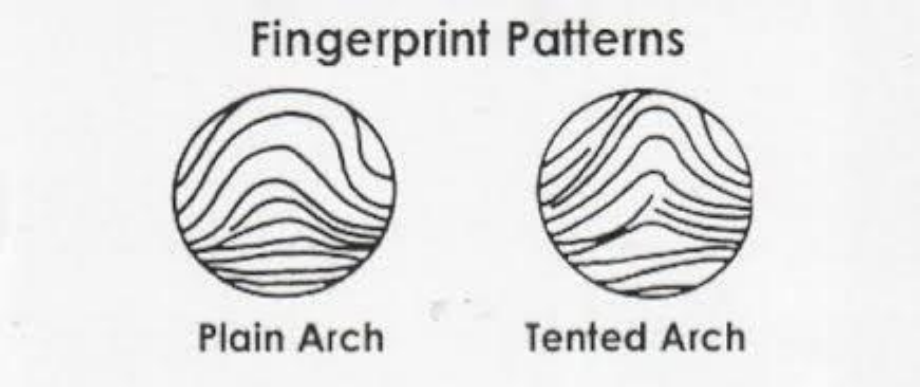
There are three sub types of whorl patterns

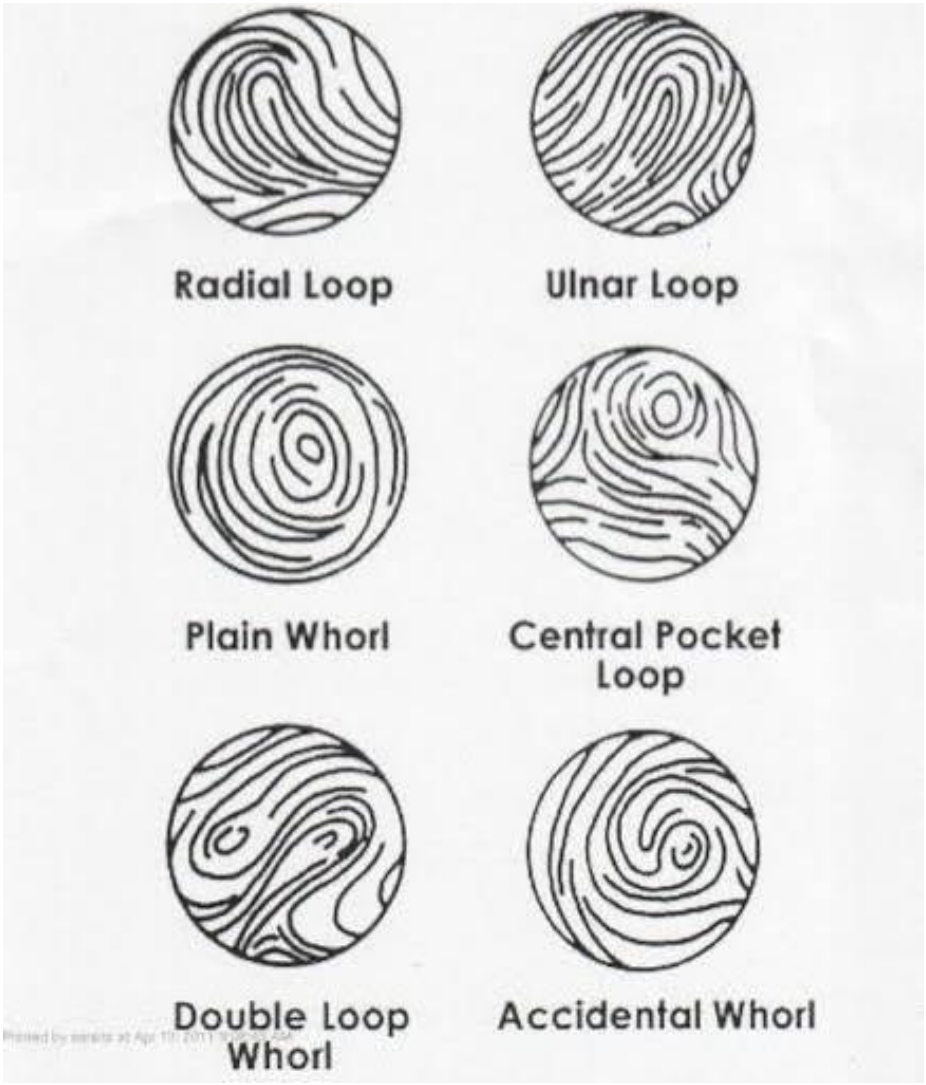
Plain whorl: A plain whorl will make a circular pattern which represents a swirl or a spiral. This Circular pattern is unbroken and this revolution formed at the centre is a result of at least a single Ridge. This is the simplest form of whorl and also most common. Central pocket loop whorl: These whorls consists o at least one re-curving ridge or an obstruction at Right angles to the line of flow with two delta and if an imaginary line is drawn in between then no recurving ridge within the pattern area will be touché or cut. These whorl ridges make one complete Circuit and may be oval, circular, spiral or any variant of a circle.

