Fingerprint as an evidence can provide an important information of individual in criminal investigation. The study of fingerprints is a kin to any other science. Many crimes occur under such circumstances where the fingerprint is present on any surface by the criminals whether it is patent, latent and plastic. In such cases, chance or latent print can found a link between a criminal and scene of crime. Fingerprint identification is based on two primary factors, uniqueness and permanence. Friction skin and fingerprint have long been considered parts of the anatomy that serve a specific purpose. Friction skin will remain on fingers, palms, toes and soles until the skin decomposes after the death (uniqueness) and the subsurface structure of human friction skin (permanence). The law enforcement agencies often rely on fingerprinting to identify the persons involved in crimes, both victims and suspects. Each person's fingerprints are unique, positive identification of unknown persons can be achieved through fingerprint analysis.

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"A Forensic Approach Between Chance And Visible Prints"

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"A Forensic Approach between Chance and Visible Prints"

A Dissertation Report submitted to the Bundelkhand University, Jhansi (U.P.) INDIA

Bundelkhand University Jhansi

Supervised By:

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Assistant Professor, Institute of forensic science & criminology

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PREFACE

Fingerprint as an evidence can provide an important information of individual in criminal investigation. The study of fingerprints is a kin to any other science. Many crimes occur under such circumstances where the fingerprint is present on any surface by the criminals whether it is patent, latent and plastic. In such cases, chance or latent print can found a link between a criminal and scene of crime. Fingerprint identification is based on two primary factors, uniqueness and permanence. Friction skin and fingerprint have long been considered parts of the anatomy that serve a specific purpose. Friction skin will remain on fingers, palms, toes and soles until the skin decomposes after the death (uniqueness) and the subsurface structure of human friction skin (permanence). The law enforcement agencies often rely on fingerprinting to identify the persons involved in crimes, both victims and suspects. Each person's fingerprints are unique, positive identification of unknown persons can be achieved through fingerprint analysis.

Chance print present at the crime scene is traditionally employed the identification of an individual through forensic analysis. The study of chance print led to belief in personal individualization. The chance print is compared over the visible print of the same individual of same finger by using black powder and inking method respectively and determined the maximum and minimum number of patterns, average percentage, ridge characteristics and frequency of ridge details found in samples of left index, left thumb, right index and right thumb fingers of an individual.

This experiment will help in the criminal investigation in detection of suspect, victim and criminal. The objectives of this study were to analyze and evaluate the unique features and minutiae present chance print over the visible print of individuals.

Shruti Verma

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It is a pleasure to give thanks to my guide ***Dr. Pradeep Kumar***, Assistant Professor, Institute of Forensic Science and Criminology, Bundelkhand University, Jhansi, for their guidance and valuable support. I owe my deepest gratitude to ***Dr. Ankit Shrivastava***, Co-ordinator, Institute of Forensic Science and Criminology, Bundelkhand University, Jhansi, for their valuable support.

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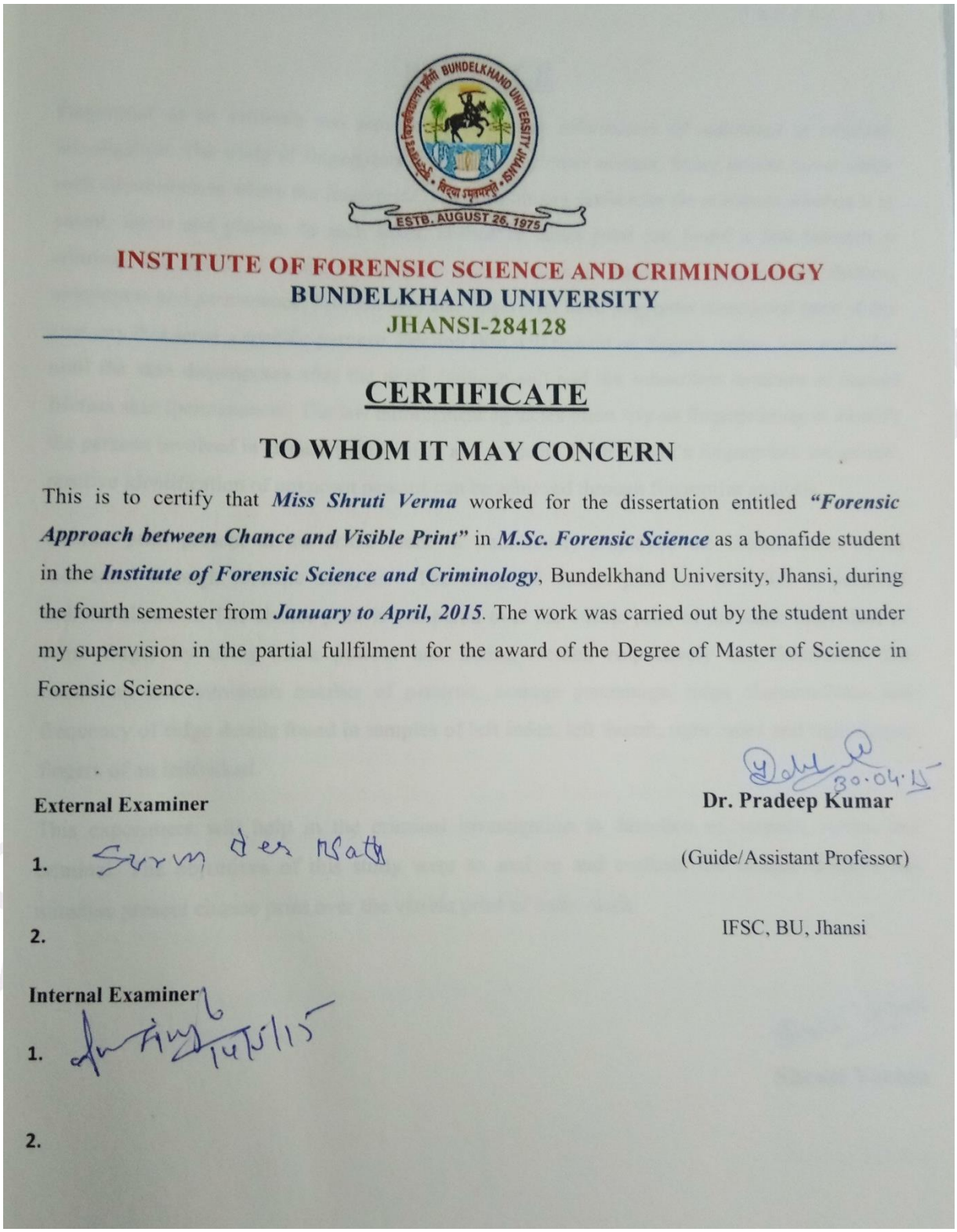
Finally I offer my regards and blessings to all of those who supported me in any respect during the completion of the thesis.

Shruti Verma

CERTIFICATE



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CERTIFICATE

TO WHOM IT MAY CONCERN

This is to certify that ***Miss Shruti Verma*** worked for the dissertation entitled ***"Forensic Approach between Chance and Visible Print"*** in ***M.Sc. Forensic Science*** as a bonafide student in the ***Institute of Forensic Science and Criminology***, Bundelkhand University, Jhansi, during the fourth semester from ***January to April, 2015***. The work was carried out by the student under my supervision in the partial fullfilment for the award of the Degree of Master of Science in Forensic Science.

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INTRODUCTION

Despite advances made in areas such as DNA profiling, fingerprints are also considered to be the best form of personal identification for criminal investigation purposes. Fingerprint detection has improved significantly over the last twenty years due to concerted efforts made by the number of researches around the world [12].

Under the Section 2(n) of ***Cr.PC*** and Section 40 of ***IPC,*** defines crime as an offence. When a crime is committed, the police service department is responsible to investigate crime. For the investigation to be successful, the evidence from the crime scene should be collected properly [18].

According to the ***Locard Principle***, evidence of the crime and the suspect must be found at the crime scene. For example-prints from fingers, palms and feet are usually found at a crime scene and on the surface of different materials [18].

The pattern of the epidermal ridges on our fingers, palms and soles, called fingerprints, is part of our everyday life. It is characterized by almost parallel ridges that form distinguishable configuration. These configurations have received a significant attention by forensic science because they make everybody's fingerprint unique and do not change in life [7]. Because each person's fingerprint are unique, positive identification of unknown persons can be achieved through fingerprint analysis. Law enforcement agencies often rely on fingerprinting to identify the persons involved in crimes, both victims and suspects [1].

Historical background

The use of fingerprints began in the late 1800s and early 1900s with the establishment of fingerprint classification systems [7].

Some historical terms associated with the fingerprints come from various parts of the world. These terms are given below:

- ***Dactylography***, Greek term that means "finger writing".
- ***Dactyloscopy***, Greek term that means "to view the fingers".
- ***Dermatoglyphics***, Latin term means "skin carving".

These terms can be converted into the scientific study of fingerprints for the purpose of identification [7].

Biological background

For the long periods of time, it has been known that there is a connection between the ridges pattern and anatomical structures, called volar pads. Volar pads are temporary eminences of the volar skin that form at **7th week** at the fingertip, on the distal part of the palm between the digits and in the thenar and hypothenar region (thenar and hypothenar pads) [21].

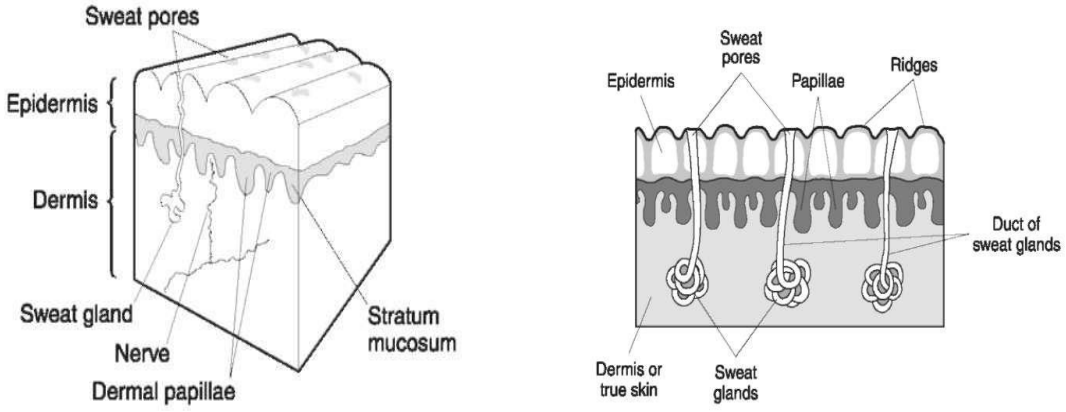
At about **10th week** of prenatal period, volar pads appear as mounds-shaped elevation on digital end, thenar, hypothenar and calcar areas [21].

At about **15th week**, these pads begin to regress. During this periods of regression dermal ridges differentiates .These ridges establish the future surface pattern at the **16th week**. The pattern formation is completed by **19th week.**

Once the pattern is completed, the epidermal ridges remain unchanged, except in size, for life. Thus, the patterns which characterize an individual are determined with finality at birth [21].

Friction skin is found on the hands and the feet of an individual and it is the outer layer of the skin that contains many of the element and characteristics, which we use to identify and individualize a print [7].

Figure 1 - The cross-section of the structure of friction skin are illustrated-



Cross-section of structure of ridged skin

1. Epidermal layer: outer layer
   a. Stratum Corneum : surface skin
      i) Friction ridges, furrows and pores
      ii) 1-2 mm thick
   b. Stratum Mucosum : inner skin
      i) Programs/forms outer skin
2. Dermal layer: inner layer
   a. Dermal papillae.
      i) Determine ridges structures.
   b. Sweat glands.
   c. Nerves of touch.
   d. Fat.

Principles of Fingerprint

Fingerprints are unique patterns, made by the friction ridges, furrows and pores, which appear on the volar pads of the fingers and thumbs. The ridges formed even before births do not change until and unless destroyed by decomposition after death shows the **permanency** in the fingerprint. While the **individuality** referred as two fingerprints are identical only if they are both produced by the same finger of the same person [`14].

Types of Fingerprint Evidences

There are three main types of fingerprint evidences that may be present at a crime scene. The first is the indented (moulded/plastic) fingermarks, which is a 3-D impression in a malleable substance such as putty or candle wax or soap etc. The second type is the visible fingermarks, which may be positive or negative depending on whether the fingers were contaminated with a coloured material (such as blood, paint and ink etc). The most common type of fingerprint evidence and the one which causes the most problem is the latent and chance fingermarks. Such

marks are largely invisible, and generally require some form of physical or chemical treatment to differentiate them [12].

Figure-2 Shows the Patent, Latent and Plastic Prints respectively.

