"A CROSS SECTIONAL STUDY TO DETERMINE THE RELATIONSHIP BETWEEN GALTON-HENRY DACTYLOGRAPHY SYSTEM WITH KARL-LANDSTEINER SYSTEM AND GENDER AMONG MEDICAL STUDENTS, BELAGAVI"

Submitted by

REG. NO – BF0121002

Dissertation

Submitted to
KLE Academy of Higher Education and Research,
Belagavi, Karnataka.
In partial fulfilment of the requirements for the degree of

M.D.(DOCTOR OF MEDICINE)
In
FORENSIC MEDICINE AND TOXICOLOGY

DEPARTMENT OF FORENSIC MEDICINE AND TOXICOLOGY, JAWAHARLAL NEHRU MEDICAL COLLEGE, KAHER, BELAGAVI – 590010 KARNATAKA, INDIA.

DECEMBER 2024/ JANUARY 2025

ENDORSEMENT CERTIFICATE

KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH

BELAGAVI, KARNATAKA

Endorsement by Head of Department and Principal / Head of the Institution

This is to certify that the dissertation entitled **"A Cross sectional study to determine the relationship between Galton-Henry Dactylography system with Karl-Landsteiner system and gender among medical students, Belagavi"** is a bonafide research work done by **Reg. No: BF0121002.**

Dr. Ravindra S Honnungar M.D.,
Professor and Head
Department of Forensic Medicine
& Toxicology,
J. N. Medical College,
Nehru Nagar Belagavi - 590010

Date: 22/6/2024
Place: Belagavi.

Dr. (Mrs.) N. S. Mahantashetti MD
Principal
J. N. Medical College,
Nehru Nagar Belagavi - 590010

Date: 24/6/24
Place: Belagavi

ACCEPTANCE LETTER

JAWAHARLAL NEHRU MEDICAL COLLEGE

(A constituent unit of KLE Academy of Higher Education & Research Deemed-to-be-University)

(Recognized by National Medical Commission, New Delhi)

Accredited 'A+' Grade by NAAC (3rd Cycle) Placed in Category 'A' by MoE (GoI)

Nehru Nagar, Belagavi- 590 010, Karnataka, INDIA

0831 – 2471350 0831 – 2470759 www.jnmc.edu principal@jnmc.edu

Ref No: MDC/PG/ Date: 15-06-2024

"ACCEPTANCE LETTER"

The softcopy of thesis entitled: **"A CROSS SECTIONAL STUDY TO DETERMINE THE RELATIONSHIP BETWEEN GALTON-HENRY DACTYLOGRAPHY SYSTEM WITH KARL-LANDSTEINER SYSTEM AND GENDER AMONG MEDICAL STUDENTS, BELAGAVI"** has been submitted for Anti-Plagiarism check through Turnitin software. The scan has been carried out and the scanned output reveals a match percentage of **01%** which is within the acceptable limits of **10%** as per the guidelines given by UGC.

Guide.

KAHER BELAGAVI J. N. MEDICAL COLLEGE

Dr. (Mrs.) N.S. Mahantashetti.
Chairperson-Antiplagiarism Committee &
Principal,
J. N. Medical College, Belagavi.

To,
Reg. No. BF0121002
Postgraduate Student,
2021-22 Batch,
Department of Forensic Medicine,
J. N. Medical College, Belagavi.

UNDERTAKING

I, (Reg. No – BF0121002), hereby declare that the information and the data mentioned in my dissertation entitled **''A CROSS SECTIONAL STUDY TO DETERMINE THE RELATIONSHIP BETWEEN GALTON-HENRY DACTYLOGRAPHY SYSTEM WITH KARL-LANDSTEINER SYSTEM AND GENDER AMONG MEDICAL STUDENTS, BELAGAVI.''** belongs to me and is original.

I am aware of the definition of plagiarism as detailed below:

- An act or instance of using or closely imitating the language and thoughts of another author without authorization and the representation of that author's work as one's own, as by not crediting the original author.

- A piece of writing or other work reflecting such unauthorized use or imitation.

- The deliberate or reckless representation of other person's words, thoughts or ideas as one's own without attribution in connection with submission of academic work, whether graded or otherwise. I hereby declare that the thesis prepared by me is original one and does not involve plagiarism anywhere. In case at a later stage, it is found that I have indulged in plagiarism, then I am solely responsible for the same and the institution is at liberty to take any disciplinary action against me including cancellation of dissertation or any other penalties imposed by the University.

Date : 14/06/2024

Place : Belagavi

(REG. NO - BF0121002)

ETHICAL CLEARANCE LETTER

K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed – to- be- University)
Accredited 'A+' Grade by NAAC in (3rd Cycle) Placed in Category 'A' by MHRD (GoI)
JNMC INSTITUTIONAL ETHICS COMMITTEE
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)

Website: http//www.jnmc.edu Phone: (+ 91-(0)831 Office : 2472550
E-Mail : dome@jnmc.edu Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref No.MDC/JNMCIEC/ 18 **Date: 27/09/2022**

To,

BF0121002
PG Student in Forensic Medicine & Toxicology,
J. N. Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"A CROSS SECTIONAL STUDY TO DETERMINE THE RELATIONSHIP BETWEEN GALTON-HENRY DACTYLOGRAPHY SYSTEM WITH KARL-LANDSTEINER SYSTEM AND GENDER AMONG MEDICAL STUDENTS, BELAGAVI."**, is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee.

(Dr. Smita Sonoli)
Member Secretary
JNMC Institutional Ethics Committee
J.N.Medical College, Belagavi.

(Dr. Harsha Hegde)
Chairman,
JNMC Institutional Ethics Committee
J.N.Medical College, Belagavi

47

LIST OF ABBREVIATIONS USED

- ACE-V - Analysis, Comparison, Evaluation, and Verification
- TFRC- Total Fingerprint Ridge Count
- PII- Pattern Intensity Index
- IAFIS- Integrated Automated Fingerprint Identification System
- SPSS - Statistical Package of Social Sciences
- ABO and Rh - ABO blood group in addition to the Rhesus (Rh) type

ACKNOWLEDGEMENT

It gives me great pleasure to thank everyone who helped with this endeavour and for their contributions. I owe a debt of thanks to each and every one of them for their helpful feedback and encouragement.

I also want to thank my mentor and guide, *Dr. Ravindra S. Honnungar MD,* Professor & Head, for giving me permission to conduct this study. He has been my inspiration for all that I have done. His insightful advice and constant motivation have been instrumental in successful completion of this thesis.

I would like to sincerely thank Prof. Dr. Prasanna S. Jirli, Prof. Dr.Vishal V. Koulapur, Dr.Vinay S. Bannur Assistant Professor, Dr. Dhivagar.K Senior resident, Dr. Aravind Varman M, Dr. Tejas S. Mohite and other junior postgraduates for their kind assistance with my thesis work despite their hectic schedules. I appreciate you all giving up this important time.

I would like to thank the principal of Jawaharlal Nehru Medical College, KAHER, Belagavi, as well as the entire faculty for their assistance. I want to express my gratitude to my parents for helping me to complete this little endeavour. I am appreciative of their affection and generosity towards me.

ABSTRACT

Title:

"A cross sectional study to determine the relationship between Galton-Henry Dactylography system with Karl-Landsteiner system and gender among medical students, Belagavi"

Introduction:

- Forensic Medicine and Toxicology currently makes great use of the distinctiveness of blood groups as well as fingerprints for identifying reasons. Blood grouping, especially the Karl-Landsteiner method, and fingerprint Dactylography offer unique indicators for individualization. Studies on the potential relationship between gender disparities along with groupings of blood based on fingerprinting patterns, especially in samples of medical students, is still insufficient, even if the differences stand alone as meaningful findings. The present research aims to investigate the relation among medical students' gender, Karl-Landsteiner blood grouping, and fingerprint characteristics.

Objectives:

- To determine the relationship between medical students' fingerprint patterns and Karl-Landsteiner blood grouping.
- To determine any possible gender-based variations in the fingerprint patterns and gender of the medical students.

Materials and Methods:

- This cross-sectional research involved the recruitment of 200 medical students in total. The blood grouping information was sourced from the individuals' prior medical records, guaranteeing precision and dependability. The ink rolling method was used to obtain fingerprints while adhering to predetermined proforma. Each volunteer fingers were rolled over ink pads, and the resulting imprints were then copied onto conventional fingerprint proforma. We took great care to make sure that each finger print was readable and clear. Subsequently, an analysis was conducted on both fingerprint patterns and blood grouping data to investigate any possible associations and gender-based differences within the research. Prior ethical approval for the current study was obtained

Results:

- The study, which included 200 students between the ages of 18 and 25, found that loops were the most common dermatoglyphic pattern among all blood types, whereas composites were the most uncommon. There were 42 composite , 759 whorls, 144 arch patterns, and 1055 loop patterns found. Significant statistical relationships were found between the Rh blood type and the fingerprint pattern on the right little finger and between the ABO blood grouping and the left thumb fingerprint pattern.

Discussion:

- In this study, an effort was made to examine the relationship between a person's fingerprints along with their gender and blood group, which may improve the fingerprints' ability to authenticate identity. Fingerprints are a reliable means of identification. Without a question, fingerprint proof is the most trustworthy and legitimate type of evidence that may be used in court today.

Conclusion:

- Fingerprints of pattern could be utilised not just to help with criminal investigations but also to identify a person's gender along with blood group. The current study's findings showed that there was no discernible correlation between gender, blood type (in the Rh or ABO systems), and fingerprint patterns.

Keywords: Fingerprint Dactylography; Karl-Landsteiner Blood Grouping; Gender; Forensic Science; Identification Markers.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

- A person's finger's friction ridges leave an impression known as a fingerprint. During the thirteenth weeks of pregnancy, a ledge-like structure forms around the base of the epidermis next adjacent to the dermis as the foetus develops. Across the ledges, the cells start to multiply quickly. Primary and secondary ridges are formed by this quick multiplication. The outer layer of the human skin uses the primary and secondary ridges like a template to generate the friction ridges that are visible on the outermost layer of the skin.[1]

- Forensic science relies heavily on the technique of recovering partial fingerprints from scenes of crime. Since the fascinating history of fingerprint development and implementation over the past century is most effectively understood if the person who reads has some understanding of Dactyloscopy, I shall quickly go over the fundamentals of this discipline. There are minute skin ridges with furrows in between each ridge on the inner regions of the hands from the tips of the fingers to the wrist and the bottom regions of the lower extremities from the big toe to the back of the heel.

- Scholars, jurists, and journalists have all criticised the use of fingerprint evidence. Scholars have said that there are no consistent guidelines for point-counting techniques, and that there is no reliable analytical basis for witness testimony and that the mistake rate in matching fingerprints hasn't been sufficiently investigated. The subject of whether specialists can accurately concentrate on fingerprint feature information without being duped by additional details in such context, has been studied.[2]

- One of the more popular and dependable biometric methods is the matching between two fingerprints. Fingerprint matching simply takes a fingerprint's evident characteristics into account. Water makes up 95%–99% of a fingerprint's content, along with other inorganic and organic substances. The organic part consists of pyruvate, proteins, glucose, fatty acids, lactase, urea, and sterols. There are also inorganic elements present, including sodium, potassium, iron, and chloride.[3]

- Fingerprint remnants can additionally include other pollutants, such as oils from cosmetics, medications and their metabolites, and food residues.[4]

- A fingerprint is an impression left by someone, the message they have given you. Dealing with cases involving criminals is the most typical application for it. A person's fingerprint is an imprint made by a person's finger's friction ridges. These are the unique qualities that make each person unique. Fingerprints leave their marks on surfaces due to the moisture. The lines where the fingers and thumb meet to form fingerprints are distinct patterns created by friction marking. Foot, palm prints, and toe prints are also seen. Criminals' identities are commonly ascertained using these.