Accidental whorl: The comparison of the pattern in the accidental whorl is derived from two distinct Types of patterns that have least two deltas. Therefore whorls containing ridges that match the Characteristics of a particular whorl sub-grouping are referred to as accidental whorls.

Double loop: This pattern consists of two distinct loop formations. It has two distinct and separate Shoulders for each core, two deltas and one more ridges that make a complete circuit. There is at least One re-curving ridge with in the inner pattern area between the two loop formations that gets touched Or cut when an imaginary line is drawn.

Figure:2





Features of fingerprint ridges, called minutiae, include:

- **Ridge ending:** The abrupt end of a ridge
- **Bifurcation:** A single ridge dividing in two
- **Short or independent ridge:** A ridge that commences, travels a short distance and then ends.
- **Island or dot:** A single small ridge inside a short ridge or ridge ending that is not connected to All other ridges
- **Lake or ridge enclosure**: A single ridge that bifurcates and reunites shortly afterward to Continue as a single ridge
- **Spur**: A bifurcation with a short ridge branching off a longer ridge
- **Bridge or crossover**: A short ridge that runs between two parallel ridges
- **Delta**: A Y-shaped ridge meeting.

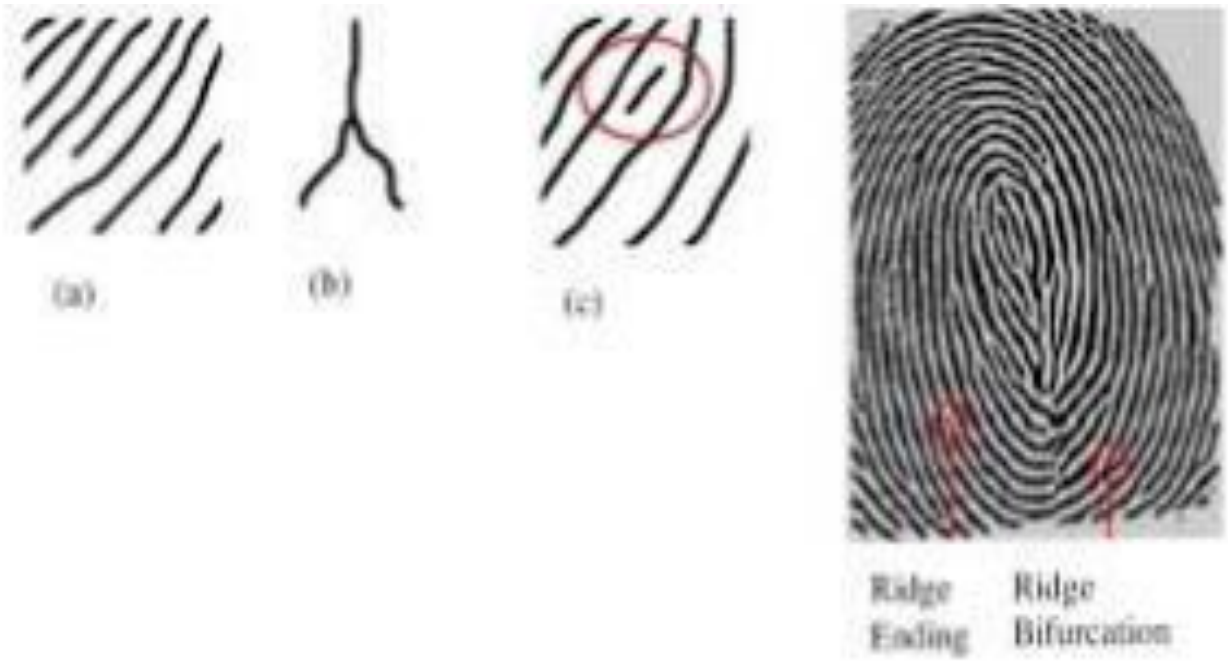


Figure:3

Literature Review

Vinod C. Nayak et.al.(2010) studied on Sex differences from fingerprint ridge density in Chinese And Malaysian population. The fingerprints are very typical for a human being. The present study Was undertaken to study the gender differences in fingerprint ridge density in Chinese and Malaysian population. The study done on 200 subjects (100 males and 100 females) of Chinese Origin and 100 subjects (50 males and 50 females) of Malaysian origin revealed that significant Gender differences occur in the finger ridge density. Fingerprint mean ridge density of 12 Ridges/25 mm2 or less is found to be more likely to be of males and a mean ridge count of more The 13 ridges/25 mm2 is more likely of female origin in Chinese subjects. Fingerprint mean ridge Density of 11 ridges/25 mm2 or less is found to be more likely to be of males and a mean ridge Count of more the 13 ridges/25 mm2 is more likely of female origin in Malaysian subjects.Richard jonathan O. Taduran et.al.(2016) studied on Sex determination from fingerprint ridge

Density and white line counts in Filipinos. This study derived Filipino-specific probabilityFormulae from fingerprints to be used for sex discrimination in human identification cases. Ridge Density from three different areas – distal radial area, distal ulnar area, and proximal area – as well As white line counts from fingerprints of 200 male and 200 female Filipinos were collected and Analyzed statistically. Ridge densities of radial and ulnar areas emerged as displaying significant Differences between the sexes, with 16 ridges/25 mm2 or more in radial area and 15 ridges/25 Mm2 or more in ulnar area being more likely to be female, whereas 13 ridges/25 mm2 or less in Radial area and 12 ridges/25 mm2 or less in ulnar area were more likely to be male. A white line Count of 0 was more likely to be male while a white line count of 2 or more was more likely to be Female. The results of this study show sex differences in Filipino fingerprints and support the Observation of previous studies that females have finer ridges than males.