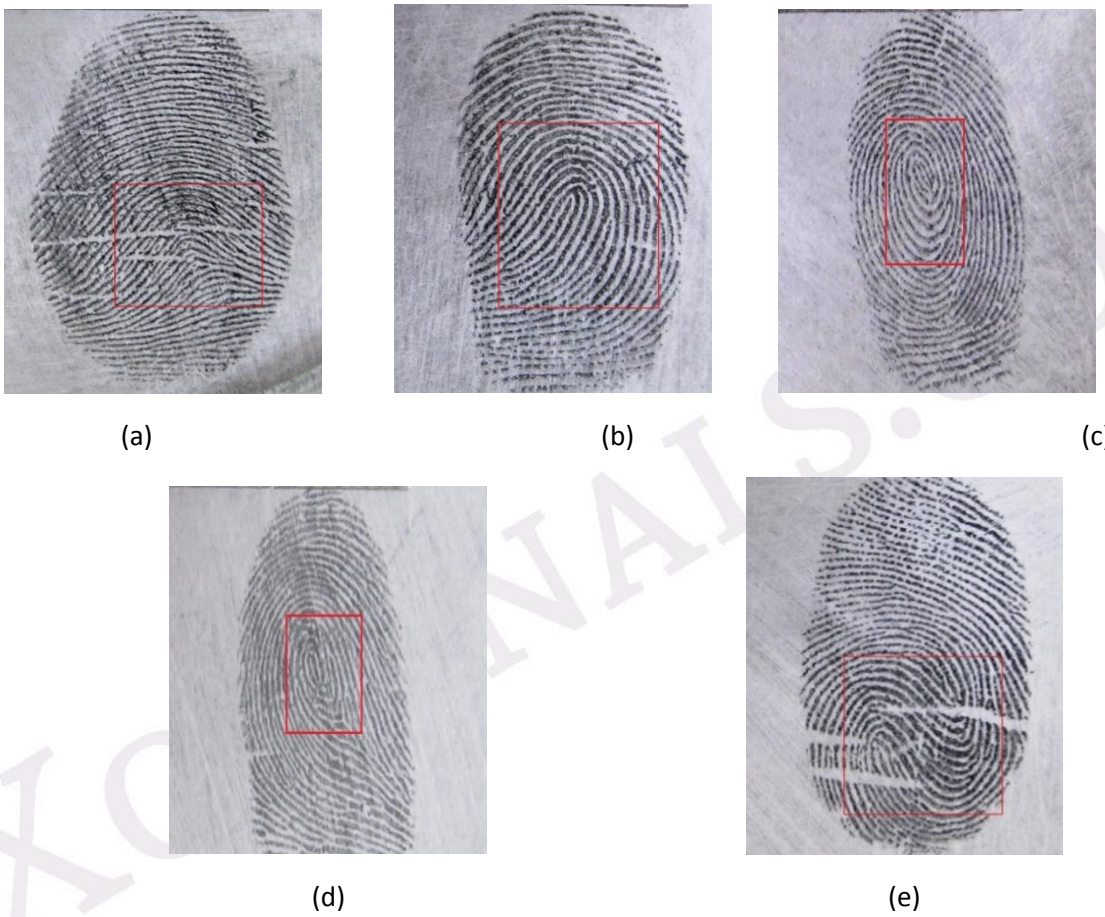
Fingerprint Patterns

Fingerprint Patterns are classified by the configuration of the ridge appearing on the distal phalange of the finger . The three basic pattern i.e. arch, loop and whorl are subdivided into nine subtypes for the purpose of classification are-

TABLE-1 Fingerprint Patterns and their symbols and conditions.

Basic Patterns	Sub- Pattern	Symbol	No of Deltas present	No of Cores present
Arch	Plain Arch	A	Nil	Nil
5-15%	Tented Arch	T	Nil	Nil
Loop	Radial Loop	R	One	One
60-65%	Ulnar Loop	U	One	One
Whorl	Plain Whorl	W	Two	Two
30-35%				
Composites	1. Central Pocket loop	C	Two	One
	2. Lateral Pocket loop	S	Two	Two

	3. Twinned loop 4. Accidentals	S X	Two Minimum Two	Two Minimum Two



(a) (b) (c)

(d) (e)

Figure- 3 Showing : a) arch, b) loop, c) whorl, d) central pocket loop and e) twinned loop.

Based on the foundation and fundamentals information, the basis of the science of fingerprints established is, every finger contains ridge detail which is unique to that finger and no other finger and unique ridge details do not change from approximately 120 days after conception until decomposition after death.

Fingerprints have been extensively investigated from many points of view. Many detailed studies and numerous papers have been written on the fingerprint features and have been statistically linked to common human features (gender) etc [10].

In spite of this comprehensive knowledge, no commonly accepted analysis of chance over visible will matches with the suspects. Reviewing the literatures, using mathematical modeling, statistical linking and performing computer simulations, we will analyze the percentage of the characteristics of ridges of chance over visible fingerprints of persons [10].

Chance Print at Crime Scene

In forensics, chance and latent fingerprints are marks left at the crime scene which are not immediately visible to the naked eye. To expose these types of marks, fingerprint examiner use fingerprints powder, fuming and other techniques.

The New Age of Fingerprint Identification

Fingerprints are now processed through the ***Integrated Automated Fingerprint Identification System (IAFIS)***. In India ***Automated Fingerprint Identification System (AFIS)*** was first installed at the *Central Fingerprint Bureau* of the *National Crime Records Bureau (NCRB)* in 1992. It uses image processing and pattern recognition technique to capture, encode, store and match fingerprints in both single digit as well as ten digit prints [22].

Ridge Characteristics

The friction ridges have certain basic features which are present in sufficient number in every fingerprint. A single fingerprint may possess as many as hundred and fifty or more characteristic features in the form of minute details of the ridges in the complete print area of the impression. The main characteristics of ridge formations commonly found in fingerprint impression [20] [22].

- ***Ridge ending or termination***- This is a ridge placed between two other, more or less parallel ridges. It ends abruptly and does not reappear.

- ***Bifurcation***- A ridge which leaves the left side of the pattern and divides for a certain length into two parallel lines and at times into three forming a trifurcation.

- ***Enclosure***- This is in the shape of an ellipse, and is formed by a ridge which bifurcates only to fuse or converge again to a single ridge almost immediately, leaving a blank space within the ridge. An enclosure may be of a small or large size. The extra-large enclosure may be referred to as a lake.

- ***Convergence or Converging Fork***: This is similar to divergence bifurcation but it is reverse or a mirror image. It is formed by two parallel ridges which leaves the left side of the pattern and fuse or converge to form a single ridge.

- ***Fragment or Short Ridge:*** A ridge with ends which finishes abruptly, and of variable length. The fragment may be small or large in size.

Figure 4- Ridge Characteristics

- ***Bridge:*** The junction of two parallel ridges by a short diagonal ridge which meets the ridges at a very acute angle.

- ***Hook or Spur:*** It is formed when a ridge bifurcates into two and one bifurcated ridge only continues further while the other does not and appears to be attached

to the ridge as an appendage ridge at an angle. A hook may be an upward hook, a downward hook, a rightward hook and a leftward hook.

- ***Return:*** A single ridge which suddenly turns upon itself and returns the way it has come, forming a rounded loop without a core.

- ***Deviated Break:*** An interruption formed by two ridges, which, instead of stopping just before they meet suddenly deviate, forming two ridge ending with a furrow between them.

- ***Intersection:*** It is found when one ridge intersects or cuts another ridge.

- ***Point or Dot or Spot:*** A very small fragment of a ridge which is only as long as it is wide, which usually found in the middle of an interruption or delta or between two ridges.

- ***Dotted Ridge:*** This is a ridge which created by the dots or points.

- ***Change-Over:*** It is formed when two parallel ridges change their places. One ridge is interrupted while the other takes its place by passing through the break.

Fingerprint Experts

The evidence of a fingerprint expert, a person especially skilled in fingerprints, is considered relevant evidence by virtue of **Section 45** of the Indian Evidence Act. The first All India Forensic Science conference held in Srinagar in 1972 recommended eight points as a uniform minimum number, for expert in India, to give positive opinion of identity of two prints [14][23].

Fingerprint Reports

In view of the general recognition of the individuality of fingerprints the Code of Criminal Procedure has been modified. The report of the Director of the Fingerprint Bureau is accepted as evidence like the report of a Chemical examiner under the **Section 293** of Code of Criminal Procedure, 1973. The court may if it is so, call the expert for evidence [14][23].

Hypothesis

The present study is to enquire that to explore the ridge characteristics between Chance and Visible Prints, whether they can be used for authentication or not.

REVIEW OF LITERATURE

It is said that thousands of years before the birth of Christ, Chinese monarchs used finger impressions for official purpose of sealing important state documents. Latent print development from crime scenes is a challenging task. Fingerprint composition, Surface type and the technique used to govern the success of development. The present approaches between chance and visible print for personal identification using modern techniques like physical, chemical and optical techniques etc. In such cases, chance or latent print can found a link between a criminal and scene of crime. So, I have decided to work on chance and visible prints for identification of individualities.

1788 J.C.A. Mayer: a German scientist, the arrangement of friction ridges are never duplicated in two individuals.

1823 Prof. J.E. Purkinje: published a thesis, and described friction ridges patterns and also classified the fingerprint into nine categories.

1858 Sir William Herschel, British chief administrative officer in Bengal, India, credited with the first known official use of fingerprints on a large scale. He started collecting the fingerprint impression and makes the use of fingerprints for identification.

1874 Dr. Henry Fauld, working at Tsukiji Hospital in Tokyo, led to belief that finger impression may lead to the scientific identification of criminals. Fauld published his findings in "***Nature***" in 1880.

1892 Sir Francis Galton, a British anthropologist and a cousin of Darwin wrote the first textbook ***"Fingerprints".*** He scientifically established that no two fingerprints were alike and made the statement that fingerprints were remains unchanged for life and they are permanent. He also devised the first scientific method of Classifying fingerprints patterns into arches, loops and whorls. Galton also pointed out the ridge characteristics and today are known as "Galton" details.

1897 Sir Edward Richard Henry, an Inspector General of Police in Bengal, developed a first and primary classification of fingerprint and is known Ten-digit classification. He published the book "classification and uses of fingerprints" in 1900.

1955-1913 BC Babylon: said fingerprints were used to seal contracts.

The fingerprint system was first suggested by Dr. Henry Faulds, initiated by Sir William Hershel, developed into system by Sir Francis Galton and perfectly applied by Sir Edward Richard Henry for the benefit of criminal justice community. The first Fingerprint Bureau in the world was established in ***Calcutta*** in 1897 (12.06.1897).

Menzel (2001) studied the recent advances in photoluminescence detection of fingerprints and concluded the new level of fingerprint detection sensitivity. These are designed for suppression of background fluorescence from articles holding latent prints, an often serious problem. The suppression of the background involves time-resolved imaging, which is dealt with from the perspective of instrumentation as well as the design of fingerprint treatment strategies.

Lennard (2001) analyzed the detection and enhancement of latent fingerprint and concluded the overview of the current techniques available to law enforcement agencies for the routine detection and enhancement of latent fingermarks on different surfaces.

Michael and Alan (2004) described the fingerprint formation and concluded their ideas was been tested by computer experiments. They are consistent with the well- known observation that the pattern type is related to the geometry of the fingertip surface when fingerprint pattern are formed.

Kucken and Newell (2004) concluded that fingerprint has been used as a mean of identification for more than 2000 years. They have also extensively studied scientifically by anthropologists and biologists. An idea has been tested by computer experiments. They are consistent with the well- known observation that the pattern type is related to the geometry of the fingertip surface when fingerprint patterns are formed.

Hsieh et. al. (2009) studied on effective method for fingerprint classification and concluded the directional information from the thinned image of the fingerprint. They use an octagon mask to search the center point of the region of interest and consider both the direction information and the singular points in the region of interest to classify the fingerprints. In the system, not only is the amount of computation reduced but also can the extracted information be used for identification on AFIS. The system has been tested all 4000 fingerprint images on the NIST

special fingerprint database 4. The classification accuracy reaches 93.425% with no rejection for 4-class classification problem.

Senbeta (2010) described an evaluation of the techniques used to collect latent prints from document and concluded the best technique to collect prints from documents.

Choi et. al. (2011) suggested that the evidential value of fingerprints and concluded that Fingerprint evidence were routinely used by forensics and law enforcement agencies worldwide to apprehend and convict criminals, a practice in use for over 100 years. Compared to previous approaches, the proposed measure allows explicit utilization of prior odds. Further, we also incorporate fingerprint image quality to improve the reliability of the estimated evidential value.