- The resulting prints are available for us to have anywhere we choose. My fingerprints come off when we touch something. Crime investigations are using fingerprints more and more frequently. Multiple approaches are employed in this process. Furthermore, researchers are developing new methods for identification of fingerprints. Criminals possess a unique capacity to conceal their prints. Everybody has a unique fingerprint, and the prints of sick people vary greatly from one another. There are significant differences. You may observe distinct shapes, lines representing friction ridges, and pores where sweat accumulates. Even if the outer layer of skin on the palm of our hand breaks, the fingerprint also returns to its original form.

- Biometrics, or the use of unique biological parameters or qualities to differentiate among people, is explained in the initial section, along with the concepts and background of the examination of fingerprint patterns, and fingerprint categorization. The remaining portion covers chemical as well as physical processing techniques as well as forensic light sources.

- As an essential field of forensic medicine, it is employed at crime scenes. When grease or moisture from the finger leaves a fingerprint on a material like metallic or glass, it may be used to locate the fingerprint. By obtaining fingerprints from the crime site and matching them to the presumed the individual's fingerprint documentation, forensic experts can provide definitive evidence of a person's identity during a criminal investigation.

- Though they weren't almost as advanced as they already are, fingerprints have been taken on documents dating back many centuries. Fingerprints are not a recent discovery to humans. There are scribbles with fingerprints in Asia, Europe, and North America that may provide identification. Evidence of fingerprints left on clay and subsequently utilised on order documentation has been found in China.

OBJECTIVES

1) To determine the relationship between fingerprint patterns (Galton-Henry classification) and blood grouping (Karl-Landsteiner system) among medical students.

2) To determine gender-based variations in fingerprint patterns and their correlation with blood groups.

REVIEW OF LITERATURE

THE FINGERPRINT'S HISTORY:

- Law enforcement has always need a dependable method of identifying individuals. This is evident in the early days of criminal investigations. From the earliest known discovery of fingerprints in 1684 until the first application of fingerprint proof in a British murder inquiry in 1905, the journey of fingerprints may be followed. Researchers have employed fingerprints to identify individuals, and attempts have been made to recognise fingerprint science as a distinct field of study, referring to the investigation of fingerprints as "DACTYLOGRAPHY." The development of contemporary fingerprint matching methods dates back to the late sixteenth century.[5]
- French police specialist Alphonse Bertillon created and implemented the very initial systematic attempt at identification for individuals in 1883. An accurate description of the individual being studied, complete with profile and full-length images, and an Anthropometric methodology with precise physical measurements are prerequisites for the Bertillon technique. The Anthropometric technique of identification was based on the observation that an individual's skeletal system remains constant size-wise from the 20 years of age until death.[6]
- It was believed that because bones dimensions varied so much, no two people could have the exact same measurement. Bertillon attests to the routine collection of eleven human anatomical characteristics. These comprised the left-side foot's length, head breadth, height, and reach .
- This methodology was thought to be the most precise technique of identification for two people in a group of 10. However, in the beginning stages of this century, law enforcement began to appreciate and use a fingerprint-based identification technique that classifies the patterns of finger ridges. The modern standard for identifying a criminals are the finger print.[6]

- William Herschel, a British Government official established in India, instituted the procedure of requiring the originals to sign committment documentation by pressing their own hand on an ink pad, a few months prior to to Bertillon beginning work on his method. Herschel might have considered fingerprinting as a kind of personal identification, nevertheless the reasons behind his request are still unknown.[7]
- The History of Crime Scene Investigation and the Murder Trial that started a field of Forensic Science much attention has once again been drawn to the part served by Scottish physician Henry Faulds in the development of identification of fingerprints during his time as a medical missionaries in Japan. Following the publication of Scottish doctor Henry Fauld's opinions about the potential use of fingerprinting for identification purposes when he was employed at a Japanese hospital. Skin ridge patterns may play a significant role in determining the identity of offenders, as demonstrated by Fauld in 1880. He described how a robber had left his fingerprints on an exterior wall that had been painted white. When he compared these prints to those of a suspicious, he discovered that they were significantly different. A few days later, the fingerprints of another suspect were discovered, and they matched the ones on the wall. The person admitted to the crime after being shown this proof.[7]
- Fingerprints, Fauld was certain, offered absolute verification of identity. Additionally, he offered to establish a fingerprint Bureau at Scotland Yard at the expense of himself in order to assess the approach's effectiveness. Nevertheless, the Bertillon method prevailed and his attempt was turned down. It was Francis Galton, a different British citizen, who conducted extensive study on fingerprinting that gave law enforcement Organisations the push they needed to recognise the system's potential. Fingerprints, the very initial publication of its sort on the topic of fingerprints, was released in 1892 by renowned textbook author Galton. The structure of fingerprints and related techniques for preserving them were covered in the book he wrote.[8]

- Names for fingerprint patterns were also shifted by Galton to three categories: Loop, Whorl, and Arch. Above all, The book proved that there were never two fingerprints same and that a person's pattern remained consistent through lifetime. The British democracy adopted fingerprinting at Galton's recommendation as an enhancement to the Bertillon method. The creation of categorization schemes capable of organising numerous fingerprints into a simple, understandable output was the next major advancement in fingerprint technology.[9]

- In 1891, an Argentine police officer named Dr. Juan Vucetich, who was impressed by Galton's work, developed a feasible idea. Over time, he completed his categorization system. A British man named Sir Edward Richard Henry developed another categorization scheme in 1897. Henry's method was taken over by Scotland Yard four years later. Bertillon's system of measurement began to lose favour at the beginning of the 20th century. Errors greatly impacted its results, particularly when measurements were conducted by individuals who weren't properly prepared.[10]

FINGERPRINT CLASSIFICATION [11]

- According to Forest, Dermatoglyphics were a component of structural constitution as well as must be laid down early in development.[11]

- An impression created by the friction ridges on the finger of an individual is known as a fingerprint. One crucial forensic technique is the retrieval of impressions of fingers or partial prints from an unlawful activity scene. The fingerprints on metal or glass objects are caused by moisture, grease, or additional debris on the finger. A surface that is smooth, such as paper or metallic materials, can be imprinted with a deliberate impression of a whole fingerprint using ink, colouring dyes, or other materials that are transmitted from the skin's friction ridge peak.

- Typically, records of fingerprints comprise imprints from the pads or some other material that adds color onto the ridges on the tips of digits and thumb. However, on occasion, fingerprint cards could record parts of the fingers' lower joints. A person's fingerprints, also known as finger imprints, are intricate, almost one-of-a-kind, hard to change, and long-lasting. Furthermore, it qualifies them for use as durable indicators of human identification. In order to facilitate the matching of an individual's fingerprint against an extensive repository of fingerprint records, a fingerprint system of classification classifies fingerprints based on their features and arrangement.[11]

- One way to accomplish this is by comparing a query containing a fingerprint that needs matching with a specific group of fingerprints in an already-existing fingerprint dataset. Early categorization schemes relied on common ridge patterns, which might incorporate one or more fingers' circular patterns or not. Because of this, paper documents in large quantities might be filed and retrieved using only the friction ridge patterns. We largely rely on Henry's Classification System, even though there are several other ways for classifying fingerprints. ARCHES, WHORLS, and LOOPS are the three fundamental classifications that are identified.

- Galton's Arch, Loop, Whorl method was modified by Sir Edward Richard Henry, who divided them into four major groupings based on the proportion of their distribution in the world's population.

- 66–67 percent for loops, 25–25 percent for whorls, 6–7 percent for archs, and 3–4 percent for composites or chances or accidental

- The term "Galton-Henry method" or "Henry method" refers to this approach and is derived from Sir.Francis Galton with Sir.Edward Richard Henry, who developed it. The most effective and widely used categorization system is the Henry’s system. Whorl, Composite, Loop, and Arch are four of the primary patterns.[11]

PROPERTIES OF FINGER PRINTS [9]

- The unique arrangement that each person leaves behind is their fingerprint. The distinction between individuals will help us recognise people. Each fingerprint was made up of ridges. The structure and shape formed by the ridges in a fingerprint give each its individuality. Fingerprints have several characteristics, such as ease of recording, permanence, universality, uniqueness, and ease of categorization.
- Because each fingerprint is distinctive, none of the fingerprints from the same finger will ever look the same. Every person has a unique fingerprint pattern that varied from finger to finger and from person to person. It hasn't previously been found that two fingerprints are similar. Following extensive research on identical twins, it was discovered that each fingerprint is distinct.

DERMAL RIDGES EMBRYOLOGY

- The earliest indications of the production of epidermal ridges are isolated proliferations of cell within basal layer underneath the skin's outermost layer - epidermis, which occur around the tenth or eleventh week of human pregnancy. As a result of those cells multiplying, ridges on the epidermis start to develop and expand. While primary ridges are recognised, the formation of new ridges between or from preexisting ridges on the border of the pattern adds to the continuous rise in the overall number of primary ridges. Until around week seventeen, there is a general increase in the digit's size along with an increase in the number of major ridges.[9]

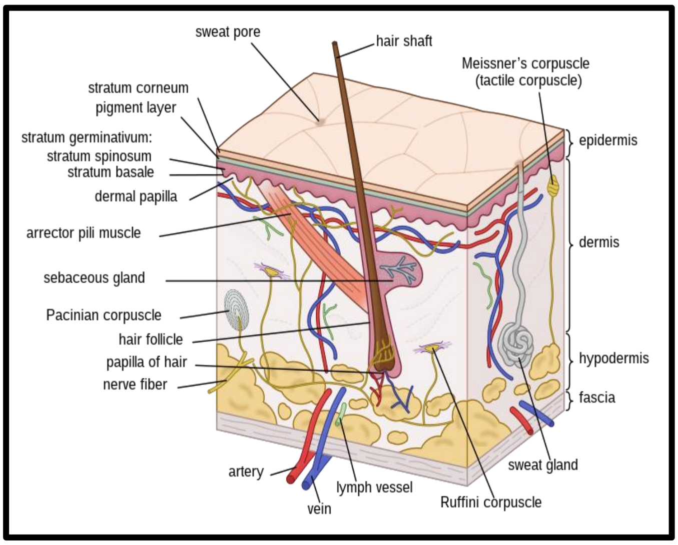
- During this point, ridges along the volar surface start to show up as fingerprints. When epidermal ridges first emerge in the base layers of the epidermis, beginning as early as in a developing baby with just 60mm for crown-rump in length. ridge patterns were identifiable. Ridge patterns get deeper and have more ridges in them throughout the ridge creation era. In addition, the foetus is vulnerable to significant genetic activities, such as cell differentiation and growth rate regulation, at this stage due to a variety of environmental influences that might affect development.[12]
- Permanence denotes that a fingerprint's ridges arrangement remains constant throughout a person's lifetime. In the 12th week of foetal development, fingerprints started developing on the palmar surface. These are completely formed by 24 weeks of Intrauterine life. This pattern will develop and widen as an individual grows into adulthood, but the quantity and structure of patterns remain same. His childhood fingerprints are exactly enlarged in his adulthood fingerprints. The epidermal ridges are occasionally affected by rare occurrences of mutilated or the emergence of other skin conditions, except for leprosy, but these ridges eventually recover. It is determined that a novel ridge design cannot be surgically implanted.
- Put simply, they are enduring signatures that are carried from the mother's womb to the grave. The concept of universality is the belief that all people begin life with fingers and friction ridge patterns on their bodies. Because of the accessibility of documenting, the fingerprint may be captured on any flat surface, even while the individual who owns it is unaware of it. Moreover, they are conveniently recordable by pressing a fingertip dye against papers.[12]
- The ability to classify an immense number of fingerprint slips simply allows for the placement of each individual in the records in a virtually unique manner. The electronic storage of fingerprint records has made retrieving much easier and faster.