Kewal Krishan et.al.(2013) studied on A study of sex differences in fingerprint ridge density in a North Indian young adult population. The present research is an attempt to distinguish sex from Fingerprint ridge density in the 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. The radial and ulnar areas are the 5 mm × 5 mm areas on the radial and ulnar side of the central Core respectively while the lower area is designated as 5 mm × 5 mm area adjoining the flexion Crease of the terminal phalanx on a fingerprint. The results indicate that the females tend to have a Significantly higher ridge density than males in the three areas analyzed in the study. The Fingerprint ridge density in the ulnar and radial areas of the fingerprints is significantly higher than The lower area.

Mark A Akree (1999) studied gender difference in fingerprint ridge density. The goal of this study Is to determine if women have significantly higher ridge density, hence finer epidermal ridge Detail, than men by counting ridges that occur within a well defined space. If significant gender Differences do exist then the likelihood of inferring gender from given ridge densities will be Explored. This study focused on 400 randomly picked ten-print cards representing 400 subjects. The demographic composition of this sample population represents 100 Caucasian males, 100 African American males, 100 Caucasian females and 100 African American females all within the Age range of 18–67. Results show that women tend to have a significantly higher ridge density Than men and that this trend is upheld in subjects of both Caucasian and African American descent ($F=81.96$, $P<0.001$). Application of Bayes' theorem suggests that a given fingerprint possessing a Ridge density of 11 ridges/25 mm2 or less is most likely to be of male origin. Likewise a Fingerprint having a ridge density of 12 ridges/25 mm2 or greater is most likely to be of female Origin, regardless of race.

Pattanawit Soanboon et.al.(2016) studied on Determination of sex difference from fingerprint Ridge density in northeastern Thai teenagers. Although, there has already been much research on The differences between sexes in fingerprint ridge density and its variability in the Thai population, Such studies have not included native northeastern Thais aged between 14 and 24 who are Descended from northeastern Thai ancestry. This study intends to determine the topological, age-Grouping and sexual differences in fingerprint ridge density (RD) in such populations. Fingerprints Were collected from 353 unrelated volunteers (191 males and 162 females) and classified into Three groups, that is, group A (total subjects), group B (14–18 years old) and group C (18–24 years Old). RD was assessed for two topological areas, radial and ulnar. Significant differences between Genders and age groups were obtained in both counting areas. Females exhibit higher RD i.e. Narrower ridges, than males. A decrease in RD values with increasing age was also detected. The RD threshold for discrimination of sexes, computed based on Bayes' theorem, was achieved in all Groups and counting areas, enabling its use in forensic investigation.