Kumari et. al. (2011) analyzed the new visualizing agents for latent fingerprints- synthetic food and festival colors and has concluded the new powdering method (synthetic food and festival color-gulal) for the development of latent fingerprints on different substrates as preliminary studies. It has been observed that the application of colors to the latent fingerprints gives clear results particularly on aluminum matrices.

Shaler and Lakhtakia (2013) studied the acquisition of sebaceous fingerprint topology using columnar thin films (CTF) on forensically relevant substrate and concluded the optimum condition for CTF development of latent sebaceous fingerprints on nonporous forensically relevant substrate. The CTFs were deposited using the CEFR technique. The CTF development method was to be compared with traditional development methods.

Tarase (2013) described the identification of an individual through fingerprints and has concluded the procedure of comparison of crime scene print with suspected prints and also attempted to understand the basic principles of fingerprints, legal aspects, types of fingerprint patterns and ridge characteristics of fingerprints.

Dhall et. al. (2014) studied on an overview of some conventional and modern fingerprint techniques and concluded that fingerprints are the most infallible means of identification. Latent print development from crime scenes is a challenging task. Fingerprint composition, Surface type and the technique used to govern the success of development. A wide range of physical,

chemical and optical techniques are available. However their application demands a complete understanding of the working and their compatibility with the other two factors. The present communication provides an overview of various conventional and modern fingerprint techniques.

Chauhan and Chattopadhyay (2014) suggested the development of latent dermal ridges present on fruits and vegetables and has concluded that the dermal ridges was successfully developed which was clear, identical and carrying enough information about an individual

Cherry and Ferriola (2015) described the scientific principles of friction ridges analysis and requires some fundamental study of human biological sciences. Thus, the basis for fingerprint identification was firmly rooted in science.

Zelson (2015) studied on fingerprint analysis method and has concluded the method for determining the probable gender of an individual based on his or her fingerprints is provided. The method relies upon a strong correlation between fingertip ridge width and gender, which was independent of body size.

MATERIALS AND METHODS

The present study has been carried out on 100 samples, 50 males and 50 females each in which both Chance and Visible prints of the four fingers (Left Index, Left Thumb, Right Index and Right Thumb) are taken.

Objectives

- Analyzing and evaluating the samples of chance print over the visible print of an individual.
- Comparison of the unique features i.e. ridge minutiae present in the two prints of the individuals.
- Evaluation of the detailed features of minutiae of an individual.

Materials

Visible Print- Ink tube, glass slab, roller, white sheets.

Chance Print- Dry black powder ink, spraying brush (very light feather).

Techniques- Digital camera (canon-10.0 mega pixel), measuring scale, magnifying lens and laptop/PC, Adobe Photoshop, MS- word 2010, MS Excel 2010, IBM SPSS Statistics software 20.

(a) **(b)** **(c)**

Fig. 5- Showing a) Ink Tube, b) Spraying Brush and c) Black Powder

Sample Collection

All the samples of chance and visible print were taken from the students of various departments (Physics, Geology and Economic and Finance) of Bundelkhand University, Jhansi. The experiment work is done in Institute of Forensic Science and Criminology, Bundelkhand University, Jhansi.

Sampling Process

a) For the purpose of Visible Print:

- On a glass slab, with the help of roller, we spread ink uniformly over slab that make a thin layer of ink on it.
- Then, the four fingers (LI, LT, RI and RT) of each individual were rolled separately from left end to right end on the glass slab.
- Now, again it rolled over the white sheet in the same way.
- Thus, the visible print form on the white sheet of paper.

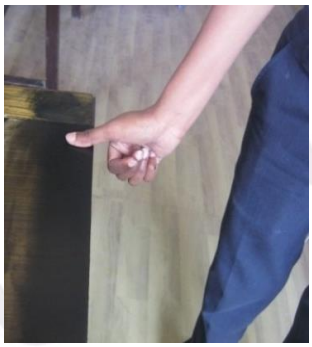



Fig. 6 Showing process of taking Visible Print from nail edge to nail edge on a white sheet.

b) For the purpose of Chance Print:

- Having chance print on any material, we take (petri disk).
- Spray black ink powder on the suspect print with the help of brush.
- Then, remove the excess of powder by brushing it in the one direction with very light hand.
- Thus, the print is visible on the suspect part.


Fig. 7- Developing Chance Print by spreading black powder on suspect area with the help of camel hair brush.

Then, we image the visible and chance print with the help of Digital Camera i.e. discussed in imaging of the fingerprint in methodology.

Precaution for taking Fingerprints

- The glass slab and the roller must be free from dust and dirt.
- Only small quantity of ink should be applied.
- Excessive pressure should be avoided.
- The finger should be rolled from left end to the right end from one side of nail to the other.
- Fingers should be cleaned of dirt and dried of perspiration.

Methods

Imaging of Fingerprint

Both the chance and the visible fingerprint samples of an individual of male and female (50 each) of Left Index (LI), Left Thumb (LT), Right Index (RI) and Right Thumb (RT) were photographed with the help of Canon Digital Camera (10.0 mega pixel) under the same lighting condition. After taking the photograph, the microchip of the camera were attached to the laptop that allowed photographs along with the scaling were converted into same size by using MS Word 2010 that make our analysis more easy to compare the sample side by side.

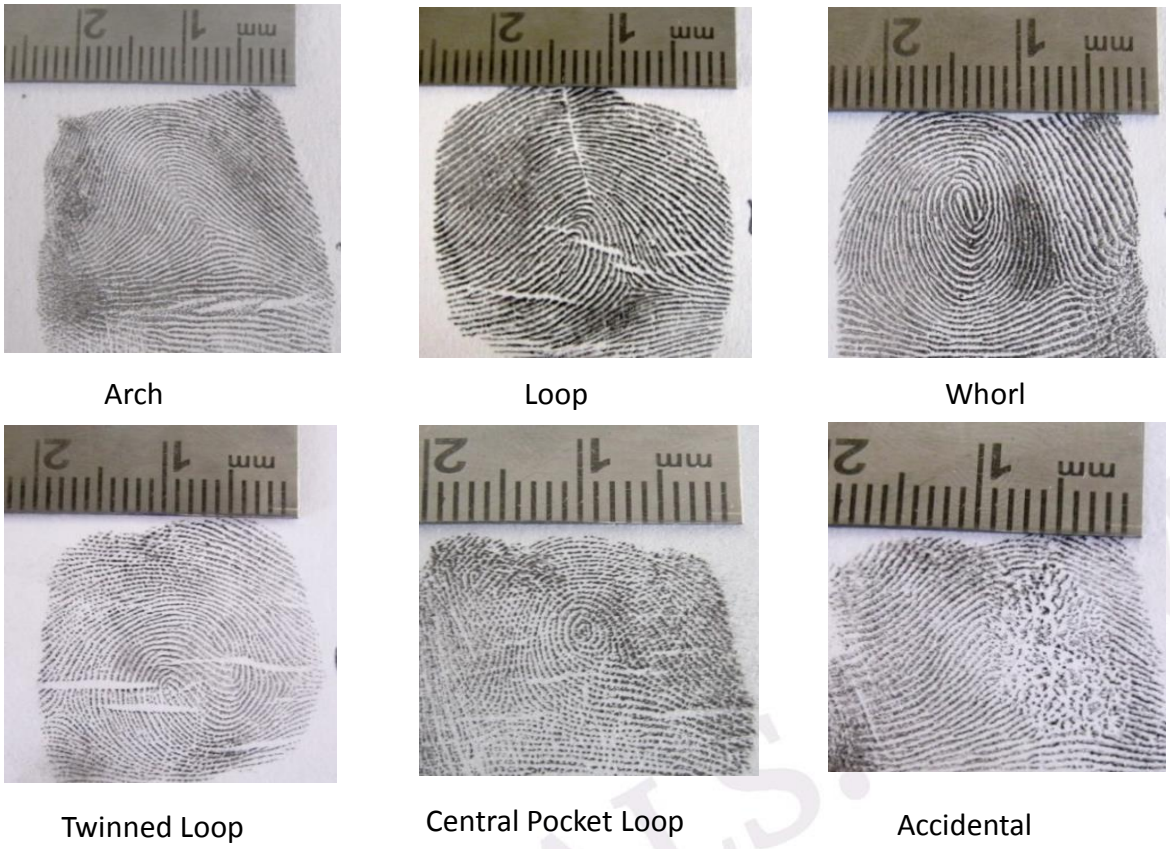


Fig. 8. Imaging patterns of Fingerprints taken by Digital Camera.

Thus, the comparison and matching of fingerprints for the purpose of identification focuses on different level i.e. level one and level two.

Level One (Ridge flow and Class Characteristics)

The central area of fingerprint provides the largest scale and general type of information such as an arch, whorl and loop etc. Showing that level one detail are identical is not enough to make an identification of finger.

Figure 9- Showing central area of print provides the largest scale information of pattern.

Level Two (Ridge Characteristics)

This level focuses on the characteristics of ridge path, such as places where ridges bifurcates, converge, end, fragment and creates a dots or lake or enclosure etc. These features provide a great deal of detail. Each feature can be identified by the type of features (end, bifurcate, enclosure, lake and convergence etc.), its direction and its location. Level two details can be used to identify one individual finger.

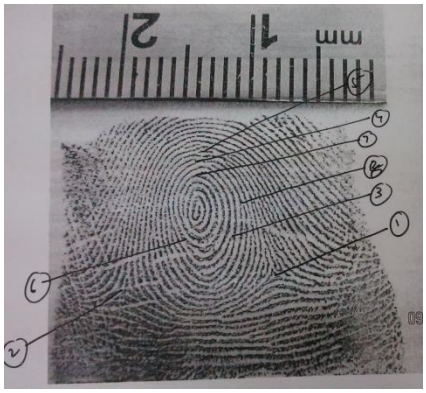


Figure 10- Showing ridged details are,

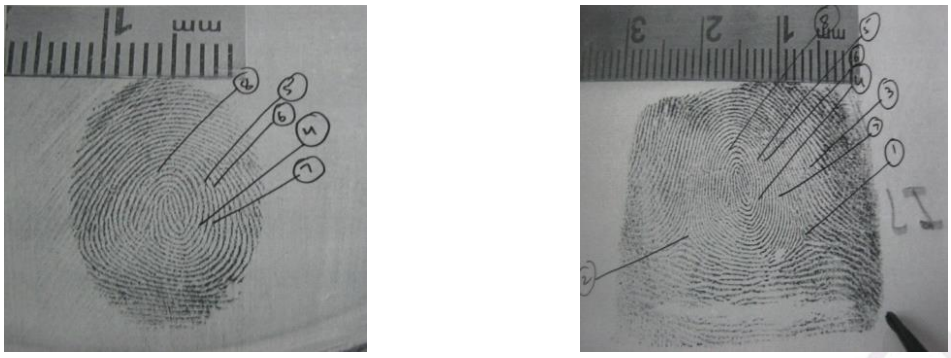
1. Delta.
2. Delta.
3. Lake.
4. Convergence.
5. Fragment.
6. Convergence.
7. Bifurcation.
8. Bifurcation.

As FBI uses and adopted the standard method, a fingerprint examiner goes through, it has four-step process with the acronym "**ACE-V**," for ***analysis***, ***comparison, evaluation*** and ***verification*** that focuses on level one and level two details.

(a) <u>Analysis:</u>

The first phase is ***analysis***. Analysis is through the examination of the chance print over the visible print of an individual. Generally, "level one" refers to the overall pattern or ridge flow of

the print. "level two detail" refers to the next feature observed, generally those with physical dimension of the ridges. They are so- called "Minutiae".



Chance Print **Visible Print**

Figure 11- Analysis of Chance and Visible Print

(b) <u>Comparison:</u>

Once the thorough analysis of the print has been completed, the second phase of identification process is ***comparison***. During the comparison phase, we concentrate primarily on the chance print and match the minutiae's present at the same place and on the same location as on the visible print. Only then we evaluate and calculate the percentage and accuracy of the chance print over the visible print.

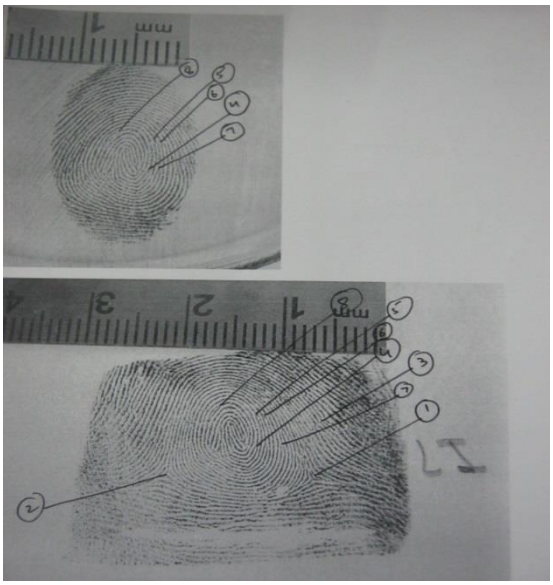


Figure 12- Showing of Comparison of Chance over Visible Print having ridge detail.