- Nonetheless, fingerprints share a feature that is referred to as the pattern. There are four typical patterns. They are the composites, whorls, loops, and arches. There are two types of arches: tented and plain. Two types of loops exist: radial loops and ulnar loops. There are four types of composites: accidental loop, twin loop, lateral loop, and central pocket loop. An individual's fingerprints are distinct due to factors such as the quantity and arrangement of patterns. There are two types of fingerprint features: class and individual characteristics. Characteristics that are specific to an individual are known as individual characteristics. These were also refer as Galton's details as they contain ridge termination,bifurcations, and islands.[12]

FINGERPRINTS ANATOMY [9]

- There are two distinct components to the skin of the palms: the dermis and the epidermis. They are all descended from distinct layers of the embryogenesis. Dermis and epidermis are produced through the mesenchyme that constitutes the embryonic layer (mesoderm) and ectoderm, respectively. Every layer is responsible for carrying out distinct tasks.

Figure 1 : Layers of skin



A brief summary of the epidermis [8,9]

1. Serves as a selective barrier that allows it easier or harder for items to pass through the area that it covered.
2. It additionally shields the tissue underneath from mechanical, chemical, and dehydration harm.
3. It has the ability to elaborate or secrete into the areas it connects.
4. It serves as a surface for senses.
5. It produces the skin's appendages.
6. Has the ability to regenerate.
7. The dermis diffuses nutrients.

Some details regarding dermis

I. Because of its elastic fibres and collagen, it gives you mechanical strength.

II. Dermis has the only vascular supply.

The Histology of interspace:

- Similar to a peg and socket, the interspaces connecting the dermis with epidemis are defined by intricate topography, indicating that each of them are firmly retaining one other. On dorsal skin locations, the dermis is often thicker. The surface of the palm & sole epidermis, on the other hand, differ structurally from other regions' thinner epidermis in that it is denser than in other places. The major dermal ridge is the connective tissue ridge that lies beneath each palm as well as sole epidermal ridge. The rete pegs, and this resemble pegs in section, are the downward projections of epidermis that split each primary ridge thru secondary dermal ridges.

Structure at the microscale [8,9]

- The skin of finger bulbs has an epidermis that is divided into two zones by a number of different cell layers.
- Germinative zone (Zona germinativa) is the innermost.
- Zona cornea (Keratinizing zone) is the superficial layer.

Zone germinativa: [8,9]

Divided into two layers, one deeper than the other.

1. Stratum basale, also known as the malpighian layer, is a single layer containing columnar cells that makes up the stratum germinativa. The basement membrane is positioned perpendicular towards the cells.

2. Stratum spinosum, also known as the the layer known as prickle cells layers appears more superficial, made up of polyhedral cells that varies in thickness. Three cell layers make up the zona cornea's more superficial zone.

Stratum granulosum: The cells develop "keratohyaline" granules that gradually flatten and are propelled upward via the stratum spinosum.

Stratum lucidum: Keratohyaline granules fuse that merge with tonofibrils when the stratum granulosum cells elongate and loses its nucleus. This layer is known as the stratum lucidum and is clear or translucent.

Stratum corneum: The outermost layer of skin, known as the stratum corneum, is composed of opaque squames that are packed with horny keratin.

Dermis :

- The dermis is thickest in the palm as well as sole that varies its thickness depending on the place. Because collagen along with elastic fibres are present, the dermis is very resilient, elastic, and flexible.

- Microscopy: Vessels for blood, lymphatic systems, nerve cells, glands for sweating, connective tissue collagen fibre, and other elastic fibres make up its composition.

- Two layers make up the dermis: 1. Deeper, reticular layer. 2. The superficial papillary layer.[8,9]

Layer of reticulum:

- Collagenous fibrous tissue bands along with elastic tissue fibres make up the majority of this layer. The arrangement of such collagen fibres is parallel. Such fibre patterns, referred to as skin cleavage lines (also known as Langer cleavage lines), differ in various regions of the body.

Layer of Papillary: [8,9]

- Projecting papillae, that are composed of many vascular and sensitive eminences, make up the majority of this layer. Those perpendicularly projecting papillae then split into two or three secondary papillae, that enter by corresponding pits underneath the epidermis' surface, whereby the skin's sensitivity is more crucial.

- The papillae can be found in rows in the palm as well as sole. As a result, each ridge has two rows of papillae, while in the space between those rows, sweat gland ducts extend outward to reveal at the ridge's crest. Given that the sweat gland's duct entrance is located at a ridge's top, studying fingerprints is essentially studying ridge patterns; this makes fingerprint analysis extremely helpful in the field that Edward Locard labelled "poroscopy." The examination of the sweat pores on these ridges is known as poroscopy. [8,9]

- The primary goal of previous fingerprint research by a number of scientists was to develop a means of determining an individual's absolute identification.
- Over a Nova Scotian cliff, fingerprints had been used thousands of years ago the birth of Jesus to indicate the pottery's marking and brand. Ancient engravings resembling papillary ridges were discovered seen.[13] In 700 A.D., the practice of fingerprints was applied in identification, having been recognised since ancient Assyria.[14]
- The scientific method of fingerprinting was initially used to identification since 700 A.D. By 3000 BC, fingerprints were being used as official papers in China.[15]
- In a research paper published in 1788, German researcher J.C.A. Mayer became the very first to suggest the hypothesis that a pair of individuals' friction ridge arrangements are never identical.[16]
- As a method of identification as well as to deter "impersonation," William-J-Herschel instituted fingerprinting classification in the city of India-Bengal, about 1858.[7]
- Anthropometry were the approach in use prior fingerprint technology became a viable means of identifying offenders. After its invention in 1880 by Parisian Alphonse Bertillon, this system is sometimes referred to as the Bertillon system of criminal identification.[6]
- In 1880, Tokyo-born physician Dr. Henry Fauld said in a publication that fingerprints can aid in identifying since ridge patterns are very variable across persons and do not vary over time.[8]
- Two Bengali Police officials, named Rai Bahadur Hem Chandra Bose along with Khan Bahadur Azizul Haque (2002), provided significant improvements to the categorization method that evolved into called as Henrys' Ten-digit classification systems. Hem C Bose developed a method involving sub-classification & a technique of single-digit categorization, while Azizul Haque refined the ten-digit pigeonhole approach.[16]

- The very first person to introduce a palm-print of their hand on right side became Herman Welcker in 1898, a anthropology professor at the Germanys' University of Halle. Prints were taken in 1856 and 1897, with a 41-year gap between them. This record stood until Herschel published finger prints that revealed a 51-year gap.[17]

A PRELIMINARY UNDERSTANDING OF THE GENDER DISPARITY AMONG FINGERPRINTS

- Cummins & Midlo (1961) discovered that women often had smaller bodies compared to men. The ridges should be anticipated to be thinner than those of males. They discovered that men have fewer ridges per centimetre than females.[18]

THE NUMBER OF RIDGES AND GENDER DISPARITY

- The gender variance count and sex and ethnic disparities in finger ridge correlations were explored by Jantz RL in 1975. Eleven samples were taken: three about Europe, one about America White, one about India, five from Sub Saharan Africa, and a single American Black, were compared based on race and sex for ten fingers in relation to Caucasians and Africans. While there was no discernible sex difference in mean correlation for the European ancestry groups, female American whites outnumbered men by a large margin. Males had considerably greater average correlations versus females in the parsis of Indians and in three of the six Negro populations. The Y chromosome especially appears to be involved in the formation of the dermal ridge, according to the pattern of variations in sex & race.[19]

THE FIRST RESEARCH ON GENDER DISPARITIES CONDUCTED IN INDIA

- In 1983, M.R.Gangadhar and K.Rajashekara Reddy, examined the Dermatoglyphics study in fingers of both male as well as female members of population of Adikarnatakas. Loops (57.11%), whorls (27.89%), and arches (15.00%) were the most prevalent finger print pattern types in the population of general group with considerable sex differences and negligible bilateral differences, according to the research, which covers the quantitative as well as qualitative characteristics.[20]

- A major research project of 400 African American as well as American group of Caucasian individuals of female and male gender was conducted over year of 1998 done in Federal Bureau of Investigation by the researcher Mark A. Acree . He discovered that there is a notable distinction between the density of ridges in male and female fingerprints. His research revealed that women possessed greater ridges than men have. In addition, he recommended conducting further research on other racial groups.[21]

- The diversity of ridge patterns among Malawian participants was examined by P.S. Igbigbi with Msamati in the year of 1999 by measurements of the ATD angle, TFRC- Total Fingerprint Ridge Count , a-b ridge counts, and PII - Pattern Intensity Index. After radial loops upon men & whorls upon females, they discovered that arches dominated the patterns across both sexes. TFRC and atd angle are considerably greater in females than in men, whereas PII values and a-b ridge counts were higher in males than in females.[22]

- The most accurate technique for estimating age were to use the equation developed by researchers Kamp et al. done from Grinnell College in the United States. After shrinking the estimate about 7.5%, the median absolute error of the estimations about year of 1.71, whereas the absolute errors exceeded 5 years in just 3.6% of cases. Thus, the width of the epidermal ridge upon ceramic fingerprints belonging to a specific ethnic group may be used to compare the ages of people.[23]

THE CORE IDEAS OF FINGERPRINT SCIENCE. [24,25]

1. Each fingerprint has been unique; none of the fingers have been identified as discovered to have the same ridge feature.

2. Throughout a person's lifetime, their fingerprints won't alter.

3. The common ridge pattern seen on fingerprints allows them to be easily categorised in an organised manner.

4. Fingerprints cannot be similar to one another. Even with uniovular twins, this is accurate. Therefore, identification fixation is guaranteed when two fingerprints matched.

5. It is possible to store millions of fingerprints in a methodical manner that makes it simple to locate the needed print for analysis when needed.

6. Fingerprints may be obtained from even extremely decomposed corpses; they can be obtained from the dermis in cases whenever the epidermis is absent or by examining the peeled-off fingers.

7. Even from corpses that have been mummies, fingerprints may be obtained by injecting glycerine through the fingers, putting the dissected fingers in a mild alkaline solution until the finger and their ridges regain its original size as well as shape.

8.A reasonable estimation of a fingerprint's age may be obtained by observing the chloride ions migration within the fingerprint (chloride may be observed through secretions of sebum, that is eventually disappear from the prints of finger).

9. Fingerprint data can be transmitted by telecommunication across nations in order to capture transnational criminals.[25]

A SUMMARY OF FINGERPRINTS [8,9]

- In 1823, Dr. Jan.E. Purkinje, a physiology professor at the University of Breslau, categorised every fingerprint under nine distinct categories.

i. Spiral whorl.

ii. Ellipse.

iii. Concentric

iv. Transverse curves.

v. Central longitudinal stria.

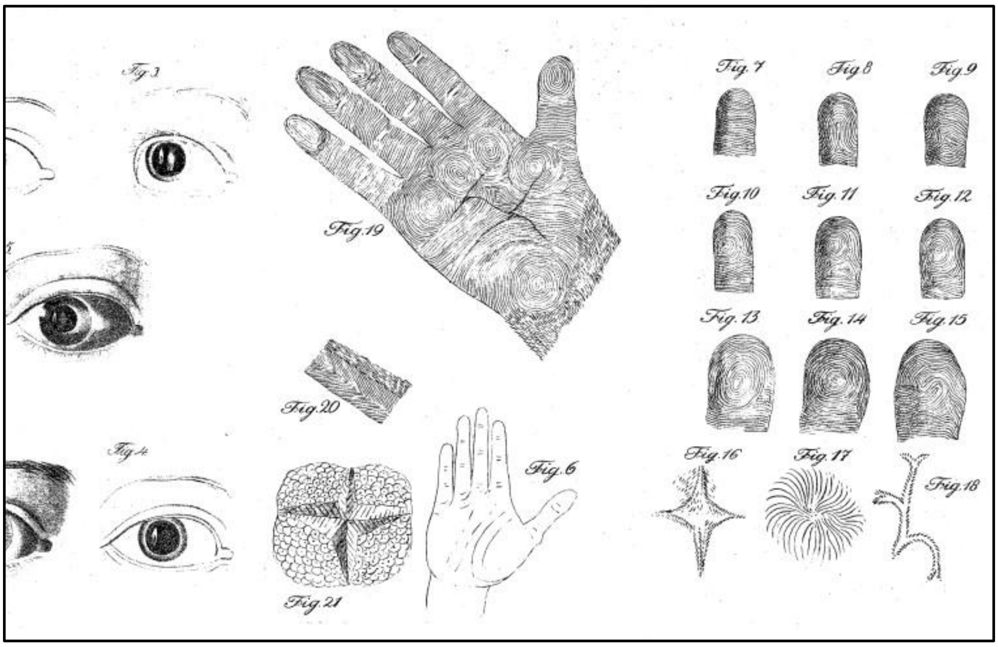
vi. Oblique stripe.

vii. Circle.

viii. Double whorl.

ix. Almond whorl.