Esperanza Gutierraze-Redomero et.al. (2014) studied on Assessment of the methodology for Estimating ridge density in fingerprints and its forensic application. In recent times, some studies Have explored the forensic application of dermatoglyphic traits such as the epidermal ridge breadth Or ridge density (RD) toward the inference of sex and population from fingerprints of unknown Origin, as it has been demonstrated that there exist significant differences of fingerprints between Sexes and between populations. Part of the population differences found between these studies

Could be of methodological nature, due both to the lack of standardization in the position of the Counting area, as well as to the differences in the method used for obtaining the fingerprint. Therefore, the aim of this study was to check whether there are differences between the RD of Fingerprints depending on where the counting area is placed and how the fingerprints are obtained. Fingerprints of each finger were obtained from 102 adult Spanish subjects (50 females and 52 Males), using two methods (plain and rolled). The

ridge density of each fingerprint was assessed in Five different areas of the dactylogram: two closer to the core area (one on the radial and the other
On the ulnar side), two closer to the outermost area of each of the sides (radial and ulnar), and Another one in the proximal region of the fingertip. Regardless of the method used and of the Position of the counting area, thumbs and forefingers show a higher RD than middle, ring, and Little fingers in both sexes, and females present a higher RD than males in all areas and fingers. In Both males and females, RD values on the core region are higher than those on the outer region, Irrespective of the technique of fingerprinting used (rolled or plain). Regardless of the sex and Location of the count area (core or outer), the rolled fingerprints exhibit RD greater than that of the Plain ones in both radial and proximal areas, whereas the trend is inverted in the ulnar area, where Rolled fingerprints demonstrate RD lesser than that of the plain ones. Therefore, in order for the Results of different studies to be comparable, it is necessary to standardize the position of the count Area and to use the same method of obtaining the fingerprint, especially when involving a forensic Application.

Aim: To study the difference of fingerprint ridge density between male & female in Puducherry city.
Objectives:
1. To identify variation in ridge density of males & females.
2. To identify variations in ridge density according to age.

Materials:
- A quality black ink formulated for this purpose (generally black ink)
- Ink roller
- Inking plate (constructed of glass)
- Ink cleaner
- Fingerprint recording sheet
- Magnifying glass
- Measuring scale .

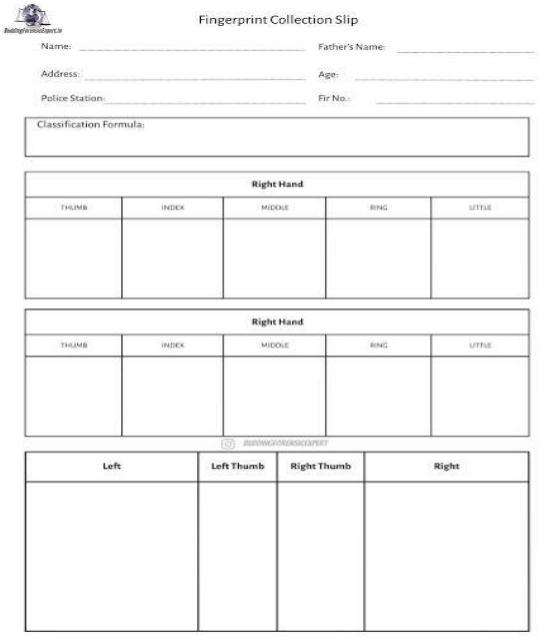

Fingerprint Collection Slip
Name: Father's Name:
Address: Age:
Police Station: Fir No.:
Classification Formula:
Right Hand
THUMB INDEX MIDDLE RING LITTLE
Right Hand
THUMB INDEX MIDDLE RING LITTLE
Left Left Thumb Right Thumb Right

Figure 4: fingerprints collection sheet.