(c) Evaluation:

The third phase is the identification process, ***evaluation***. In this phase, the two prints are examined together side by side and their differences in appearance between the two images of each finger LI, LT, RI and RT of both the prints i.e. chance and visible print. It decides if the print are of same source or different source.

TABLE-2 Evaluation of chance print over visible print.

S.No.	Characteristics	Chance Print	Visible Print
1.	**Delta**	Absent	Present
2.	**Delta**	Absent	Present
3.	**Ridge Crossing**	Absent	Present
4.	**Lake**	Present	Present
5.	**Convergence**	Present	Present
6.	**Convergence**	Present	Present
7.	**Convergence**	Present	Present
8.	**Lake**	Present	Present

In above table shows that the delta is absent in the chance print where as present in the visible print, ridge crossing is absent in the chance print where as present in the visible print, and lake and convergence is present in both chance and visible print.

(d) Verification:

The final step in the process is ***verification***; in this another expert will repeat the entire process that has made the positive identification. In this another examiner independently analyzes, compare and evaluate the prints to either support or refuse the conclusion of the original examiner.

RESULTS AND DISCUSSION

Fingerprint identification is the result of a comparison of the unique features present in the two prints being compared. The compared process is done in a methodical way using the scientific methodology referred as ACE-V. The detail or features present are analyzed. The detail present in both the two prints is compared, and an evaluation of that detail take place to determine the maximum and minimum number of pattern found in male and female, average percentage, maximum and minimum number of characteristics, frequency and bar graph of the chance print over the visible prints. After the identification is made, the process is repeated during the verification process by another examiner.

COMPARISON RESULT

TABLE-3 Maximum and minimum number of pattern found in male (50 sample).

Total number of sample of male of each finger= 50			
S.No	**Sample Name**	**Pattern /Max. no.**	**Pattern/Min. no.**
1.	**Left Index (LI)**	Ulnar loop (24)	Arch (1)
2	**Left Thumb (LT)**	Ulnar loop (24)	Arch (3)
3.	**Right Index (RI)**	Ulnar loop (23)	Arch (1)
4.	**Right Thumb (RT)**	Whorl (18)	Central pocket loop (3)

TABLE-4 Maximum and Minimum number of pattern found in female (50 sample).

Total number of sample of male of each finger= 50			
S.No	**Sample Name**	**Pattern /Max. no.**	**Pattern/Min. no.**
1.	**Left Index (LI)**	Whorl (19)	Central pocket loop (1)
2	**Left Thumb (LT)**	Ulnar loop (25)	Central pocket loop (1)
3.	**Right Index (RI)**	Whorl (23)	Radial loop (1)
4.	**Right Thumb (RT)**	Ulnar loop, Whorl (18)	Central pocket loop (4)

Table 3 and table 4 represents the maximum and minimum number of pattern found in LI, LT, RI and RT that was analyzed from 50 samples each.

TABLE-5 Average percentage of Chance Print over Visible Print of male.

S.No.	Sample of Male	Ridge Characteristics		Average percentage of Chance over Visible Print
		Visible Print	**Chance Print**	
1.	**M1**	24	22	91.66
2.	**M2**	28	18	64.28
3.	**M3**	26	13	50.00
4.	**M4**	15	13	86.66
5.	**M5**	26	23	88.46
6.	**M6**	17	14	82.35
7.	**M7**	22	16	72.72
8.	**M8**	13	11	84.61
9.	**M9**	22	17	77.27
10.	**M10**	18	16	88.88
11.	**M11**	22	20	90.90
12.	**M12**	22	17	77.27
13.	**M13**	17	17	100.00
14.	**M14**	22	17	77.27
15.	**M15**	33	28	84.84
16.	**M16**	21	20	95.23

17.	**M17**	22	19	86.36
18.	**M18**	19	18	94.73
19.	**M19**	15	13	86.66
20.	**M20**	23	18	78.26
21.	**M21**	30	23	76.66
22.	**M22**	17	12	70.58
23.	**M23**	20	17	85.00
24.	**M24**	15	14	93.33
25.	**M25**	28	27	96.42
26.	**M26**	27	18	66.66
27.	**M27**	23	14	60.86
28.	**M28**	19	16	84.21
29.	**M29**	22	15	68.18
30.	**M30**	10	08	80.00
31.	**M31**	20	16	80.00
32.	**M32**	22	16	72.72
33.	**M33**	25	18	72.00
34.	**M34**	32	22	68.75
35.	**M35**	20	19	95.00
36.	**M36**	21	18	85.71
37.	**M37**	20	16	80.00
38.	**M38**	28	25	89.28
39.	**M39**	31	24	77.41

40.	**M40**	25	15	60.00
41.	**M41**	31	28	90.32
42.	**M42**	13	07	53.84
43.	**M43**	18	13	72.22
44.	**M44**	27	09	33.33
45.	**M45**	25	20	80.00
46.	**M46**	28	17	60.71
47.	**M47**	26	19	73.07
48.	**M48**	27	17	62.96
49.	**M49**	17	10	58.82
50.	**M50**	38	28	73.68
			Average	77.6%

From table no.5, the maximum and minimum average percentage of chance print over the visible print among 50 male samples was found to be 100% and 33.33% respectively and the average of the percentage is 77.6%.

TABLE-6 Average percentage of Chance Print over Visible Print of Females.

S.No	Sample of Female	Ridge Characteristics		Average Percentage of Chance over Visible Print
		Visible Print	**Chance Print**	
1.	**F1**	15	13	86.66

2.	**F2**	17	17	100.00
3.	**F3**	12	08	66.66
4.	**F4**	16	08	50.00
5.	**F5**	17	14	82.35
6.	**F6**	12	10	83.33
7.	**F7**	08	08	100.00
8.	**F8**	18	12	66.66
9.	**F9**	13	12	92.30
10.	**F10**	15	13	86.66
11.	**F11**	21	12	57.14
12.	**F12**	21	15	71.42
13.	**F13**	15	11	73.33
14.	**F14**	20	12	60.00
15.	**F15**	22	17	77.27
16.	**F16**	17	14	82.35
17.	**F17**	13	12	92.30
18.	**F18**	20	14	70.00
19.	**F19**	12	10	83.33
20.	**F20**	18	16	88.88
21.	**F21**	22	13	59.09
22.	**F22**	20	11	55.00
23.	**F23**	17	11	64.70
24.	**F24**	23	16	69.56

25.	**F25**	20	14	70.00
26.	**F26**	14	06	42.85
27.	**F27**	11	10	90.90
28.	**F28**	18	12	66.66
29.	**F29**	22	19	86.36
30.	**F30**	14	07	50.00
31.	**F31**	16	12	75.00
32.	**F32**	12	12	100.00
33.	**F33**	18	12	66.66
34.	**F34**	24	15	62.50
35.	**F35**	20	16	80.00
36.	**F36**	09	08	88.88
37.	**F37**	09	07	77.77
38.	**F38**	14	11	78.57
39.	**F39**	15	11	73.33
40.	**F40**	18	15	83.33
41.	**F41**	16	09	56.25
42.	**F42**	11	09	81.81
43.	**F43**	17	08	47.05
44.	**F44**	13	11	84.61
45.	**F45**	15	08	53.33
46.	**F46**	18	12	66.66
47.	**F47**	16	13	81.25

48.	**F48**	27	22	81.48
49.	**F49**	17	13	76.47
50.	**F50**	12	10	83.33
			Average	74.4%

From table no.6, the maximum and minimum average percentage of chance print over the visible print among 50 female samples was found to be 100% and 42.85% respectively and the average of the percentage is 74.4%.

TABLE-7 Maximum and minimum ridge characteristics of male.

	Ridge Characteristics- Visible Print	Ridge Characteristics- Chance Print
No. of sample	50	50
Maximum	38.00	28.00
Minimum	10.00	7.00

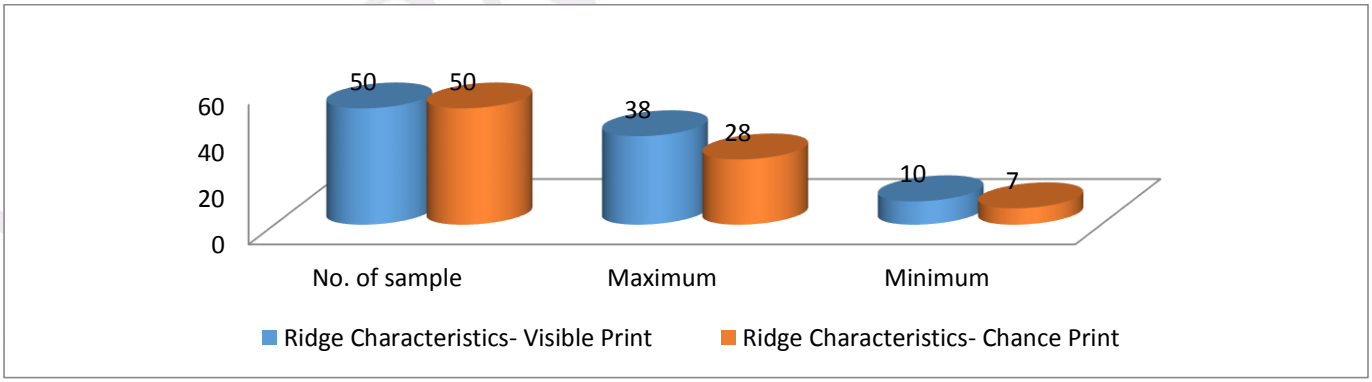


Chart-1 The chart represents the maximum and minimum ridge characteristics found in chance over visible print among 50 male samples is (28, 38) and (07, 10) respectively**.**

TABLE-8 Maximum and minimum ridge characteristics of female.

	Ridge Characteristics- Visible Print	Ridge Characteristics- Chance Print
No. of sample	50	50

Maximum	27.00	22.00
Minimum	8.00	6.00

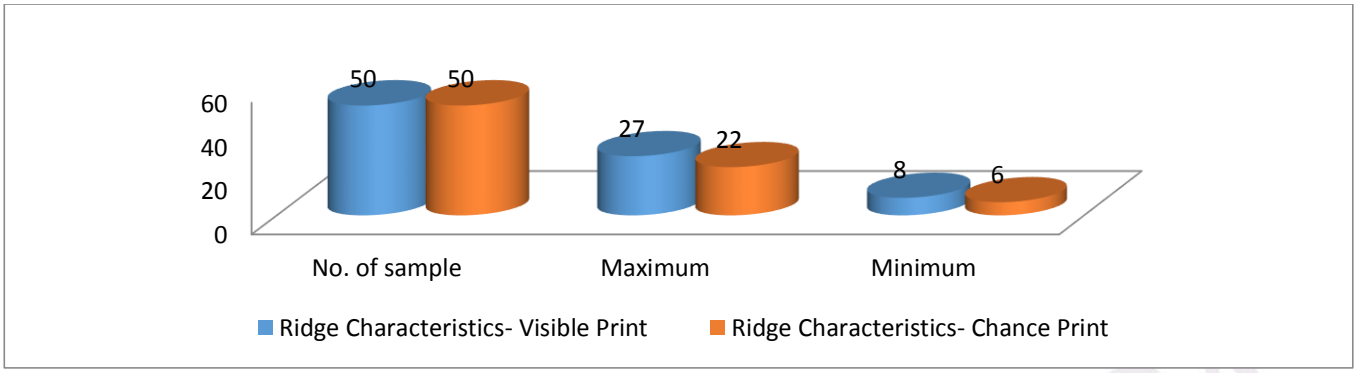


Chart-2 The chart represents the maximum and minimum ridge characteristics found in chance over visible print among 50 female samples is (22, 27) and (06, 08) respectively**.**

TABLE-9 Frequency Table of Visible and Chance Print of Male.

