Pattern of Different Types of Fingerprints amongst the Community- an Observational Cross Sectional Study

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Abstract :

Background: No two people have exactly the same fingerprints. Even identical twins, with identical DNA, have different fingerprints. This uniqueness allows fingerprints to be used in all sort of ways, including background checks, biometric security, mass disaster identification, and of course, in criminal situations. This scientific examination of fingerprints for identification purposes is known as dactylography. **Aim:** To prove the uniqueness and study various pattern of fingerprint in an individual. **Objectives:** 1) To study pattern of fingerprints for identification of an individual, 2) To study different types of fingerprints and keep statistical data of loops, whorls, arches and compound/composite in a group of individual, and 3) To study different methods of fingerprinting in an individual. **Methodology:** The study was conducted among individuals under the age group of 25-40 years, including 50 males and 50 females. The study was conducted based on Henry Galton method. The fingerprints were taken by means of an ink pad on a blank sheet; a magnifying glass was used for clarity of the finger impressions. **Result:** There are 4 types of fingerprints namely loops-52.16%, whorls-34.99%, composite-10.04% and arches-2.81%. **Conclusion:** On this basis uniqueness of fingerprints was proved. Fingerprints are considered as secondary evidence in the court of law, even though it is used as a primary and the most basic source of identification of an individual. Also according to our study the percentage of types of fingerprints varied.

Keywords: Fingerprints, uniqueness, evidence, dactylography.

Introduction:

Forensic medicine is the application of scientific medical knowledge in a court of law for the administration of justice.[(1)] Dactylography refers to scientific study of fingerprints as a method of identification. Dactylography refers to the impression on a surface of curved ridges on a fingertip, such an impression made of ink and used as means of identification.[(2)] The uniqueness of fingerprint in an individual was first studied by Sir William Herschel a British officer for the Indian Civil Service.[(3,4)] A fingerprint is an impression left by the friction ridges of a human finger.[(2)] The recovery of partial fingerprints from a crime scene is an important method of forensic science. The ridge pattern present on the finger can be obtained by ink or other substances (e.g. powder, luminescent, metallic, etc.) on a smooth surface like paper. The impressions of finger are taken from last interphalangeal joint of fingers and thumb.[(5,6)]

No two finger prints are ever exactly alike in every detail; even two impressions recorded immediately after each other from the same hand may be slightly different. The identification of individuals by means of fingerprints is based upon three premises:

1. The ridge patterns on the digits never change during the life of an individual.
2. The ridge patterns differ from individual to individual, and even from digit to digit in every individual.
3. Although all patterns are individual and distinct in their ridge characteristics, they vary within limits which allow for systematic classification.[(5,6)]

Material & Method:

The study is a cross sectional study conducted among hundred (50 males and 50 females) individuals of age 25-40 years after obtaining clearance from institutional ethical committee with their written informed consent.

Inclusion criteria:

- Participants having all fingers and all ridges visible were included.
- Individuals consented to give prints.
- With age group 25-40 years.
- With 50 males and 50 females.

Exclusion criteria:

- Participants with malformations, deformity, trauma, surgical scars and genetic deformity (eg. Hypodactylic, Adermatoglyphia, cuts and bruises)
- Genetic deformity Adermatoglyphia where there is absence of finger ridges. The development of fingerprints is at the age of 6 months of intra uterine life of the fetus. When there is no presence of such ridge pattern then the condition is known as Adermatoglyphia.
- Finger deformities include swan neck deformity, boutonnière deformity and dupuytren contracture. These deformities may be caused by an injury or may result from another disorder (for example, rheumatoid arthritis). Typically, doctors base the diagnosis of finger deformities on an examination.
- Participants allergic to ink pad.
- Participants unwilling to give finger prints.
- Participants with other pathologic conditions.

Study Material: Stamp pad: camlin metal stamp pad, shade number- 3 violet, Smudge free, white sheets, sanitizer and tissue paper.

Study type: Observational, cross sectional study

Study site: Department of Forensic medicine and Toxicology, Medical College and Hospital, Ahmednagar, Maharashtra, India.

Number of samples: 100 (50 males and 50 females).