Figure 5: ink pad r

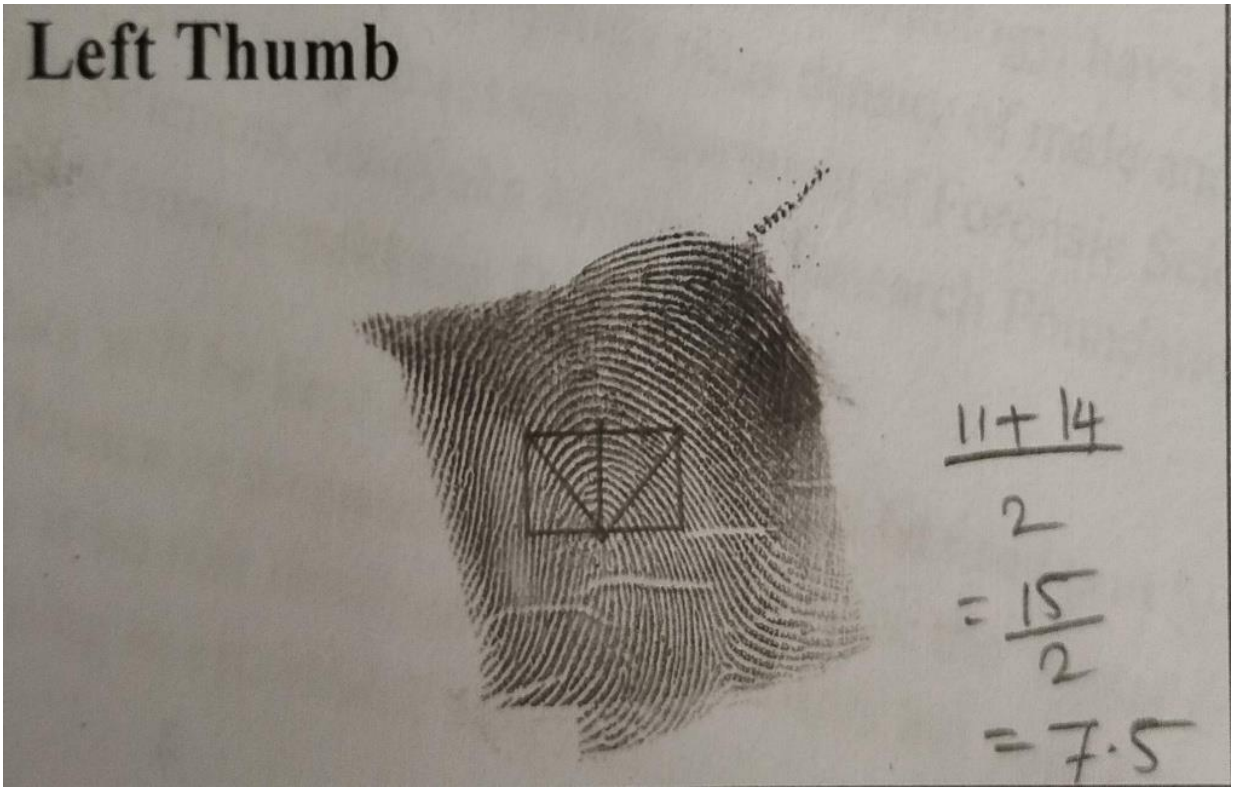
Methodology

The samples for the selected study consisted of fingerprints from 25 males and 25 females were chosen Randomly from Puducherry city in sahs campus, aged between 18 years to 25 years. The purpose of this study was Explained and verbal informed consent was taken from all the subjects' individually. Before taking Fingerprints, the subjects were asked to clean their hand A plain glass plate of 15 cm2 Is smeared with Fingerprinting black ink with the help of a roller that was used for the collection of prints. The subjects Were asked to roll their finger from the radial side (thumb) to the ulnar side (little finger) on the smeared Plate and then transferred their finger prints in the same manner onto the specified space on the bond Paper. In this manner, fingerprints of all the ten fingers were obtained from each individual.