Ridge Characteristics- Visible Print

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
10.00	1	2.0	2.0	2.0
13.00	2	4.0	4.0	6.0
15.00	3	6.0	6.0	12.0
17.00	4	8.0	8.0	20.0
18.00	2	4.0	4.0	24.0
19.00	2	4.0	4.0	28.0
20.00	4	8.0	8.0	36.0
21.00	2	4.0	4.0	40.0
22.00	8	16.0	16.0	56.0
23.00	2	4.0	4.0	60.0
24.00	1	2.0	2.0	62.0

25.00	3	6.0	6.0	68.0
26.00	3	6.0	6.0	74.0
27.00	3	6.0	6.0	80.0
28.00	4	8.0	8.0	88.0
30.00	1	2.0	2.0	90.0
31.00	2	4.0	4.0	94.0
32.00	1	2.0	2.0	96.0
33.00	1	2.0	2.0	98.0
38.00	1	2.0	2.0	100.0
Total	50	100.0	100.0	

It has been observed from the given table 9, 8 is the maximum frequency of 22 ridge characteristics and 1 is the minimum frequency of 10, 24, 30, 32, 33 and 38 ridge characteristics found in the visible print of the male.

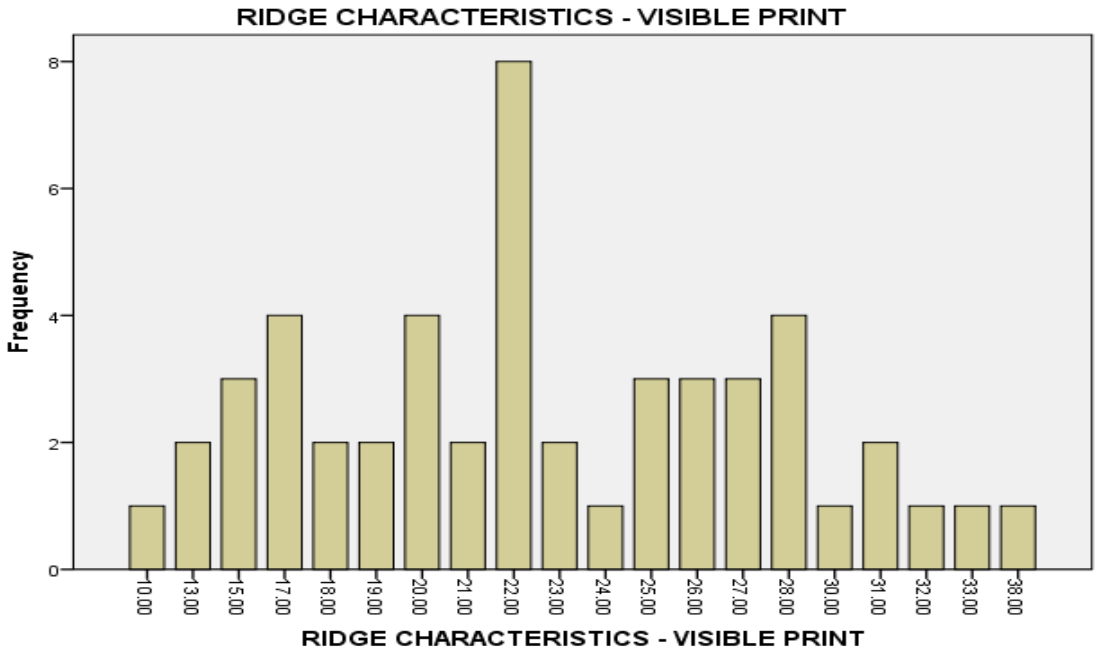
Ridge Characteristics- Chance Print

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
7.00	1	2.0	2.0	2.0
8.00	1	2.0	2.0	4.0
9.00	1	2.0	2.0	6.0
10.00	1	2.0	2.0	8.0
11.00	1	2.0	2.0	10.0
12.00	1	2.0	2.0	12.0
13.00	4	8.0	8.0	20.0

14.00	3	6.0	6.0	26.0
15.00	2	4.0	4.0	30.0
16.00	6	12.0	12.0	42.0
17.00	7	14.0	14.0	56.0
18.00	6	12.0	12.0	68.0
19.00	3	6.0	6.0	74.0
20.00	3	6.0	6.0	80.0
22.00	2	4.0	4.0	84.0
23.00	2	4.0	4.0	88.0
24.00	1	2.0	2.0	90.0
25.00	1	2.0	2.0	92.0
27.00	1	2.0	2.0	94.0
28.00	3	6.0	6.0	100.0
Total	50	100.0	100.0	

It has been observed from the above table, 7 is the maximum frequency of 17 ridge characteristics and 1 is the minimum frequency of 7, 8, 9, 10, 11, 12, 24, 25 and 27 ridge characteristics found in the chance print of the male.

Graph-1 Showing the Bar Graph of Visible and Chance Print of male.



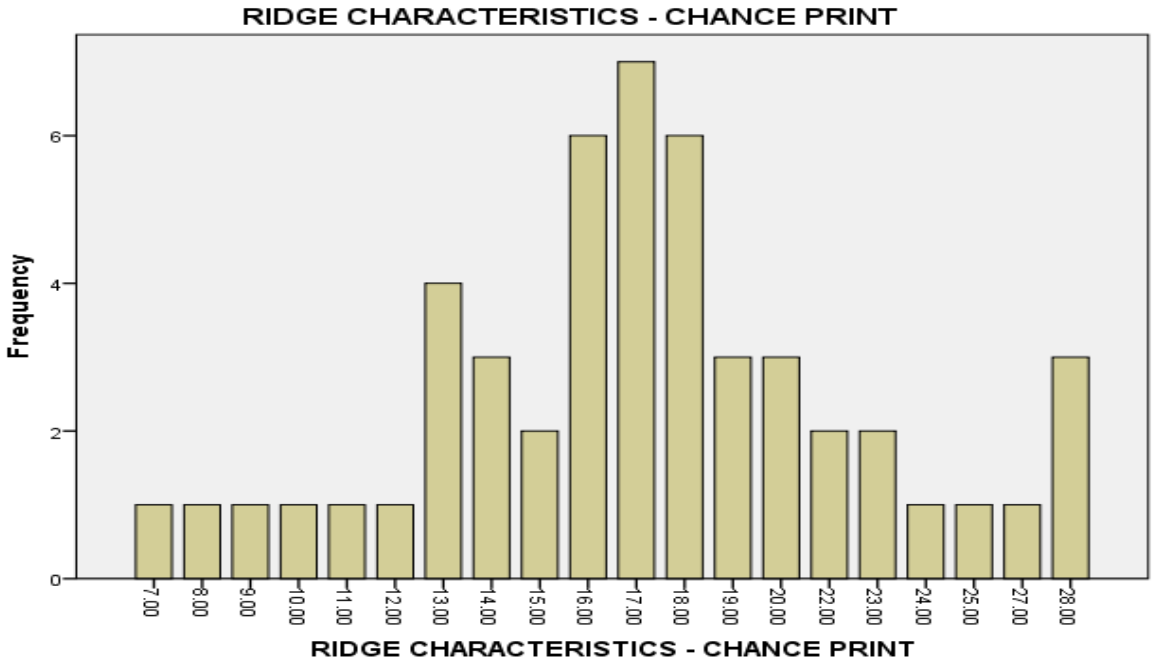


TABLE-10 Frequency Table of Visible and Chance Print of Female.

Ridge Characteristics- Visible Print

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
8.00	1	2.0	2.0	2.0
9.00	2	4.0	4.0	6.0
11.00	2	4.0	4.0	10.0
12.00	5	10.0	10.0	20.0
13.00	3	6.0	6.0	26.0
14.00	3	6.0	6.0	32.0
15.00	5	10.0	10.0	42.0
16.00	4	8.0	8.0	50.0
17.00	6	12.0	12.0	62.0
18.00	6	12.0	12.0	74.0
20.00	5	10.0	10.0	84.0
21.00	2	4.0	4.0	88.0
22.00	3	6.0	6.0	94.0
23.00	1	2.0	2.0	96.0
24.00	1	2.0	2.0	98.0
27.00	1	2.0	2.0	100.0
Total	50	100.0	100.0	

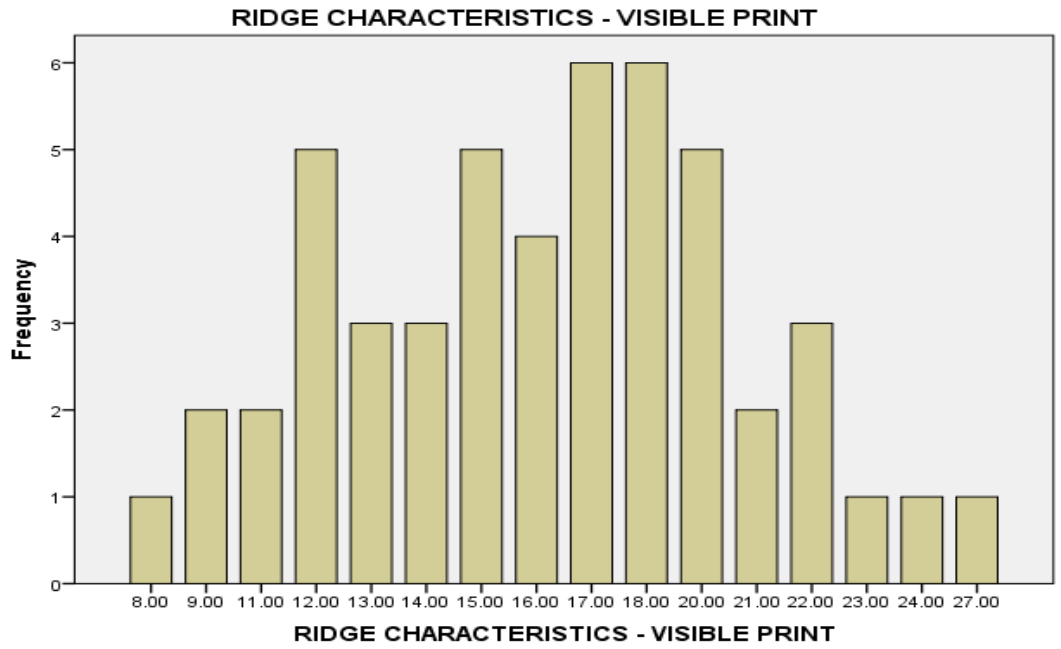
It has been observed from the table 10, 6 is the maximum frequency of 17 and 18 ridge characteristics and 1 is the minimum frequency of 8, 23, 24 and 27 ridge characteristics found in the visible print of the female.

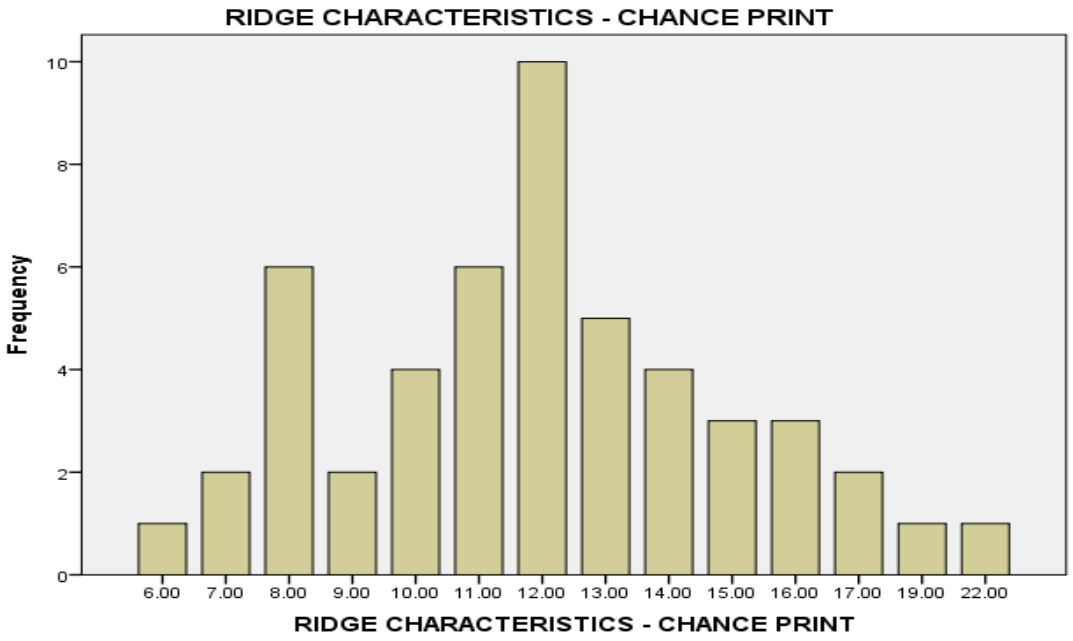
Ridge Characteristics- Chance Print

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
6.00	1	2.0	2.0	2.0
7.00	2	4.0	4.0	6.0
8.00	6	12.0	12.0	18.0
9.00	2	4.0	4.0	22.0
10.00	4	8.0	8.0	30.0
11.00	6	12.0	12.0	42.0
12.00	10	20.0	20.0	62.0
13.00	5	10.0	10.0	72.0
14.00	4	8.0	8.0	80.0
15.00	3	6.0	6.0	86.0
16.00	3	6.0	6.0	92.0
17.00	2	4.0	4.0	96.0
19.00	1	2.0	2.0	98.0
22.00	1	2.0	2.0	100.0
Total	50	100.0	100.0	

It has been observed from the above table, 10 is the maximum frequency of 12 ridge characteristics and 1 is the minimum frequency of 6, 19 and 22 ridge characteristics found in the chance print of the female.