Methodology: The method used is known as Henry Galton Method.[6,7] The system used by most experts, although complex, is similar to the Henry Classification System. The system uses five fractions in which:[8]

R = right

L= left

i = index finger

m = middle finger

r = ring finger

p = pinky finger

t = thumb

The fractions are as follows:

Ri/Rt + Rr/Rm + Lt/Rp + Lm/Li + Lp/Lr

The numbers assigned to each print are based on whether or not they are whorls. A whorl in first fraction is given a 16, the second an 8, third a 4, fourth a 2 and last fraction is given a 0. The fraction are:

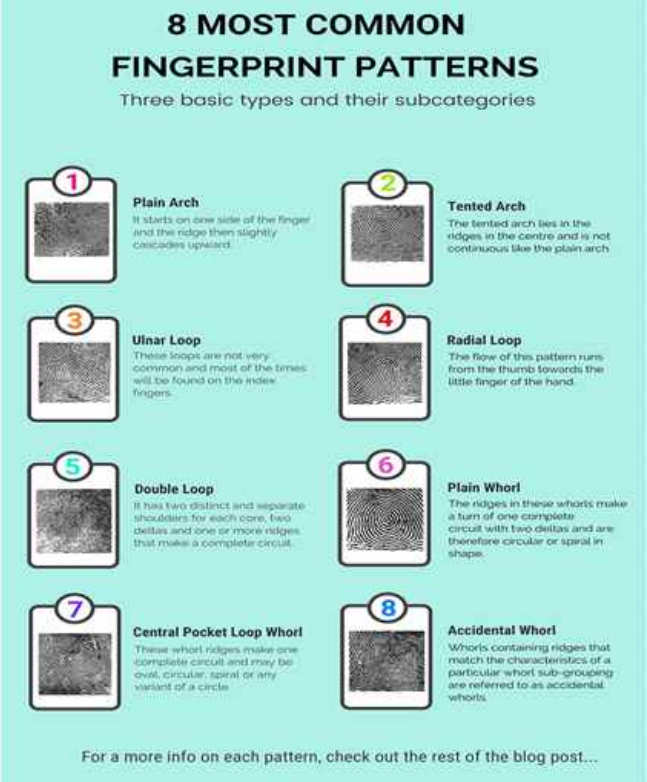
(Ri + Rr + Lt + Lm + Lp) / (Rt + Rm + Rp + Li + Lr)

A 1 is added to both top and bottom, to exclude any possibility of division by zero. For example: If the right ring finger and the left index finger have whorls, the fraction used is:

0/0 + 8/0 + 0/0 + 0/2 + 0/0 + 1/1

The resulting calculation is:

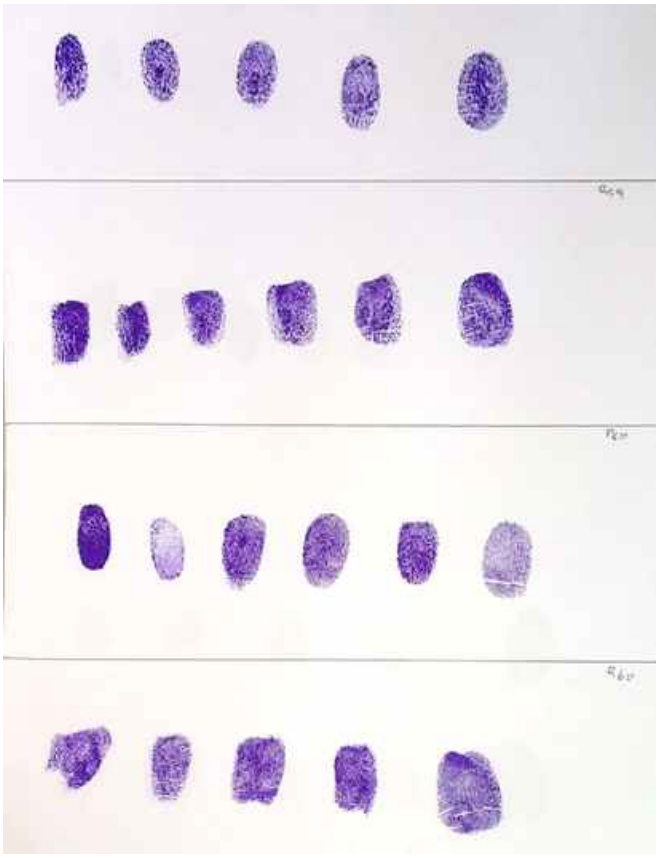
(0+8+0+0+0+1)/(0+0+0+2+0+1) = 9/3 = 3



Observation & Results:

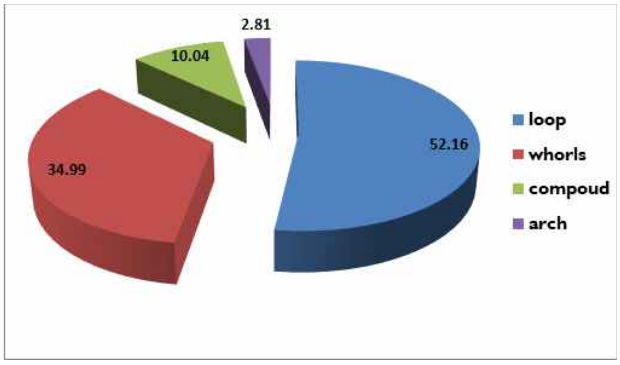
Loop & Arch type of fingerprint in a female

Male & Female Fingerprint In Plain & Rolled Pattern



According to the samples collected amongst these individuals the percentages are as follows:

- LOOPS: 52.16%
- WHORLS: 34.99%
- COMPOUND/ COMPOSITE: 10.04%
- ARCHES: 2.81%



Discussion:

The fingerprints develop at the age of 6 months of intrauterine life. Left hand fingerprint is preferred over right hand fingerprint, this is because, maximum individuals are right handed because of which the hand maximum in use is right hand which means the ridges on finger might not appear clear, that is the reason we prefer left hand fingerprints.

According to section 4 prisoners' act 1920. The station house officer and investigating officers are empowered to take fingerprints of on convicted persons who have been arrested in connection with an offence punishable with rigorous imprisonment for a term of 1 year or more. The fingerprints are not admissible in court unless examiners claim absolute certainty that a mark has been left by particular suspect.[7]

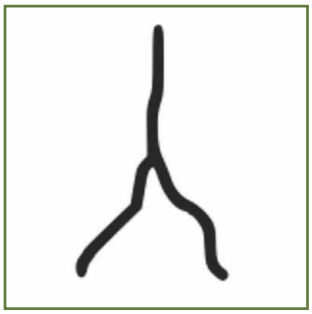
The study was conducted among individuals under the age group of 25-40 years, including 50 males and 50 females. There are 4 types of fingerprints namely loops-52.16%, whorls-34.99%, composite-10.04% and arches-2.81%. On this basis uniqueness of fingerprints was proved. Fingerprints are considered as secondary evidence in the court of law, even though it is used as a primary and the most basic source of identification of an individual. Though according to other books the percentages of the types of fingerprints differ as;

Loop- 65%, Whorls- 30%, and arches- 5%.[9] These recordings are usually found but in our findings the records differ.

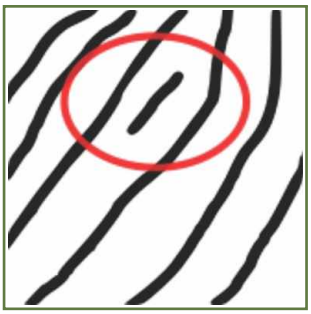
Features of fingerprint ridges, called minutiae, include: [10]

- **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
- **core:** A circle in the ridge pattern

RIDGE ENDING



BIFURCATION



SHORT RIDGE (DOT)

Adermatoglyphia is a rare condition that is characterized by lack of ridges on skin, fingers, and toes, palms of hand and soles of feet. This rare condition is caused by mutation in SMARCAD1 gene.[11] This case was seen in a Swiss woman in 2007, in her late 20's had an unusual hard time crossing the U.S border. The woman's passport picture matched her face just fine but when the agents scanned her hands, they discovered something shocking: she had no fingerprints. This is when the women knew she had an extremely rare condition known as adermatoglyphia.[11]

Since the elasticity of skin decreases with age, many senior citizens have fingerprints that are difficult to capture. The ridges get thicker; the height between the top of the ridge and the bottom of the furrow gets narrow, so there is less prominence.

Fingerprints can be erased permanently and this can potentially be used by criminals to reduce their chance of conviction.

Conclusion:

With this study one can conclude that all individuals have different fingerprints and your fingerprints are unique. It means that no one else in the world has the exact same set of ridges and lines that you have on your fingers. Not even identical twins have the same fingerprints. Your fingerprints also stay the same from the time you're born until death.

Your fingerprints also stay the same from the time you're born until death. Their uniqueness and lasting quality make fingerprints one of the best ways to identify a person.

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