Figure 2: Nine fingerprint patterns of purkynje.[6,7]

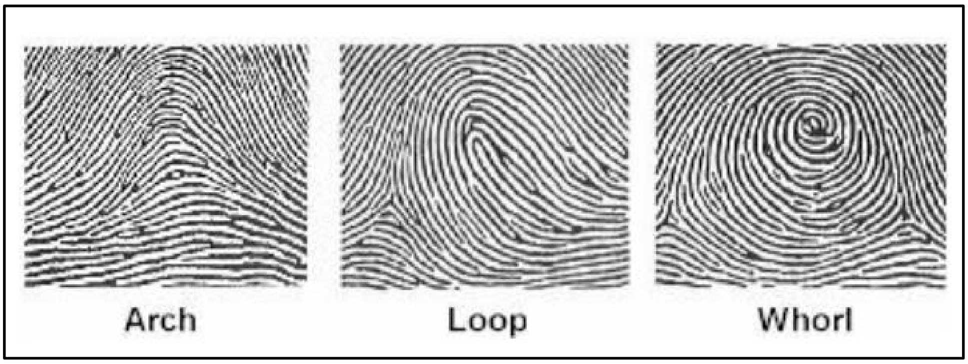


Figs. 7-15. "Nine principal configurations of the rugae and sulci serving the sense of touch on the terminal phalanges of the human hand." [Copied from photostat.]

- Based on the proportion of each group's distribution over the entire globe, Henry used Galton's Whorl, Arch and Loop approach to create four primary groupings. These are

1. Whorl (25%)
2. Arch (6-7%)
3. Loop (65 – 67%) and
4. Composite or accidental or chance (3-4%)

Figure 3: Primary finger print patterns [6,7]



- Loop, Whorl, Arch, and Composite are the four primary patterns. [26]
- Loop: Ridges alongside the other requirements are applicable to fingerprints in addition to the broader use of the phrase loop. While being appropriately categorised as a loop, a pattern needs to meet a number of requirements. Still, 60 to 65% of the total prints are of this pattern category, which is the most prevalent.
- Examples of loop fingerprint patterns are imaginable lines that are drawn from the delta towards the core and terminate or tend to finish upon precisely the same area of the impression through wherever the ridges come. They can also cross an imaginary line, recurve, or touch one. A loop's delta has a single value. Loops are divided into 2 main categories: radial loops & ulnar loops, depending on their location and the direction of the ridges.

- The radial loop gets its name because of the way the ridges run or finish in relation to the radius bone of the forearm. The palm of the right hand has ridges that lean left, whereas the fingers of the left hand tilt right.

- The ulnar loop's ridges get their name because they run or terminate in the direction of the forearm's ulnar bone; the ridges on the left hand's digits slant left, while the ridges on the right hand's slant right.

- Whorl: A circular structure with a few ridges revolving around the core to form a full circle is what defines a whorl. If there are two or more deltas with a recurve in front of each, the pattern is known as a whorl. About 30% of all fingerprints have whorl-style patterns. Remember that this term is quite broad. If whorls are more common in big groups, this pattern can be further separated for purposes of extension. All whorl designs are based on the letter "W" and are classified under the generic term "whorl," despite the fact that this extension could have been employed. Following is the breakdown of the whorl pattern:[6,7]

1) Plain whorl.
2) Lateral pocket loop & twinned loop - Double loop
3) Accidental Pattern.
4) Central pocket loop.

- Arch: The ridges that entrance one side direction of the pattern of fingerprint then leave the other have a small rise (elevation) in them. Plain & tented arches are two subtypes of arches. Delta formations are absent from both the simple arch and the tented arch.

1) Exceptional Arch
2) Accidentals - X
3) Plain arch
4) Tented arch

THE PRINCIPAL DICTIONARY. [25]

- Whorls are assigned in the basic categorization based on the existence of a whorl pattern in various hand fingers. Sixteen points are given for right sided thumb or right sided index finger having a whorl. Eight points are given for each position in case of whorls were visible in the right middle or ring fingers. Four scores were permitted per location for whorl in the left thumb or right little finger. For fingers without whorls, one score is given; for whorl at the left ring or little finger, two scores are given; and for fingers with whorls at the left index or middle finger, one score was given. After that, the scores are ordered as follows:

$$\frac{Rt.T + Rt.R + Lt.T + Lt.M + Lt.L + I}{Rt.I + Rt.M + Rt.L + Lt.I + Lt.R + I}$$

FINGERPRINT TYPES [16]

- The greatest conclusive kind of physical evidence were fingerprints. Every item found at the location of the crime ought to be taken into account as potential fingerprint evidence. "Chance Prints" refer to the fingerprints that the criminal leaves at the crime site. These prints, which the criminal intentionally leaves behind, are appropriately referred to as "burglar's visiting cards." As talked about below, there are three primary kinds of chance prints[16]
- Fingerprints are present on a variety of materials, including the body of a person. At the site of a criminal activity, three types of fingerprints are frequently found. They are plastic, latent, and visible prints.
- Considering that the individual who left the fingerprints can't readily see it, latent fingerprints are among the most significant and frequently found at locations of criminal activity[27]
- Prints that are easily identifiable to the normal sight are referred to as visible prints, and they don't need to be developed anymore. These kinds of fingerprints become less frequently discovered at crime scenes since the culprit tries to erase them, although the person leaving them may obviously see them as well.
- Plastic prints were fingerprints that appear on pliable surface areas. These prints are frequently observed on a variety of items, including soap, soil, pitch, candles, molten wax, adhesives, and more.
- There is no need for additional development because these prints are readily apparent to the bare eye.
- Latent fingerprints are the most significant of the three types of prints, and they are crucial as documentation in forensic analyses. Sweat, oil, and other fluids that accumulate on the outer layer of the skin leave latent impressions. Further research is required since latent prints are not readily apparent [28]

- In inquiries into crimes, fingerprints discovered at the site of the criminal activity are extremely important. Every individual has a distinct fingerprint that may be used for recognising them. Therefore, the discovery of a fingerprint at an unlawful activity scene suggests that someone was there. The ability of fingerprints to establish a connection between a suspect and the victim is one of its greatest crucial uses. An important component of investigation into crime scenes is the recovery of fingerprints from the place of the crime.
- Features belonging to a class are those that focus on a group rather than an individual. Loops, whorls, and arches are the three forms of fingerprint classes. Only about five percent of fingerprints include arches, making them the least frequent kind. Loops, on the other hand, are found in sixty to sixty-five of fingerprints. Between thirty and thirty-five percent of people are whorls. Conversely, hardly one percent to two percent of people have composites.

EXAMINING FINGERPRINTS [6,16]

- Forensic laboratory settings or law enforcement authorities are often responsible for fingerprint analysis. When examining fingerprints, the primary focus is on number and quality of prints to determine if the existing print from the database and the still unidentified print from the site of the crime are identical or distinct.
- The ACE-V (Analysis, Comparison, Evaluation, and Verification) approach is used by fingerprint experts to determine the identity of each impression. Analysing a print involves evaluating it to see if it may be used as a reference. Prints of little number or poor quality are not appropriate for comparison. Analyzers compare known and questionable prints to one another to accomplish this comparison.
- The universe's biggest fingerprint dataset is found in the Integrated Automated Fingerprint Identification System (IAFIS). During assessment, the expert determines if the impressions are reliable or come from multiple sources. Verification is the process by which a second expert examines, compares, and analyses the prints on their own.

LATENT PRINT DEVELOPMENT

- Latent fingerprints can be generated in two broad ways: chemically and physically. Physical techniques, including powder dusting and iodine fuming, rely on the fact that sweat and oily materials hold onto some compounds without fusing them. Chemical methods modify the constituents of sweat directly, resulting in a process that produces specific colouring, such as silver nitrate as well as Ninhydrin. There are several approaches available for development; therefore, it's critical to ascertain which approach will yield the finest outcomes.

METHODS OF POWDER DEVELOPMENT [6,16]

- Powders for fingerprints in black, grey, and anthracene are often supplied for fingerprint development. Gold, crimson, and silver fingerprint powders are also included in some packages.

1) Black powder consists primarily of charcoal, graphite, and lamp black.

2) Chalk and mercury combine to create an amazing grey/white powder. Different formulations are also available, such as white powder made of acacia, zinc oxide, and titanium dioxide.

3) The resin which is finely powdered from the palm tree fruit, called red powder or dragon's blood, is used to make zinc engravings. Heat and dragon's blood can form a latent print, resulting in the appearance of a fine print.

4) Finely ground aluminium dust was the primary component of silver powder. When applied to polished nor varnished surfaces that are hard, as well as items like feathers and cellophane, in trace is utilised.

5) Fluorescence powder: This type of powder is used to generate fingerprints onto coloured objects like calendars, tins, magazine covers, and cartoons. The prints then go out of the developed state and placed under UV light in a room that is completely dark. With the coloured backdrop out of the way, the latent imprints glow and are photographically captureable.

- The technical facets of collecting and analysing fingerprint data: Many methods are employed to create latent impressions, among those most often used constituting a hairbrush similar to that of a camel either squirrel. A favourite accessory is the ostrich feathers brushing. Utilising a powder bottle then tapping powder onto the developing surface are necessary for a good development. Particulate stick to greasy deposits when powder is applied upon an area with a latent print in it. In contrast to the backdrop, only ridge patterns are recognisable. Powder application must be done sparingly to get good effects. Gently apply the brushstrokes. Brushstrokes follow the flow of ridges after a pattern's structure is seen. With minimal harm to the ridges, this aids in getting rid of extra powder that has adhered between them.

- **Evolution of the Magna brush:** This particular brushing powder approach is unique. The utilised powder has a magnetic quality to it. The bristle-less brush draws dust to its tip when it comes into contact with powder. Subsequently, the latent print is approached with the brush. The fine powder reveals the print over the surface when the magnetic contact is released. This low-cost technique can create latent prints on raw wood, leather, paper, etc., (porous materials like) but it can't be applied to metallic objects.[16]

- **Fingerprint creation techniques using chemicals Development of iodine fuming:** This is considered to be the earliest technique for displaying concealed prints. When oily prints leave behind oil and fatty substances on porous surfaces like paper, cardboard, and plaster walls, this technique works well. Oily and fatty accumulations physically absorb the element iodine fumes as they are pressed onto the surface, developing the print to a yellow-brown tint. Immediate photography of the created prints is recommended to avoid print fading caused by iodine releasing. Use 1% starch solution to repair prints that were developed using iodine. Over the course of a few weeks or even several months, the print will begin to turn blue.

- **Evolution of Silver Nitrate:** Though the salt by the sweat lingers forever, time passes. Silver Nitrate reacts chemically with sodium chloride to produce photosensitive silver chloride when an aqueous solution containing approximately 3% silver nitrate remains in order to act on latent print. A dark, established print appears on the dry object when it gets exposed to light. Long-term preservation of the created print is possible. Paper, cardboard, and even untreated wood are excellent materials for this technique.