Graph-2 Showing the Bar Chart of Visible and Chance Print of female.


RIDGE CHARACTERISTICS - VISIBLE PRINT
Frequency
0
1
2
3
4
5
6
8.00 9.00 11.00 12.00 13.00 14.00 15.00 16.00 17.00 18.00 20.00 21.00 22.00 23.00 24.00 27.00
RIDGE CHARACTERISTICS - VISIBLE PRINT


RIDGE CHARACTERISTICS - CHANCE PRINT
Frequency
0
2
4
6
8
10
6.00 7.00 8.00 9.00 10.00 11.00 12.00 13.00 14.00 15.00 16.00 17.00 19.00 22.00
RIDGE CHARACTERISTICS - CHANCE PRINT

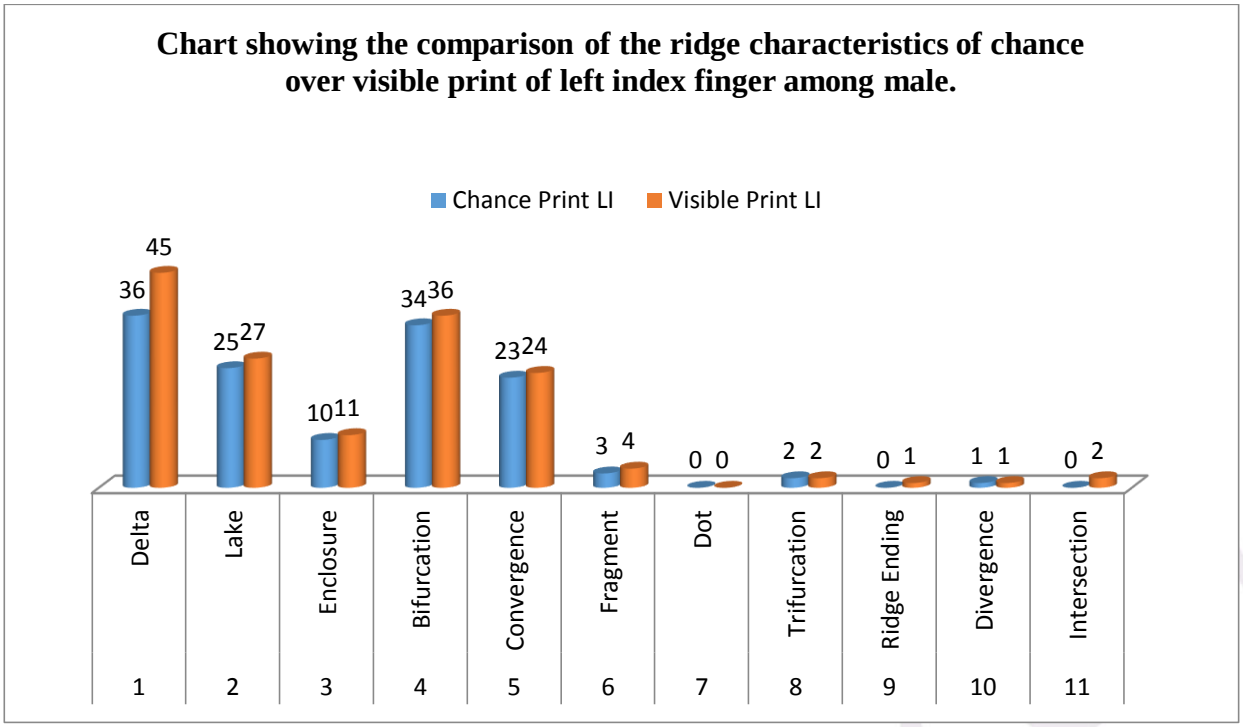


Chart-3 Assessment of ridge characteristics of chance over visible print of left index (LI) finger of male of 50 samples.

S.No	Characteristics	Chance Print	Visible Print
		LI	LI
1.	Delta	36	45
2.	Lake	25	27
3.	Enclosure	10	11
4.	Bifurcation	34	36
5.	Convergence	23	24
6.	Fragment	03	04
7.	Dot	00	00
8.	Trifurcation	02	02
9.	Ridge Ending	00	01
10.	Divergence	01	01
11.	Intersection	00	02

TABLE- 11a It represents the data for the assessment of chance over visible print of ridge characteristics of left index (LI) finger among 50 male samples. It has been observed that the

delta (36, 45) and bifurcation (34, 36) respectively are the characteristic which shows the highest level of matching and the divergence (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the dot or point is the only characteristic, which is not present in both the sample of the print.

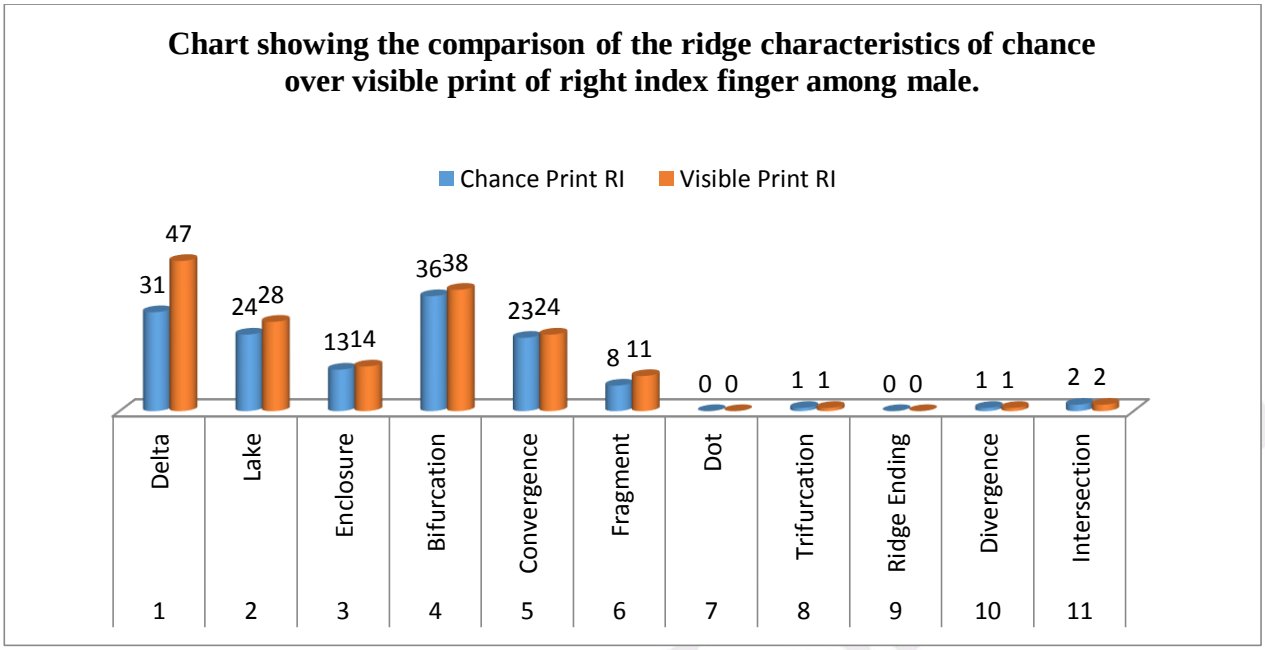


Chart-4 Assessment of ridge characteristics of chance over visible print of right index (RI) finger of male of 50 samples.

S.No	Characteristics	Chance Print	Visible Print
		RI	RI
1.	Delta	31	47
2.	Lake	24	28
3.	Enclosure	13	14
4.	Bifurcation	36	38
5.	Convergence	23	24
6.	Fragment	08	11
7.	Dot	00	00
8.	Trifurcation	01	01
9.	Ridge Ending	00	00
10.	Divergence	01	01
11.	Intersection	02	02

TABLE- 11b It represents the data for the assessment of chance over visible print of ridge characteristics of right index (RI) finger among 50 male samples. It has been observed that the delta (31, 47) and bifurcation (36, 38) respectively are the characteristics which show the highest level of matching and the divergence (1, 1) and trifurcation (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the dot or point and ridge ending are the characteristics, which is not present in both the sample of the print.

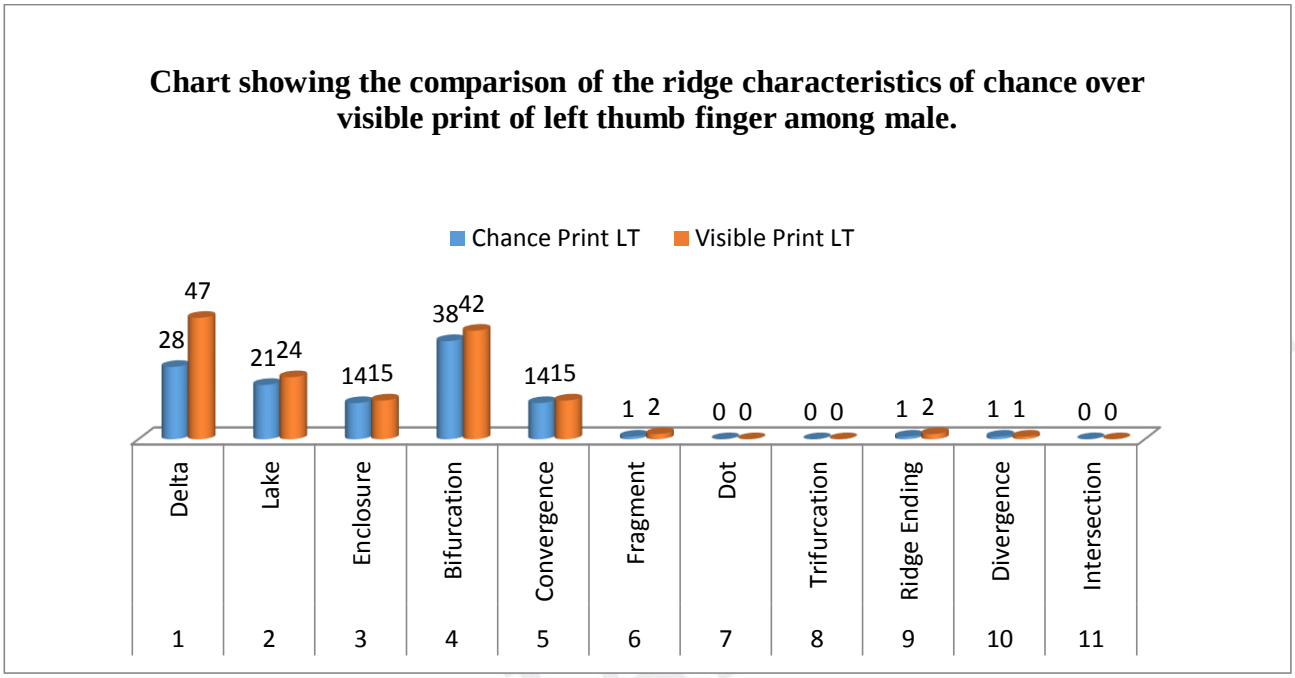


Chart-5 Assessment of ridge characteristics of chance over visible print of left thumb (LT) finger of male of 50 samples.

S.No	Characteristics	Chance Print	Visible Print
		LT	LT
1.	Delta	28	47
2.	Lake	21	24
3.	Enclosure	14	15
4.	Bifurcation	38	42
5.	Convergence	14	15
6.	Fragment	01	02
7.	Dot	00	00
8.	Trifurcation	00	00
9.	Ridge Ending	01	02

10.	**Divergence**	01	01
11.	**Intersection**	00	00

TABLE-12a It represents the data for the assessment of chance over visible print of ridge characteristics of left thumb (LT) finger among 50 male samples. It has been observed that the delta (28, 47) and bifurcation (38, 42) respectively are the characteristics which show the highest level of matching and the divergence (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the dot or point, trifurcation and intersection are the characteristics, which are not present in both the sample of the print.