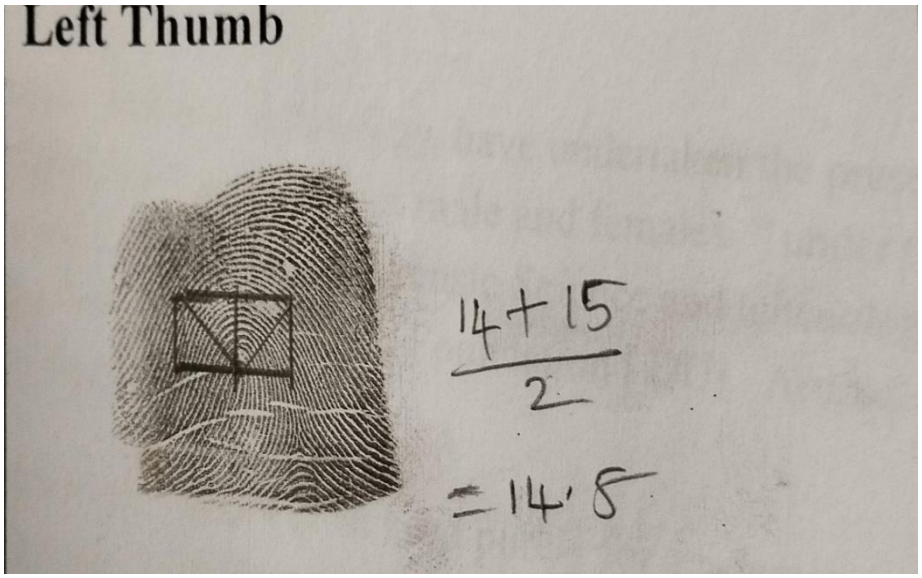
For analysis, constructed two squares of 5 × 5 mm2Each and placed them on the second ridge above the Top of the core split into tow box

OBSERVATION AND CALCULATION

Male fingerprint



Female fingerprint



MALE FINGERPRINTS SAMPLE

SAMPLE	AGE	RIGHT HAND	LEFT HAND	AVERAGE	TOTAL AVERAGE
1	18	11.5	10.4	10.9	
2	18	11.8	12.2	12	
3	19	11.5	11.6	11.5	
4	18	12.7	13.2	12.9	
5	19	12.7	12.4	18.9	
6	18	13.1	12	12.5	
7	20	12.1	16	14	
8	18	12.1	12	12.5	
9	18	11.5	12.7	12.4	
10	20	11.5	12.2	12.1	
11	19	11.8	11.6	11.5	
12	18	12.1	8.6	10	
13	21	11.5	12.2	12	
14	20	11.8	13.2	12.6	12.69
15	23	12.1	13.2	12.4	
16	24	12.3	12.9	18.9	
17	20	12.7	12.2	12	
18	18	12.7	12.4	11.5	
19	19	11.8	12.2	12.4	
20	19	11.5	11.6	10	
21	18	12.1	12.7	12.5	
22	20	11.5	8.7	12.5	
23	22	13.1	12	14	
24	18	13.1	12	14	

25	**22**	**12.1**	**16**	**12.8**	

FEMALE FINGERPRINTS SAMPLE

SAMPLE	AGE	RIGHT HAND	LEFT HAND	AVERAGE	TOTAL AVERAGE
1	**20**	**18.3**	**15**	**16.6**	
2	**23**	**16.5**	**15.2**	**15.8**	
3	**17**	**18.4**	**16**	**17.2**	
4	**19**	**16.3**	**16.5**	**16.4**	
5	**20**	**15**	**14.8**	**14.9**	
6	**24**	**16**	**17.2**	**16.6**	
7	**20**	**16**	**16.4**	**16.2**	
8	**20**	**15.2**	**14.9**	**15.05**	
9	**25**	**16.5**	**15**	**15.7**	
10	**25**	**18.1**	**15**	**16.5**	
11	**23**	**17**	**15.9**	**16.4**	
12	**18**	**16.2**	**15.5**	**15.7**	**15.8**
13	**22**	**16.4**	**16.4**	**16.4**	
14	**18**	**15.2**	**15**	**15.1**	
15	**15**	**12.4**	**14.4**	**13.4**	
16	**18**	**15.5**	**16.2**	**15.8**	
17	**17**	**15.6**	**17**	**16.3**	
18	**17**	**14.5**	**15.6**	**15**	
19	**16**	**16**	**16.1**	**16**	
20	**15**	**15**	**15.1**	**15**	
21	**20**	**15**	**15.2**	**15.1**	
22	**20**	**16**	**17.2**	**16.6**	
23	**22**	**17**	**16.8**	**16.9**	
24	**25**	**16.5**	**15**	**15.7**	
25	**24**	**15**	**16.2**	**15.6**	

RESULTS AND CONCLUSION

In the present study the average ridge density for Male in the age group 18-25 years is Calculated as 12.69 and the average of ridge density for Female in the age group 18-25 ye**ars is 15.8 .**

CONCLUSION

In the present study, the average of ridge density of Female is greater than the average of ridge Density of Male in Puducherry 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 population of various regions of Puducherry.

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