- **Development of Ninhydrin:** The following is a novel procedure that may be employed to develop extremely ancient prints whereby the powders are unlikely to stick onto the prints and when the development of silver nitrate nor iodine fuming is also unlikely to be successful. Ninhydrin causes a reaction with the amino acids found in human sweat, which results in a lack of pink or purple coloration. Heat application speeds up the development of fingerprints. Prints over paper have been the only usage for this. This procedure need to be carried out before to the silver nitrate process but following the iodine approach.

- Alternative techniques for developing fingerprints The fingerprint technique has been revolutionised by laser light. Canada's Xerox Research Centre and the Ontario Provincial Police developed the laser technique. Perspiration comprises a number of components that glow when exposed to laser light, which is exploited by lasers. Latent fingerprint residue can be shown to contain a range of organic materials with intrinsic luminescence properties, including oils, paints, and inks. Latent fingerprints exhibit luminosity when seen via appropriate filters employing a continuously operating argon ion laser. Certain filters may be employed to take pictures of these prints. Latent fingerprints examined with coumarin-6 (fluorescent materials) to give them more induced luminescence while inherent luminescence is unable to reveal them by lasers.

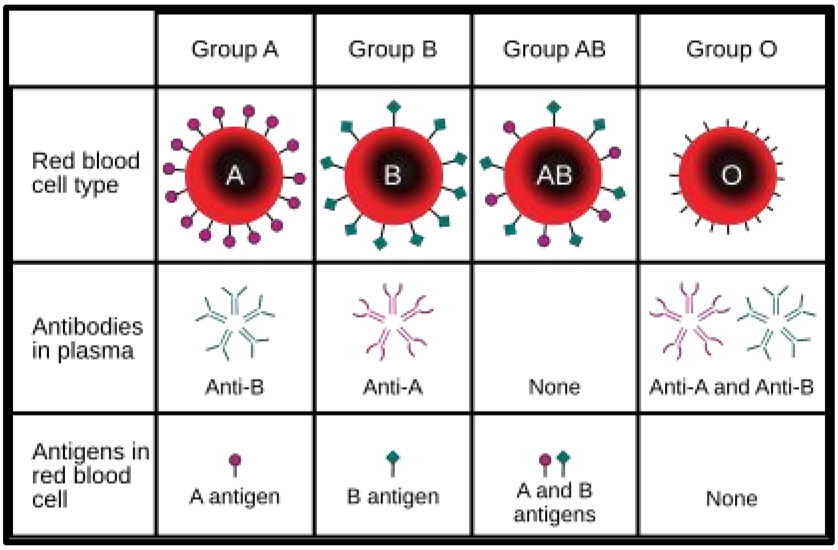
- Utilising the laser process, extremely old prints—up to 10 years old—can be created on a variety of materials, including paper, wood,plastic, rubber, painted walls, leather, etc. Capacity of the laser beam to produce latent prints which can't be develop in any other manner is its primary benefit compared with traditional fingerprint development techniques. It is a very sensitive approach with no time constraints. The created prints are clearly visible when illuminated by a laser. This approach is well developed and has the potential to become the standard that other traditional approaches adopt.
- **Method of Photography:** Although only regions in direct touch may be captured, the prints produced by this approach are crystal-clear. The procedure is costly and has little utility in dermatoglyphic assessment. Forensic additionally criminalistics have been using fingerprint matching for more than a century, and the last ten years have witnessed a worldwide increase in the usage of automated fingerprint identification. One application of Biometrics is the identification of fingerprints. The automatic identification of people based on behavioural as well as physiological traits is known as Biometrics. Recognition of fingerprints is the most popular biometric technology.[29]
- A key biometric technology, fingerprint recognition is being used more and more often. Fingerprint recognition is impacted by a number of physiological parameters, including age and skin ageing, as well as technological aspects, such sensor technology. In a number of applications nowadays, it is very desired to compare and identify fingerprints using computing. As an illustration, consider police activities and building safety devices. It is really difficult to identify complex patterns because, although each fingerprint represents a unique pattern, there are some structural similarities across them. A comprehensive fingerprint identification method had been shown, which included core point detection, edge line thinning, fingerprint picture recognition, identification, and edge line detection.[30]

- A novel quick edge was presented by Ali and Al-Zewary for identifying the ridge lines in fingerprint pictures. Additionally introduced is the edge line skeleton approach, which is based on edge point classification. Using an adaptive approach, the core point of a fingerprint picture was identified. The core is based on splitting the edge lines among four distinct categories, each of which represents one of the four possible orientations (Two diagonals, vertical, horizontal). A collection of 34 measure characteristics is suggested for the purpose of detecting and recognising fingerprint photographs.[30]

BLOOD GROUP COMPARED TO FINGERPRINT

- Karl-Landsteiner established the blood group system in 1901. Blood is categorised according to blood type by looking for hereditary antigenic components on the outermost layers of red blood cells. The ABO system is the principal type. In accordance with the existence of homologous antigenic plasma, ABO type is primarily split into O, AB, A and B, groups. Bernstein discovered the precise way that the ABO blood type is inherited.
- Bloterogel established a link between blood types and physical characteristics.[31]
- Owing to the extensive possibilities of fingerprints as a productive means of proof of identity, an analysis of pattern formation and their relationship with blood types has been attempted in this dissertation.[32]

Figure 4: Classification of ABO blood grouping system



LITERATURES

- In 2021, 800 medics with varying ABO and Rh blood types who worked at the AIIMS in Bihar, Patna, Eastern India, participated in a cross-sectional observational research by Rastogi et.al. People without groups of blood disorders, those with hand or finger abnormalities, those lost fingers, and those allergic to the ink pads were eliminated from the study. Healthy people, or those not afflicted with any conditions that may impair fingerprints, were also included. On a white A4-sized Proforma, rolled impressions of each participant's ten fingers were obtained, and they were categorised as loops, whorls, arches, and composites. Next, the fingerprint patterns distribution was examined according to group of blood (Rh, ABO), as well as gender. Male to female ratio which is 1.9:1, major of research participants (66.0%) were men. The blood grouping that was most prevalent was B (37.7%), which was followed by O (29.8%), A (23.0%), and AB (9.5%). Among all the instances that were analysed, about 96% were Rh-positive patients; the remaining cases were Rh-ve. Loops were the most common fingerprint pattern, accounting for 55.9% of the total pattern distribution. Whorls (34.9%), arches (6.0%), and composites (3.1%) were the next most common fingerprint patterns. There was no discernible difference (p=0.11) in the overall distribution of fingerprint patterns between the sexes for men and women. Nonetheless, there was a statistically significant difference (p=0.0003) in the distribution of the finger patterns among the ABO blood types, but not among the Rh blood groups (p=0.08). The occurrence of an individual fingerprint patterns is related to the "ABO" blood type, but not to gender or Rh blood group, according to the study's findings. It is possible to predict a person's blood group from their fingerprints and vice versa.[33]

- A search by Thakur et al., "Fingerprint Patterns in Relation to Gender and Blood Group among Residents of Central Indian District," was carried out in 2019. Three hundred participants, 150 of them were male and the other 150 were female, between the ages of 18 and 40, were the subjects of a cross-sectional research. Utilising the conventional method, each subject's blood type along with fingerprints were gathered. Blood groups "O" (87, 29%), "A" (72, 24%), and "AB" (23, 7.7%), after which made up the largest proportion of the study's subjects Blood type "B" (118, 39.3%). This study discovered that the number of whorl were greatest in each of the ABO groupings of the blood system's individual, with the exception of blood group O, whereby loops found frequently dispersed among patients from various blood groups. Moreover, they observed that patterns of fingerprints with blood group ABO did not appear to be correlated. Findings imply that only ways to securely identify someone are to evaluate their fingerprints, gender, and ABO blood group individually.[34]

- A research entitled "Correlation Among Lip Print Pattern, Finger Print Pattern and Abo Blood Group" was carried out in 2014 by Srilekha N et al., using a research consisting of 27 male and 27 female participants ages 20-40 years. Everyone's fingerprints, lip prints, and Rh and ABO blood types were noted. Fingerprints and lip prints were categorised using the methods used by Michael and Kucken as well as Suzuki and Tsuchihashi respectively. Results showed that despite the fact that blood groups, lip prints, and finger prints each have unique characteristics, there was no discernible association between each of the three variables.[35]

- In their 2004 study, Bharadwaja et al. compared the relationship between dermatoglyphics and blood group, finding that the B blood group has significantly more dominating Total Finger Ridge Count (TFRC), group A type of blood contains high frequency loops, and group AB type of blood contains high frequency whorls. Fingerprints are an important means of identifying a person, according to the research conducted in 2004 under a heading "Pattern of finger-prints in different ABO blood groups" by Bharadwaja et al. Three hundred people participated in the study, including ABO categories from the Medical Institute of Ajmer. The principal aim of this investigation is to examine the relationship among the participants' fingerprints and ABO blood groupings, as well as the distribution of finger print patterns.The outcomes of the research demonstrated that whorls were moderate and that arches were least prevalent amongst such individuals, the majority of subjects had loop patterns. A collection has more loops. AB displayed a larger whorl. The research's conclusion made the suggestion that blood types and fingerprints are related.[36]

- Iju Shrestha et al.'s 2019 research, from May to July 2019, a descriptive cross-sectional survey of the residents of Bhaktapur's Duwakot VDC was conducted. A total of 106 participants, ranging in age from 18 to 60, have been included in the study. All 10 fingers' fingerprints were analysed, the distribution pattern was examined, and gender disparities were examined. Loops 1033 (52.71%) had the greatest frequency in the survey, subsequent to whorls 537 (27.38%), arches 537 (27.38%), then composite pattern 300 (15.28%). Of the total number of men, 397 (5.54%) had more radial loops than ulnar loops, 636 (96.38%) of all the females had more ulnar loops. Males saw more concentric whorls (245) than females did (53.27%), with females seeing more spiral whorls (292).[37]

- In a research published in 2023, Garg P et al. gathered the fingerprints and ABO along with Rh blood types of 190 medical students in the 17–29 age range. It was a cross-sectional study. The majority of participants (39.47%) belonging to the group of blood "O," which was followed by blood-group "B." Rh +ve blood type makes up the greatest percentage (93.68%). In both males and females across all blood types, loop patterns found among the most prevalent main fingerprint pattern, subsequent to whorls and arches. Except for the ring finger, every finger on both hands displayed the greatest frequency of the loop main fingerprint pattern. The research demonstrates a relationship between gender with blood group 'B' and the overall distribution of the primary fingerprinting pattern. With the exception of the "AB" blood type, the primary fingerprint pattern dispersion has a relationship with the unique digit in all blood groups.[38]

- Manikandan et al. carried out a study named "Dermatoglyphics and their Relationship with Blood Group: An Exploration" in 2019. The research involved 150 dental students from the Vivekanandha Dental College for Women in Tiruchengode, India's Elayampalayam, stamp pad using the fingers of your right and left hands. On white A4-sized paper, prints were made. Last but not least, each subject's blood type was recorded alongside fingerprint whorls, loops, and arches were studied under a magnifier lens. The findings of this study showed that 38% of participants were Rh-positive (96.77%) and 3.23% had been Rh-negative. Blood types O, A, B, and AB came next in sequence; ABO, Rh blood group, gender, and Dermatoglyphic distributions are all related, according to this study.[39]