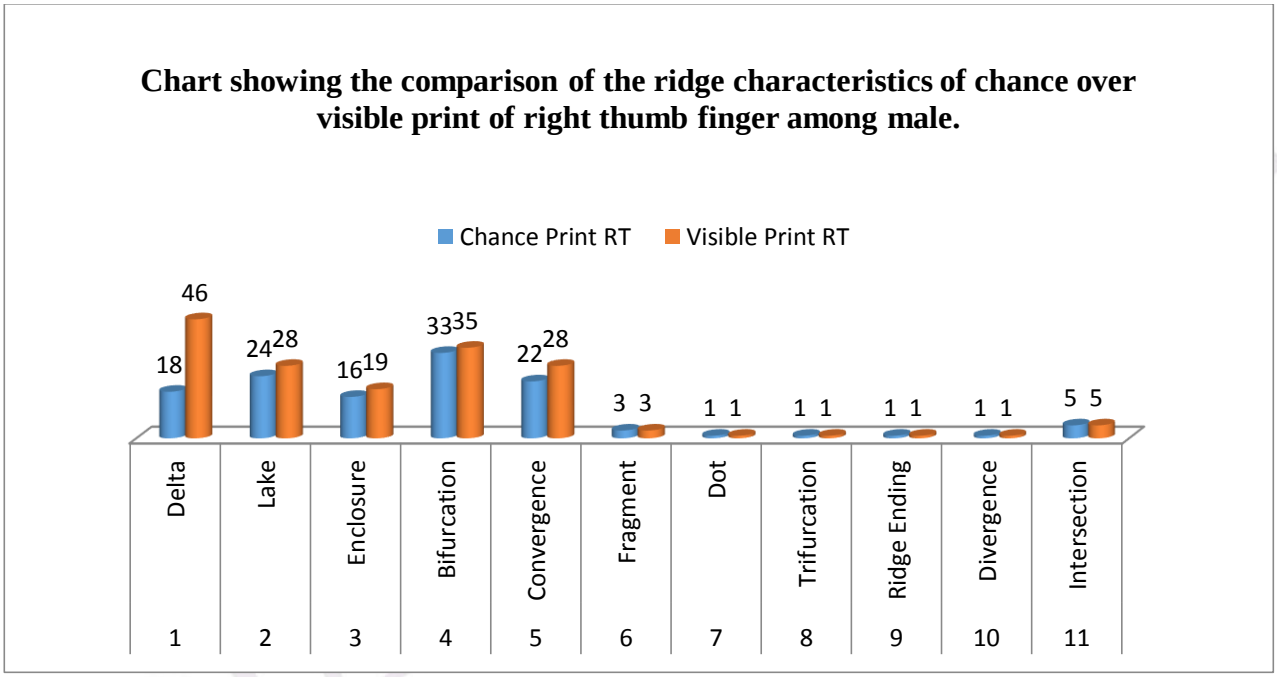


Chart-6 Assessment of ridge characteristics of chance over visible print of right thumb (RT) finger of male of 50 samples.

S.No	Characteristics	Chance Print	Visible Print
		RT	**RT**
1.	**Delta**	18	46
2.	**Lake**	24	28
3.	**Enclosure**	16	19
4.	**Bifurcation**	33	35
5.	**Convergence**	22	28
6.	**Fragment**	03	03
7.	**Dot**	01	01

8.	**Trifurcation**	01	01
9.	**Ridge Ending**	01	01
10.	**Divergence**	01	01
11.	**Intersection**	05	05

TABLE-12b It represents the data for the assessment of chance over visible print of ridge characteristics of left thumb (LT) finger among 50 male samples. It has been observed that the delta (18, 46) and bifurcation (33, 35) respectively are the characteristics which show the highest level of matching and the dot (1, 1), trifurcation (1, 1), ridge ending (1, 1) and divergence (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that in this finger there are no characteristic, which is not present in both the sample of the print.

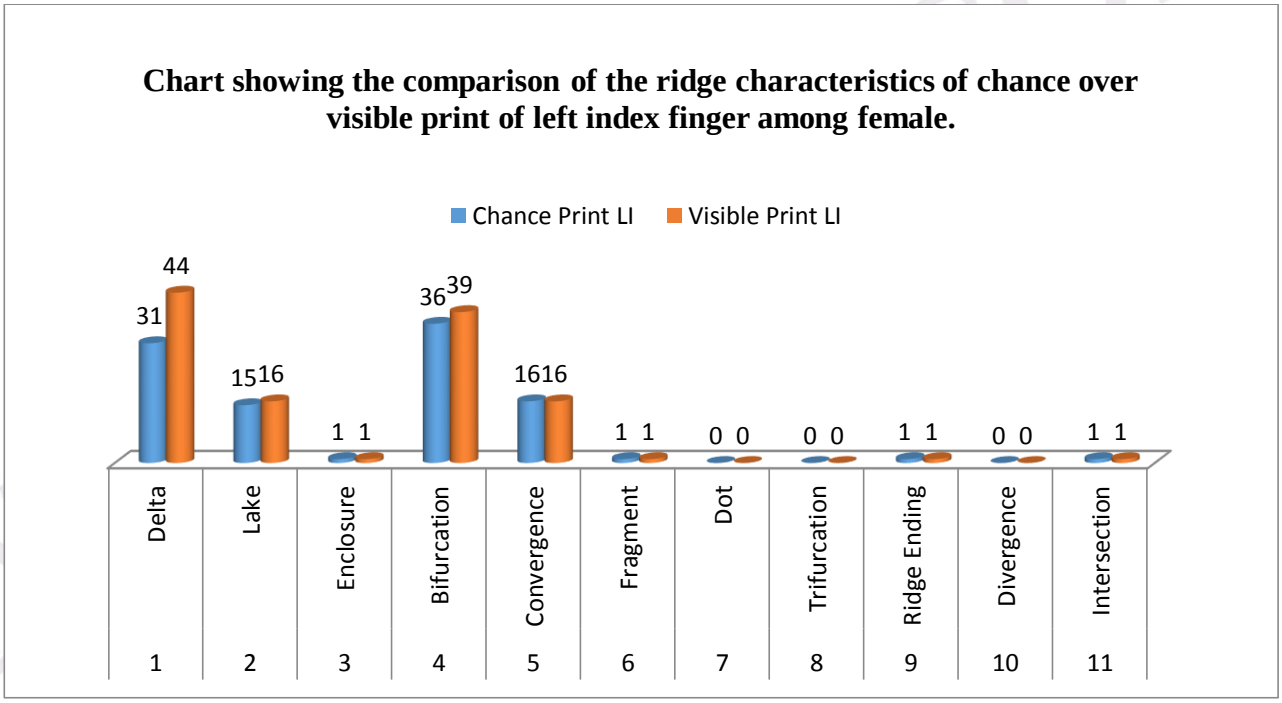


Chart-7 Assessment of ridge characteristics of chance over visible print of left index (LI) finger of female of 50 samples.

S.No	Characteristics	Chance Print	Visible Print
		LI	**LI**
1.	**Delta**	31	44
2.	**Lake**	15	16
3.	**Enclosure**	01	01

4.	**Bifurcation**	36	39
5.	**Convergence**	16	16
6.	**Fragment**	01	01
7.	**Dot**	00	00
8.	**Trifurcation**	00	00
9.	**Ridge Ending**	01	01
10.	**Divergence**	00	00
11	**Intersection**	01	01

TABLE- 13a It represents the data for the assessment of chance over visible print of ridge characteristics of left index (LI) finger among 50 female samples. It has been observed that the delta (31, 44) and bifurcation (36, 39) respectively are the characteristics which show the highest level of matching and enclosure (1, 1), fragment (1, 1), ridge ending (1, 1) and intersection (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the dot or point, trifurcation and divergence are the characteristics, which is not present in both the sample of the print.

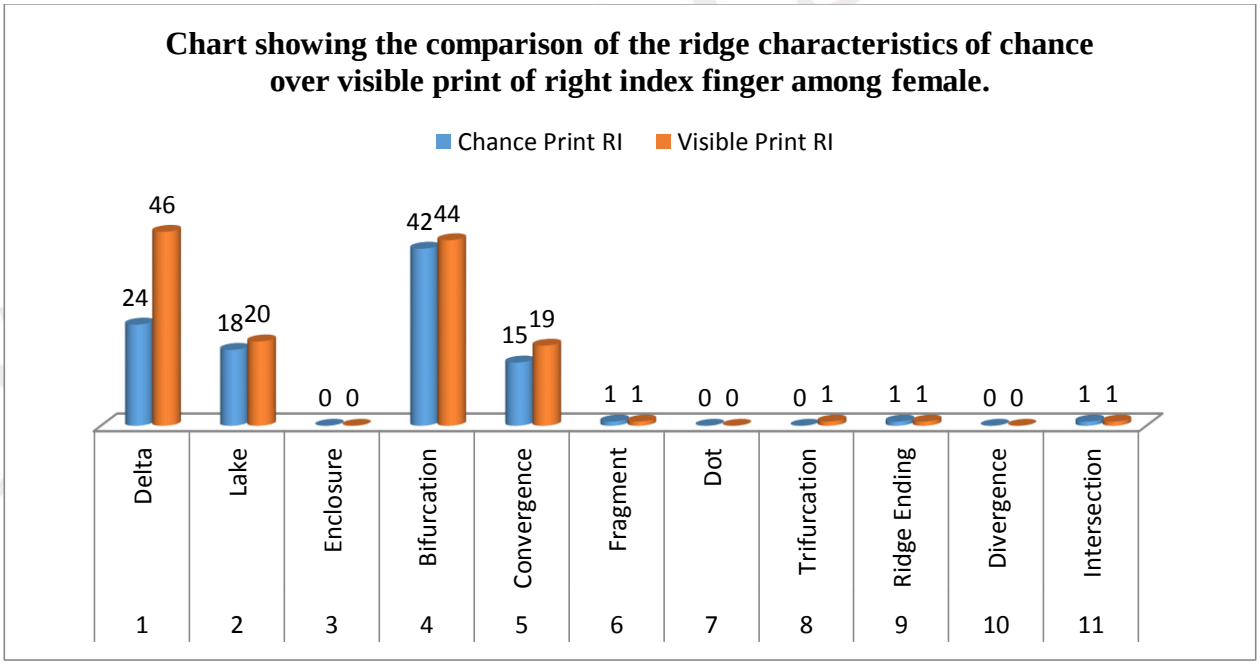


Chart-8 Assessment of ridge characteristics of chance over visible print of right index (RI) finger of female of 50 samples.

S.No	Characteristics	Chance Print	Visible Print
		RI	**RI**

1.	**Delta**	24	46
2.	**Lake**	18	20
3.	**Enclosure**	00	00
4.	**Bifurcation**	42	44
5.	**Convergence**	15	19
6.	**Fragment**	01	01
7.	**Dot**	00	00
8.	**Trifurcation**	00	01
9.	**Ridge Ending**	01	01
10.	**Divergence**	00	00
11	**Intersection**	01	01

TABLE- 13b It represents the data for the assessment of chance over visible print of ridge characteristics of right index (RI) finger among 50 female samples. It has been observed that the delta (24, 46) and bifurcation (42, 44) respectively are the characteristics which show the highest level of matching and the fragment (1, 1), ridge ending (1, 1) and intersection (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the enclosure, dot or point and divergence are the only characteristics, which is not present in both the sample of the print.

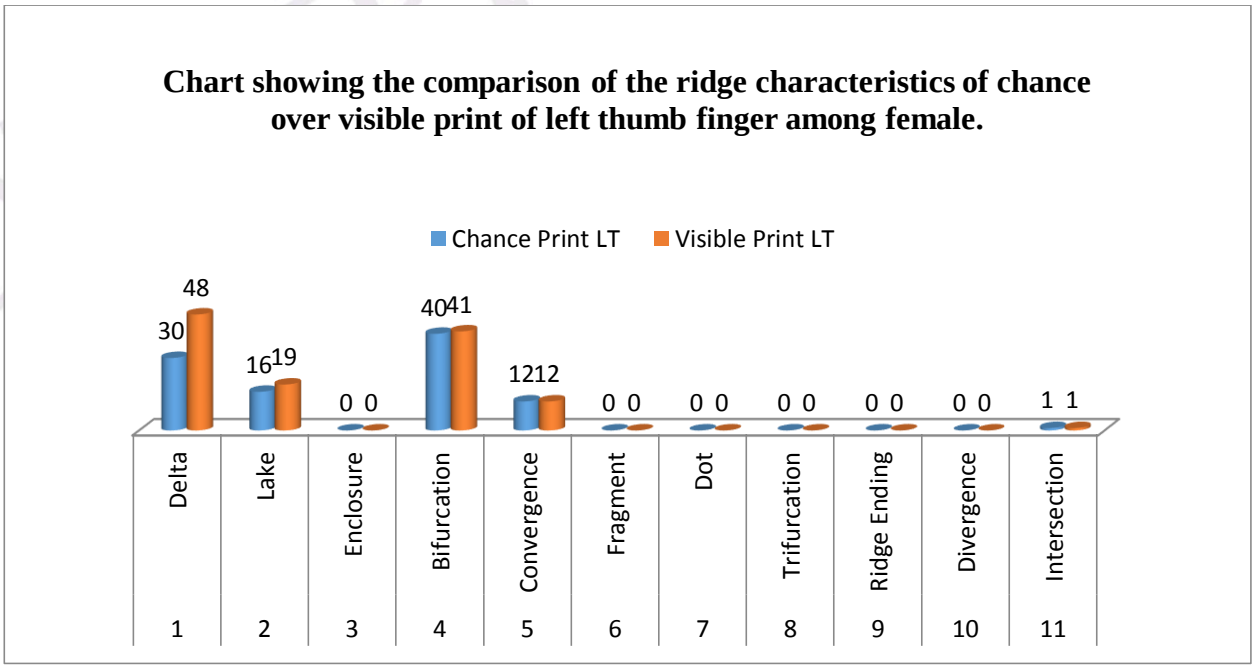


Chart-9 Assessment of ridge characteristics of chance over visible print of left thumb (LT) finger of female of 50 samples.

S.No	Characteristics	Chance Print	Visible Print
		LT	LT
1.	Delta	30	48
2.	Lake	16	19
3.	Enclosure	00	00
4.	Bifurcation	40	41
5.	Convergence	12	12
6.	Fragment	00	00
7.	Dot	00	00
8.	Trifurcation	00	00
9.	Ridge Ending	00	00
10.	Divergence	00	00
11	Intersection	01	01

TABLE-14a It represents the data for the assessment of chance over visible print of ridge characteristics of left thumb (LT) finger among 50 female samples. It has been observed that the delta (30, 48) and bifurcation (40, 41) respectively are the characteristics which show the highest level of matching and the intersection (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the enclosure, fragment, dot or point, trifurcation, ridge ending and divergence are the characteristics, which is not present in both the sample of the print.

Chart showing the comparison of the ridge characteristics of chance over visible print of right thumb finger among female.

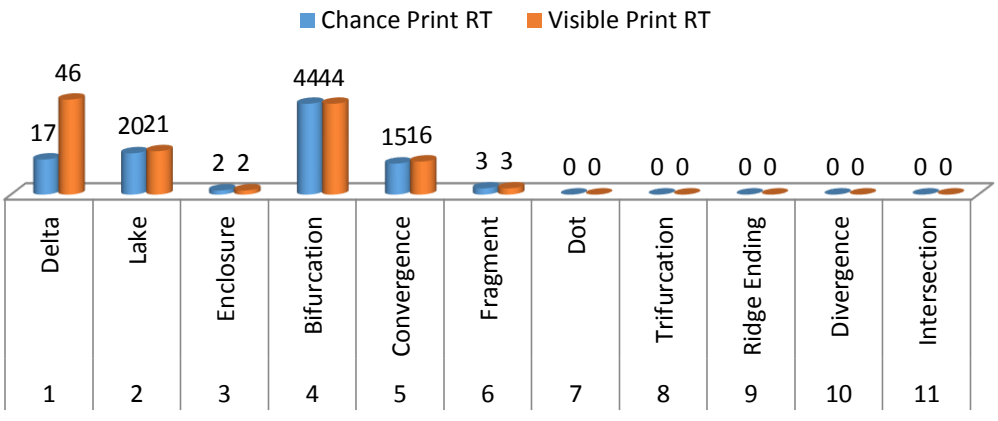


Chart-10 Assessment of ridge characteristics of chance over visible print of right thumb (RT) finger of female of 50 samples.

S.No	Characteristics	Chance Print	Visible Print
		RT	RT
1.	Delta	17	46
2.	Lake	20	21
3.	Enclosure	02	02
4.	Bifurcation	44	44
5.	Convergence	15	16
6.	Fragment	03	03
7.	Dot	00	00
8.	Trifurcation	00	00
9.	Ridge Ending	00	00
10.	Divergence	00	00
11	Intersection	00	00

TABLE-14b It represents the data for the assessment of chance over visible print of ridge characteristics of left thumb (LT) finger among 50 female samples. It has been observed that the delta (17, 46) and bifurcation (44, 44) respectively are the characteristics which show the highest level of matching and enclosure (2, 2) shows the lowest level of matching sample of chance over visible print. The present table further reveals that dot, trifurcation, ridge ending, divergence and intersection are the characteristic, which is not present in both the sample of the print.

Final observations of the results:

1. Table -3 & 4, represents the maximum and minimum number of pattern found in LI, LT, RI and RT of male and female.
2. Table- 5, presents the maximum and minimum average percentage of chance print over the visible print among 50 male samples was found to be 100% and 33.33% respectively.
3. Table- 6, presents the maximum and minimum average percentage of chance print over the visible print among 50 female samples was found to be 100% and 42.85% respectively.

4. Table- 7, shows the chart that represents the maximum and minimum ridge characteristics found in chance over visible print among 50 male samples is (28, 38) and (07, 10) respectively.
5. Table- 8, shows the chart that represents the maximum and minimum ridge characteristics found in chance over visible print among 50 female samples is (22, 27) and (06, 08) respectively.
6. Table-9, represent 8 is the maximum frequency of 22 ridge characteristics and 1 is the minimum frequency of 10, 24, 30, 32, 33 and 38 ridge characteristics found in the visible print and 7 is the maximum frequency of 17 ridge characteristics and 1 is the minimum frequency of 7, 8, 9, 10, 11, 12, 24, 25 and 27 ridge characteristics found in the chance print of the male along with bar graph chart.
7. Table- 10, represent 6 is the maximum frequency of 17 and 18 ridge characteristics and 1 is the minimum frequency of 8, 23, 24 and 27 ridge characteristics found in the visible print and 10 is the maximum frequency of 12 ridge characteristics and 1 is the minimum frequency of 6, 19 and 22 ridge characteristics found in the chance print of the female along with bar graph chart.
8. Table- 11a, represents the data for the assessment of chance over visible print of ridge characteristics of left index (LI) finger among 50 male samples are delta (36, 45) and bifurcation (34, 36) respectively are the characteristic which shows the highest level of matching and the divergence (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the dot or point is the only characteristic, which is not present in both the sample of the print.
9. Table- 11b, represents the data for the assessment of chance over visible print of ridge characteristics of right index (RI) finger among 50 male samples are delta (31, 47) and bifurcation (36, 38) respectively are the characteristics which show the highest level of matching and the divergence (1, 1) and trifurcation (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the dot or point and ridge ending are the characteristics, which is not present in both the sample of the print.
10. Table- 12a, represents the data for the assessment of chance over visible print of ridge characteristics of left thumb (LT) finger among 50 male samples are the delta (28, 47) and bifurcation (38, 42) respectively are the characteristics which show the highest level of matching and the divergence (1, 1) shows the lowest level of matching sample of chance

over visible print. The present table further reveals that the dot or point, trifurcation and intersection are the characteristics, which are not present in both the sample of the print.

11. Table- 12b, represents the data for the assessment of chance over visible print of ridge characteristics of left thumb (LT) finger among 50 male samples are the delta (18, 46) and bifurcation (33, 35) respectively are the characteristics which show the highest level of matching and the dot (1, 1), trifurcation (1, 1), ridge ending (1, 1) and divergence (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that in this finger there are no characteristic, which is not present in both the sample of the print.
12. Table- 13a, represents the data for the assessment of chance over visible print of ridge characteristics of left index (LI) finger among 50 female samples are the delta (31, 44) and bifurcation (36, 39) respectively are the characteristics which show the highest level of matching and enclosure (1, 1), fragment (1, 1), ridge ending (1, 1) and intersection (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the dot or point, trifurcation and divergence are the characteristics, which is not present in both the sample of the print.
13. Table- 13b, represents the data for the assessment of chance over visible print of ridge characteristics of right index (RI) finger among 50 female samples are the delta (24, 46) and bifurcation (42, 44) respectively are the characteristics which show the highest level of matching and the fragment (1, 1), ridge ending (1, 1) and intersection (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the enclosure, dot or point and divergence are the only characteristics, which is not present in both the sample of the print.
14. Table- 14a**,** represents the data for the assessment of chance over visible print of ridge characteristics of left thumb (LT) finger among 50 female samples are the delta (30, 48) and bifurcation (40, 41) respectively are the characteristics which show the highest level of matching and the intersection (1, 1) shows the lowest level of matching sample of chance over visible print. The present table further reveals that the enclosure, fragment, dot or point, trifurcation, ridge ending and divergence are the characteristics, which is not present in both the sample of the print.
15. Table- 14b, represents the data for the assessment of chance over visible print of ridge characteristics of left thumb (LT) finger among 50 female samples are the delta (17, 46) and bifurcation (44, 44) respectively are the characteristics which show the highest level of

matching and enclosure (2, 2) shows the lowest level of matching sample of chance over visible print. The present table further reveals that dot, trifurcation, ridge ending, divergence and intersection are the characteristic, which is not present in both the sample of the print.

16. Among these 50 male samples, there is only one accidental print found in Left Index finger. It has been observed from the visible print that some ridge characters are found through which we can individualize or identify the person but it is rare from the chance print, we can individualize or identify the individual.
17. 1% of accidental print is found among 100 samples of male and female.

DISCUSSION

The present study helps in personal identification of an individual from the chance print which was compared with visible print of the same individual in LI, LT, RI and RT finger of male and female. It have been observed that ulnar loop is the patterns found in maximum number and arch, central pocket loop and radial loop are the patterns found minimum in number among 100 samples containing 50 male and female each. Similarly Chauhan and Chattopadhyay [3] reported the recovery and enhancement of lateral dermal ridges have been successfully done by using a battery of powder on fruits and vegetables. The result obtained in the present study also reveals that the development of fingerprints depends upon the powder used, type of brush used and the type of surface on which the fingerprint are present as well as the chance or latent prints deposited.

Only one accidental print was found in LI finger of male and it has been clear that accidentals prints are also recovered from crime scene which is left by the suspect as chance print or latent print, but in chance print ridge details are not clearly visible in comparison with the visible print. Similarly Harish.et.al [6] concluded that latent fingerprint development in writing surface of CD i.e. glossy and smooth texture has not been examined by common agents (food colors and holi colors).

The latent ridges details present on any surface were successfully developed and having an enough information about the personal identification of an individuals. The developed ridges were clear with the ridge details of an individual, which give enough information for identification.

SUMMARY

Fingerprint plays a vital role in the criminal investigation because evidence of fingerprint is considered as conclusive evidence in the court of law. It is very accurate and cheapest method for identification of person.

One of the most important contributions has made in the investigation of crime is the development of chance print left behind by criminals at the scene of crime or on crime articles and their identification. Fingerprint identification is a method of identification using the impressions made by the minute ridge formation or patterns found on fingertips.

In the present study, the chance print of an individual is analyzed and compared with the visible print of the same individual in left index, left thumb, right index and right thumb fingers of male and female. It has been observed that the ulnar loop is the pattern found maximum and arch, central pocket loop and radial loop found minimum in number among both the samples. The result also shows the highest and lowest level of ridge details present in LI, LT, RI and RT fingers of the sample. One accidental was also found in the LI finger of the male which reveals the recovery of the accidental print was possible as it was left behind by criminal at scene of crime.

CONCLUSION

The uniqueness of dermal ridges of an individual has been accepted by forensic investigators as valid means of identification. The prints at crime scene which are left bychance by the suspect can be added as an evidence for identification of a suspect. In this study, we find out that if any chance or latent print found at scene of crime, it be added as an evidence for identification of suspect.

Based on the findings of the study, the following conclusions were established:

- ✓ The chance print helps in personal identification through comparison with the suspect sample.
- ✓ It provides an idea about the full fingerprint of the suspected person.
- ✓ Provide information about the number of suspect involved in case.
- ✓ A collaborated full fingerprint can be obtained from fragmented chance print found at different location.
- ✓ Manner of propagation of fingers at the surface can be identifying by keenly observing the chance print.
- ✓ Individualization can be performed on the basis of minutiae present at the chance print.
- ✓ A killer may leave their fingerprints on suspected murder weapon.
- ✓ A thief's fingerprint may found on the safe.
- ✓ A bank robber's fingerprint may be found on robbery note.
- ✓ The average of the male samples will be found more in comparison with the female samples i.e. 77.6 and 74.4 respectively.

The dermal ridges developed were clear, identifiable and having enough information for nabbing the suspects.

Forensic Application

Fingerprint plays a vital role in the field of Forensic Science for the purpose of establishing the correct identity of an individual and help in Criminal Investigation System.

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