- A 2019 study named "Qualitative Analysis of Primary Fingerprint Pattern in Different Blood Group and Gender in Nepalese" by Sudikshya KC et al, reveals following a basic pattern classification and statistical analysis, the digital fingerprints of 300 Nepalese people with known blood types and varying ages were examined. In males and females, the Rh +ve along with ABO types of blood had the highest frequency of loops, whereas the Rh -ve blood types had the highest frequency of whorls, subsequently followed by loops & arches. Loops were greater in number in all blood types except "A-ve" additionally "B-ve," whereas whorls were more prevalent. With a few Rh blood types belonging to blood group "A," the distinctive fingerprint pattern proved statistically significant; among other blood types, the result was not. While whorls were greater in all blood types on the ring finger, loops greater in number in the middle and little fingers. Thumb and index finger whorls seemed more common, with the exception of blood group "O," where loops appeared more common. This research concludes that the distribution of a fingerprint's primarily pattern relates to individual digits and not to gender or blood group.[40]

- In a year 2010 study, Rastogi and Pillai et al sought to determine whether a person's blood grouping and patterns of fingerprints were related. Study participants included a total of 209 students studying medicine. They were from Kasturba Medical College in Mangalore, India, and ranged in age from 18 to 25. Of them, 100 had been female and 100 had been male. Papers as well as an ink pad were used to collect each person's fingerprinting. According to the study, loop fingerprint patterns are the most prevalent, whereas arch fingerprint patterns are least prevalent. Except in O negative, where Whorls appeared more prevalent, Loops dominated all the other categories. They concluded that the arrangement of fingerprint patterns and blood types are related as a result of their investigation. Consequently, one may predict an individual's blood group by examining their fingerprints.[41]

- Sangam Muralidhar Reddy et al (2011) states in "Finger Print Pattern in Different Blood Groups" that ridge patterns are used to classify and record fingerprints. Every person's ridge pattern leaves marks that persist over time. 400 people with different ABO blood types participated in the study; 200 of the participants had been male and the other 200 had been female. Each of the ten fingerprints were collected using a fingerprinting slip as well as categorised into loops, whorls, and arches. The blood group O predominated, according to the data. Just a small percentage of the individuals had whorls, whereas most had loop in. Blood group AB demonstrated the lowest frequency among the various Dactyloglyphic patterns, but blood group O was observed to be prominent in relation to this loop pattern. Females demonstrated the greatest number of arches, whereas males primarily presented with loops and whorls. It was determined that there was a correlation between blood groupings and fingerprint patterns, indicating that using them for personal identification is not ineffective.[42]

- In an attempt to determine a person's blood group and gender utilising fingerprint patterns, Sandeep K. Raloti et al (2012) found that blood grouping according to ABO remains the most widely used and universal technique for determining blood grouping. 511 (55.01%) men and 418 (44.99%) females underwent examination out of 929 unique samples that had been compared and characterised in order to link fingerprints with ABO blood groupings. The groupings of blood of the people were documented on a flat sheet after their finger impressions were examined under a magnifying lens to record its features. Following blood groups A (20.78%) and AB (9.47%), blood groups O and B (36.28% and 33.48%, respectively) had the greatest frequency range, according to the analysis of the results. Rh+ve prevalence had been greater (96.02%) than Rh-ve prevalence

(3.98%). The most common fingerprint patterns comprised loops, which accounted for 59.22% of the total, subsequent to whorls and 5.16% for arches. According to their idea, blood types and finger impressions have a relationship and could therefore assist with one's identity.[43]

- A research on the relationship between blood groupings and fingerprints was conducted by Fayrouz et al. (2012). The objective of the researched was to determine the prevalence of patterns of fingerprint across individuals with varying ABO & Rh blood typing and to estimate the relationships among the ABO group they belong to and personality traits. 305 Libyan health care students in Al-Jabal Al-Gharbi educational University, Zawia, Libya participated in this research project. According to their findings, the majority of the patterns of fingerprints had a large proportion of 50.5% were loops , 35.1% were whorls , and 14.4% were arches. The predominant patterns in Rh+ve blood groupings A and B patients comprised loops (52% and 54.3%, respectively), followed by whorls (33.4%). Whorls accounted for the majority of Rh+ve along with Rh-ve instances in the B group of blood. All groups of blood had a higher prevalence of loops in the index, thumb, and little fingers.[44]
- A research project on patterns of fingerprints and the grouping of blood relationships was carried out by Bhavana et al. in the year 2013. The objective of the current research is to evaluate the fingerprints patterns & compare them with an individual's blood grouping. They completed a research with 200 participants, 100 of whom seemed male and 100 of whom seemed female and belonged to distinct ABO blood groupings. In Hubli-Dharwad, Karnataka, India, this study was carried out. They categorised the ten fingerprint patterns towards loops, arches, and whorls. The CAMLIN enterprise's 157×96mm stamping pad was used to obtain the fingerprints of the subjects. We took both the right and left hand's rolled along with plane prints. While arches were among the least common fingerprint patterns, loops belong to the majority of often observed ones, according to an analysis of the prints that were taken from various people. Although whorls only appeared in blood from O-negative groups, loops were detected in every kind of blood group.[45]

- In 2013, Eboh et al. conducted research on fingerprints to ascertain the patterns of fingerprints pertaining to an individual's blood grouping. Participants from Delta State University in Abraka, Nigeria, participated in the research. Endorsing ink along with plain white paper have been employed to gather the samples. Their findings indicated that among blood type O negative individuals, loop had greater rates than Arch and Whorl. They came to the conclusion that ABO blood grouping were only useful for identifying people when utilised separately.[46]

- According to the 2014 research study "A Study of Fingerprints in Relation to Gender and Blood Group among Residents of Maiduguri, Nigeria" by Nathan Isaac Dibal et.al, a human finger's friction ridges produce an impression on paper that is known to become a fingerprint. The likelihood of two people having the same fingerprints is extremely low. During life as a whole the finger ridges that are developed while in the embryonic stage do not alter. They studied their theory on the ABO blood groups method out among all blood grouping methods. Given the outstanding effectiveness of fingerprints as a means of personal identity, researchers at Medical University of Haryana attempted to examine the relationship between a human being's fingerprint and blood grouping. The research involved one hundred participants in a gender ratio of 50:50, with different kinds of ABO blood types and age categories. Ten fingerprints were taken, and they were all categorised into different patterns such as loops, whorls, and arches. Blood groups with O+ and B+ had greater frequencies of loops, with ulnar loops being the most common kind.[47]

- In accordance with the research done by L Jha et al (2015) under the heading "Fingerprint pattern examination of right hand thumb in relation to Blood Group," one may infer the predicted blood grouping by looking at a person's fingerprint patterns. For the purpose of to get an imprint of the whole tip, the researchers performed the investigation by rolling the thumb of their right hand. Furthermore, a record of the blood grouping was established. The blood group with the largest proportion of loops, AB, is followed by O, according to the study's findings. The proportion of loops in both of the A and B groups is the same. B and O groups are next in order of whorl percentage, with A group having the greatest proportion. The AB blood group was found to have the lowest whorl frequency. In the exact same way, B groups had the lowest proportion of arch. At last, they demonstrated that ridges on fingerprints and blood type are interrelated.[48]

- The relation among blood groupings and fingerprints was demonstrated in the study conducted by Chaudhary et al (2017) under the subject of "Fingerprints as an Alternative Method to Determine ABO and Rh Blood Groups". During this research, 700 participants were chosen at randomly from Manipal Teaching Hospital & College of Medicine. Participants' genders and ages were not restricted. Blood grouping was performed, and fingerprints were obtained on A4 paper using a stamp pad. Later, all of the samples that were gathered were used to study the loop, whorl, and arch patterns. The study's findings, which were presented to the 700 participants, showed that, with the exception of the A-ve group, which was mostly dispersed by whorls, loops were significantly distributed among all blood groups. Additionally, they noted that the right middle finger of the B-ve blood type had an extremely distributed loop. While the A-ve group's right index fingers exhibited the largest arch dispersion, the AB+ ve group's left thumb, right index and left ring fingers displayed a widely dispersed whorl. They declared at the end of their research that blood group could not be done using fingerprints.[49]

- According to the research "Pattern of Fingerprints in different ABO and Rh blood types" conducted a researcher Maled et al (2015), the fingerprints of an individual can be used to identify them. Four hundred Indian medical students with varying types of ABO blood participated in this study. Their blood groups and fingerprints had been collected, tallied, and examined. Their research showed that the majority of the aforementioned individuals had loops, whorls, and arches in order of precedence. Loops were more common in the O group among them, followed by B and AB in blood type Rh+ve & Rh-ve cases. They ended the study by saying that blood types, gender, and fingerprints are interrelated.[50]

- In the context of the research carried out by Arjun Rao Isukapatla et al (2016), "Distribution of Fingerprint Patterns in Different ABO Blood Groups" The likelihood of two individuals having identical or nearly identical fingerprints amounts to 1 per sixty-four thousand millions. The field of forensics deals with a wide range of cases, including criminal, civil, and recent transaction fraudulent activities, where a reliable personal identity is essential. The goal of the research is to show how blood groupings and fingerprint patterns relate to one another. In a 2012 research, 89 medical students between the ages of 17 and 21 were included; 62 of the participants were men and 27 were women. Using printer dye, the impressions of all 10 fingers had been taken on a flawless white sheet. Using a magnifier lens, the imprints that were captured on the paper were examined and recognised. The final results demonstrated that individuals with the B+ group of blood tend to have loop patterns, whereas those with the O+ the blood group tend to have whorl patterns. As a result, the relationship between fingerprints and blood group was discovered.[51]

- In order to investigate how fingerprint patterns relate to a person's blood type, Narayana et al (2016) conducted a study on fingerprint patterns. One hundred individuals of various blood types and age groups participated in this study. Ten fingerprints were collected and classified as composites, whorls, loops, and arches. They discovered that the most prevalent pattern identified in people was a loop, followed by composites, whorls, then arches. Most common type of loops seen in O positive groupings of blood were ulnar loops, which constituted the predominant pattern among loops.[52]

- According to research by Sahu et al (2016), an individual's fingerprints' association with their blood grouping might boost the fingerprint identification's accuracy. The research, which had 929 participants, found that the group of blood known as O, had been greatest frequency of loops. and noted that those with groups of blood O and B had the most loops and a modest amount of whorls.[53]

- The type of blood in the ABO system and fingerprint patterns were compared by Deepalaxmi Salmani et al (2016). The Malabar Medical College in Kozhikode, Kerala, employed 140 first-year medical students for research. Blood types O was collected in higher numbers, according to the data. The most common fingerprints found are loops (63.14%), whorls (23.78%), and lastly arches (13.07%). The blood groups A and B were discovered as having whorls and loops less frequently than blood type O. In every blood group, arches were the least common.[54]

- ABO and Rh blood types may be determined using fingerprints instead of other methods, as demonstrated by the research conducted by Chaudhary et al (2017) on the subject, 700 participants were chosen at randomly from Manipal College of Medical Sciences, both male and female, without regard to age, for this research. They also performed blood grouping and gathered fingerprints on an A4 sheet of paper using a stamp pad. The obtained samples were then used to study the loop, whorl, and arch patterns. After 700 individuals, the study's findings showed that, with the exception of the A-ve group, which was mostly dispersed by whorls, loops were highly dispersed among all blood types. They additionally noted that the B-ve blood group's right middle finger had a large distribution of the loop. The arch dispersion had been found to be greatest in the right index fingers of the A-ve group, whereas the whorl was heavily dispersed in the left thumb, left ring finger, and right index finger of the AB+ ve groups. They declared at the study's conclusion that blood grouping cannot be done using fingerprints.[55]

- The research conducted in Navi Mumbai by Patil et al (2017) with the subject of "Fingerprint patterns in relation to gender and blood groups" stated that because fingerprints are unique, they can be used to identify a person. It also mentioned that a person's fingerprint pattern, blood group, and gender all have a substantial correlation. 170 participants in the 18–65 age range participated in the study, 70 of whom were men and 100 of whom were women. Afterwards, the gender and blood groupings of the fingerprint collection were compared. Based on the gathered samples, the study found that the loops is the most prevalent, followed by the whorl and arch patterns. The results of the study indicated that there is no relation among fingerprint and gender and that there may be a link between fingerprinting and blood groups such as ABO.[56]

- According to a research by Rani et al (2018), fingerprints have long been recognised as the identification method that contributes the most to the police department out of all the data approaches accessible. The primary aim to determine possible relationships between ABO groups of blood with fingerprint pattern. The 500 participants of Indian descent who are older than 18 are the study's participants of the current cross-sectional research. The examination of fingerprint patterns based on observation and results revealed that loops are among the most often observed pattern in the research, subsequent to whorls and arches, which are regularly seen in both Rh positive and Rh negative persons.[57]

- The research was titled "Association of Fingerprints with the ABO Blood grouping among students in Gandaki Medical College" by R. Shrestha et al (2019), given that Dermatoglyphics studies are unquestionably the most dependable, practical, and acceptable means of identifying an individual, an effort is undertaken to analyze the relationship between a person's blood type and Dermatoglyphics pattern, which are both indicative of genetic inheritance and maintain consistency at all times of life. A cross-sectional research comprising 200 students aged 17–27 who were previously aware of their blood type at Gandaki Medical College in Pokhara, Nepal, was conducted for this comparison. Both hands' finger impressions were discovered and examined. According to the findings of this study, the most prevalent pattern was the loop, which was followed by whorls, arches, and composite. When examining gender trends, it was found that while females were generally more prevalent in the arch, men had a greater prevalence of whorl and loop patterns. People with the blood type O+ were more likely to possess loop and whorl patterns, whereas people with the blood group B+ve were more likely to possess arch patterns. According to the study, there is no substantial relationship among the distribution of Dactyloglyphic patterns and blood group, hence it is not feasible to determine a person's blood group from their finer imprints.[58]

- Avicenna Medical College Lahore students participated in a comparative research on Dactylography in 2012, which was carried out by Mudaser hussain abbasi et al., comprising from December 1, 2011, to February 29, 2012. Participating in the research were 100 Avicenna Medical College Lahore third-year MBBS students. Every learners fingerprint was allocated a unique serial number and roll number after being formulated with the plain & rolled approach on white, unprinted paper, utilising a stamp pad. The Proforma contained the students' names as well as generic information on their blood types, sex, and age. There were 30 male and 70 female students in each topic, with an age range of 19 to 25. The study found that the most frequent finger print configuration is a loop, while the least frequent form is an arch. A negative grouping is the rarest, whereas B positive grouping is the most prevalent. In persons with blood groups A +ve, B +ve, and O+ve, loops are more common. Blood groups B+ve, O+ve, and A+ve have higher whorl frequencies, whereas A-ve and B-ve have lower whorl frequencies. Blood groups B+ve and O+ve have the highest frequency of loops and whorls, respectively.[59]

- A research titled "Frequency and correlation of lip prints, fingerprints, and ABO blood groups in population of Sriganganagar District, Rajasthan" was carried out in 2017 by Harpreet Sandhu et al. The study involved 1200 individuals who were healthy in the 18–30 age range. Each the individual's Cheiloscopic and Dermatographic characteristics were collected, and they had been analysed using the Henry, Tsuchihashi, and Suzuki methods of categorization, in that order. The patterns were separately examined by two forensic specialists. Every the individual's ABO Rh blood group was additionally noted. The commonest blood type in both sexes was found to be B+ve, whilst A-ve was found to be the lowest frequent in males as well as AB-ve in females. The commonest lip pattern were Type II, whereas Type I' and Type V were far less common in males and females, respectively. In men and women, the most prevalent fingerprint pattern was UL, whereas RL was hardly noticeable. There was a link between every fingerprint pattern and various lip print patterns. With the exception of Type I (vertical) lip patterns, a link between various blood types and lip print patterns was discovered. All blood groups as well as fingerprint patterns showed a positive connection, with the exception of the RL pattern. For both genders, there is a relationship between ABO blood types and fingerprint and lip print patterns. Correlating these physical proofs' distinctiveness can therefore occasionally assist the forensic team personnel in accurately identifying a subject, it can help to focus their search in cases when there is no other information that could potentially reveal the subject's identification.[60]

- A research named "Correlation and Comparison of Cheiloscopy and Dactyloscopy with Blood Groups – An Institutional Study" was carried out in 2020 by Sisodia M et al. Examining the connection among blood group with cheiloscopy & dactyloscopy is the aim of this research in dentistry students from Western Maharashtra. The research comprised 200 dental school learners in age groups spanning from 18 to 25 years. ABO blood types, fingerprint patterns, and lip prints were gathered and compared. ABO-Rh blood groups with fingerprinting had a correlation that was statistically significant with lip prints as well as ABO-Rh blood groups.[61]

METHODS AND MATERIALS

- After receiving approval from the Institutional Human Ethics Committee and Scientific Research Committee, the present thesis was conducted.
- Throughout this study, the principles and standards of the Helsinki Biomedical Ethics Guidelines which pertain to the ethics of human subjects research have been honoured and followed.

Study design

- At Jawaharlal Nehru Medical College in Belagavi, medical students participated in this cross-sectional study to determine the relationship between the Galton-Henry Dactylography system with the Karl-Landsteiner method and Gender.
- Medical students who are in MBBS phase II and phase III in academic year 2022-2024 in Jawaharlal Nehru Medical College of KAHER, Belagavi were enrolled in this study.

Study period

- The study was carried out between October 2022 and April 2024, a duration of eighteen months.
- The 18-month study period was selected to ensure methodological rigor and flexibility in data collection. This extended duration provided ample time to coordinate with the medical students' academic schedules, allowing for consistent recruitment and data gathering. It also enabled follow-ups to verify data accuracy, which is critical in biometric research, where data integrity is paramount. The chosen period allowed us to mitigate any disruptions and ensure robust and representative data collection, essential for achieving valid and replicable results in this cross-sectional analysis.

Study area

- Jawaharlal Nehru Medical College, KAHER, Belagavi is the area of this study.

Eligibility criteria

Inclusion Criteria:

1) Subjects with normal fingerprints

2) The research included two hundred medical students, ranging in age from eighteen to twenty-five.

3) The age range of 18-25 years was chosen because it represents a stage where dermatoglyphic features, such as fingerprint patterns, are fully developed and stable. This range minimizes potential variability in biometric characteristics that might arise due to age-related factors, ensuring that the observed patterns are not influenced by developmental changes. Selecting this age range allows for clear, unbiased comparisons within a demographic known for stability in these characteristics, enhancing both the validity and generalizability of the findings to similar populations.

Exclusion Criteria:

1. Participants with permanent scars, lesion, cuts, Electric injury, after exposure to radiation

2. Subjects with hand deformity due to injury, congenital defect or disease.

3. Worn fingerprint, extra webbed or bandaged fingers, hypersensitivity to endorsing ink.

4. H/O Coeliac disease, Dermatitis, Eczema, Acanthosis Nigricans , Leprosy, Acromegaly.

Sample Size:

200 Medical students

Here, Sample size calculated with p = 42.9% ; q = 100-p ;

[Z1-α/2] = 1.96 = constant value; 95% confidence interval; 20% Allowable error ; 10% Attrition

$$\text{Sample size (n)} = \frac{[Z_1\text{-}\alpha/2]^2 \times pq \times 1.1}{(20\% \text{ of } p)^2}$$

$$= \frac{1.96^2 \times 42.9 \times (100-42.9) \times 1.1}{(0.20 \times 42.9)^2}$$

$$n = 140.6 = 141$$

Sampling method

- Simple random sampling was used to choose study participants. After obtaining everyone's informed written consent, the samples that met the eligibility requirements—200 medical students from Jawaharlal Nehru Medical College, KAHER, Belagavi—were included in the study.
- While the minimum sample size calculation suggested 141 participants, we opted to increase the sample size to 200 to enhance statistical power and reliability. A larger sample size improves precision, allows for more robust subgroup analyses (e.g., gender comparisons), and reduces the potential for random error, thus strengthening the overall reliability of the findings. Additionally, oversampling addresses any possible attrition, ensuring that the study remains adequately powered even if a portion of data needs to be excluded. This approach was taken to achieve the highest possible accuracy in our results.

Data collection procedure:

- The institutional ethics committee gave its prior clearance before the study was conducted. Written informed consent had been obtained in advance of data collection. After receiving consent from the corresponding medical students, each student was given a unique enrollment number. It was asked of each participant to thoroughly rinse their palms using water along with soap and to allow them to air dry. The tips of the fingers or the entire area just above the fold of the first phalangeal joint were covered with ink using a roller. Next, with normal pressure, a rolled fingerprint was captured from the radial to the ulnar border (i.e., from inside to outside) on a proforma that had been put in the appropriate location. On the proforma, all 10 fingers' fingerprints were collected in this way for each individual. To keep the print from being smudged, great care was taken to avoid slipping fingers. Information such as age and sex was recorded once the fingerprints were collected. From their prior laboratory blood results, the specifics of their blood type were documented. Henry's categorization approach claimed that the fingerprint patterns were examined under a magnifying lens and were divided into four categories: loops, whorls, arches, and composite.

Statistical analysis

1) The collected data was coded and entered using Microsoft Excel.
2) The data that was gathered was represented using percentages as well as frequencies.
3) Tables and charts are made.
4) The coefficient of correlation was ascertained by regression analysis.

- Frequency distribution and the Chi-square test were used to statistically evaluate the collected data using the Statistical Package of Social Sciences [the SPSS programme] version 20.0 along with The Jamovi (Version 2.4) (2023) [Computer Software]. When it comes to variable relationships, a P-Value of less than 0.05 is considered statistically significant.

Table 1 : Data analysis table

Independent Variables	**Dependent Variables**	**Statistical Analysis**
Age & Gender	Knowledge of GALTON-HENRY DACTYLOGRAPHY SYSTEM	Percentages and Proportions (Categorical Data)
Degree Course	Knowledge of KARL-LANDSTEINER SYSTEM	Chi-square test & p - value
Blood group	Attitude towards Forensic Identification	SPSS version 20.0 & The Jamovi (Version 2.4) (2023) [Computer Software] (Computing and Data Analysis)

Ethical Clearance:

- The Institutional Ethics Committee and Scientific Research Committee of Jawaharlal Nehru Medical College gave their approval before the study could be carried out **(Ref - MDC/JNMCIEC/18, dated 27/09/2022).**

After providing each participant with an information sheet outlining the study's goal, confidentiality procedures, and their right to participate, each responder signed an informed written consent form (Annexure I). Throughout the study, confidentiality and anonymity were respected about the data. The letter of clearance from the ethical committee is attached.

RESULTS

- This study compared the ABO blood categorization system, gender, and fingerprint characteristics. Exactly 200 students who were between the ages of 18 and 25 were included in our research for this objective. The findings show that across all blood categories, the loop is the greatest common pattern, and composite is one of the least prominent.

- For the present study, the left and right hands of 200 individuals provided a total of 2,000 fingerprints. 76 (38.0%) of them were men, and 124 (62.0%) were women. The research population seemed to favour the loop pattern (52.75%) in terms of fingerprint pattern distribution, following by the whorl (37.95%) while arch (7.2%).

- The blood types (ABO and Rh) of the participants were O (38.5%), B (35.5%), A (18.5%), and AB (7.5%), in order of greatest to lowest frequency. Our study concentrated on determining the relationship between a person's gender, blood type, and fingerprints and whether or not this linkage aids in personal identification.

- From the research, we were able to discover at least 42 composite patterns, 759 whorls, 144 arch patterns, and 1055 loop patterns altogether. The geographic distribution of Rh type of blood and the right little finger finger print pattern, as well as the prevalence of ABO blood grouping and the left thumb finger print patterns, were shown to only significantly correlate.

- The tabulated findings of our analysis are as follows,

TABLE 2 - Frequencies of Gender

Table 2 explains Gender Distribution of Participants, This table illustrates the gender distribution among participants, establishing the demographic baseline for gender-based analysis of fingerprint patterns and blood group correlations.

Gender	Counts	% of Total
Male	76	38.0 %
Female	124	62.0 %

Figure 5 : Frequency distribution of study cases gender (n=200)

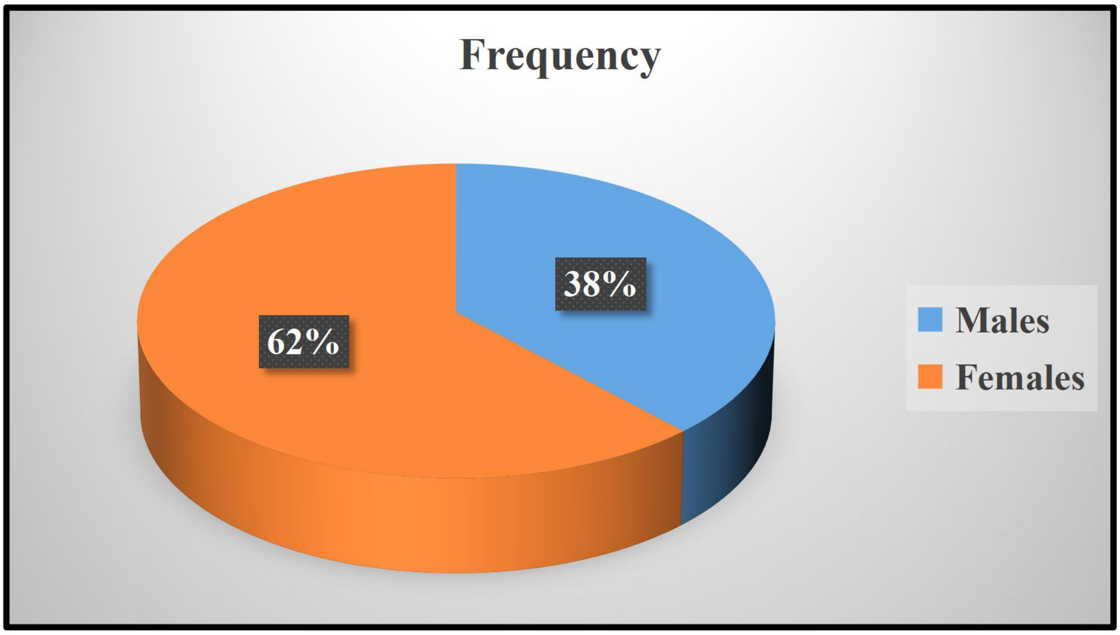


TABLE 3 - Frequencies of Age

Age	Counts	% of Total
11 to 20	100	50.0 %
21 to 30	100	50.0 %

Table 3 explains Age Distribution of Participants - This table displays the ages of participants within the specified range (18-25 years), confirming the sample's consistency with the study criteria. Establishing the age demographic is vital, as it ensures that biometric variations are examined within a population where age-related differences in fingerprint patterns are minimized, thereby supporting the study's reliability.

TABLE 4 - Frequencies of Finger print pattern

Patterns in all ten fingers	Counts	% of Total
Arches	144	7.2 %
Loops	1055	52.75 %
Whorls	759	37.95%
Composite	42	2.1%
Total	2000	100%

Table 4 explains Frequency of Fingerprint Patterns Across Participants - This table provides the overall distribution of primary fingerprint patterns (loops, whorls, arches, composites) across all participants. Understanding these baseline frequencies is essential for exploring how fingerprint pattern prevalence may differ according to gender and blood type, addressing the core objectives of identifying potential biometric correlations.

Figure 6 : Frequency distribution of all ten finger print patterns (n=2000)

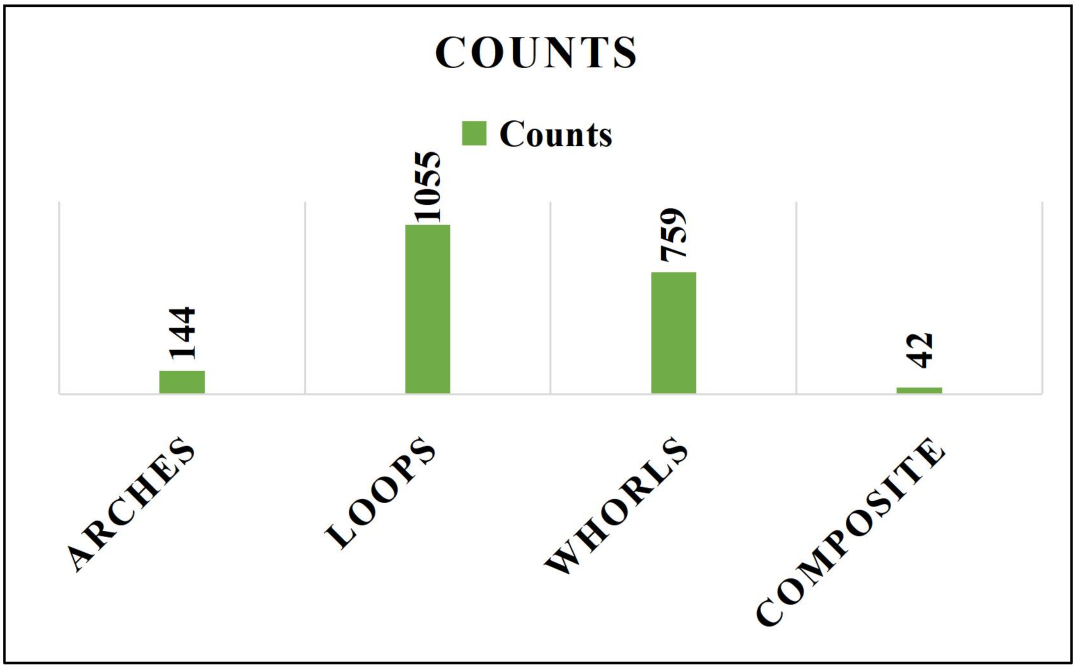


TABLE 5 - Frequencies of blood grouping and Rh typing

ABO	Rh	Count	% of Total
A	Positive	33	16.5 %
	Negative	4	2.0 %
B	Positive	68	34.0 %
	Negative	3	1.5 %
AB	Positive	14	7.0 %
	Negative	1	0.5 %
O	Positive	69	34.5 %
	Negative	8	4.0 %

Table 5 explains Distribution of Blood Group and Rh Factor Among Participants - This table outlines the distribution of ABO blood groups and Rh factor among the sample. This foundational information is crucial as it allows for subsequent analyses comparing blood group types to fingerprint patterns, setting the stage for identifying any statistical relationships between these variables.

Figure 7 : Frequency distribution of of blood grouping and Rh typing

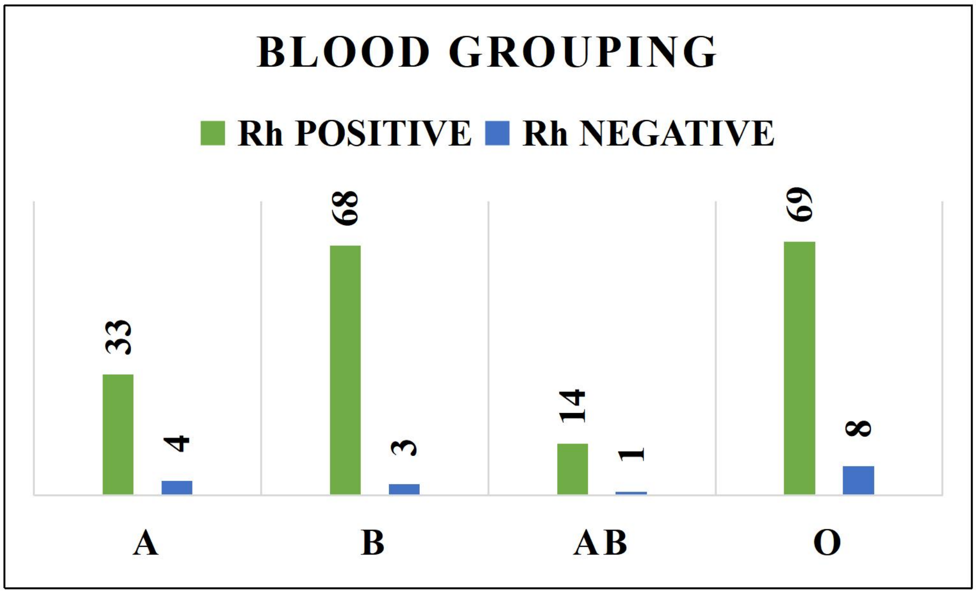


Figure 7 explains Frequency distribution of of blood grouping and Rh typing among that Blood group O, B are most common respectively.

TABLE 6 - Distribution of ABO blood grouping in relation to Gender

		ABO			
Gender	**A**	**B**	**AB**	**O**	**Total**
Male	14	27	6	29	76
% of total	7.0 %	13.5 %	3.0 %	14.5 %	38.0 %
Female	23	44	9	48	124
% of total	11.5 %	22.0 %	4.5 %	24.0 %	62.0 %
Total	37	71	15	77	200
% of total	18.5 %	35.5 %	7.5 %	38.5 %	100.0 %

χ^2 Tests		
Value	**df**	**p**
χ^2 0.0296	3	0.999

The table 6 presents the distribution of ABO blood groups among 200 participants, comprising 76 males and 124 females. Blood group O (38.5%) is the most common, followed by group B (35.5%), A (18.5%), and AB (7.5%). Among males, blood group O (14.5%) is the most frequent, while in females, it is also group O (24%). A Chi-square test shows no statistically significant association between gender and ABO blood group distribution.

TABLE 7 - Distribution of RH blood typing in relation to Gender

			Rh	
Gender		**Positive**	**Negative**	**Total**
Male	Observed	70	6	76
	% of total	35.0 %	3.0 %	38.0 %
Female	Observed	114	10	124
	% of total	57.0 %	5.0 %	62.0 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

Value	**p**
χ^2 0.00185	0.96

This table 7 shows Rh factor distribution by gender. Both genders predominantly exhibit Rh positive, and no significant gender-based differences are observed.

TABLE 8 - Distribution of ABO blood grouping in relation to finger print pattern in left little finger

				Left little finger		
ABO		**Arch**	**Loop**	**Whorl**	**Composite**	**Total**
A	Observed	2	26	8	1	37
	% of total	1.0 %	13.0 %	4.0 %	0.5 %	18.5 %
B	Observed	1	54	16	0	71
	% of total	0.5 %	27.0 %	8.0 %	0.0 %	35.5 %
AB	Observed	1	10	4	0	15
	% of total	0.5 %	5.0 %	2.0 %	0.0 %	7.5 %
O	Observed	5	54	17	1	77
	% of total	2.5 %	27.0 %	8.5 %	0.5 %	38.5 %
Total	Observed	9	144	45	2	200
	% of total	4.5 %	72.0 %	22.5 %	1.0 %	100.0 %

	Value	**df**	**p**
χ^2	4.82	9	0.850

This table 8 shows the association between ABO blood groups and fingerprint patterns in the left little finger. The loop is the most common pattern, with no significant correlation to blood groups.

TABLE 9 - Distribution of ABO blood grouping in relation to finger print pattern in left Ring finger

Left ring finger		A	B	AB	O	Total
Arch	Observed	0	3	0	8	11
	% of total	0.0 %	1.5 %	0.0 %	4.0 %	5.5 %
Loop	Observed	16	34	7	30	87
	% of total	8.0 %	17.0 %	3.5 %	15.0 %	43.5 %
Whorl	Observed	21	34	8	39	102
	% of total	10.5 %	17.0 %	4.0 %	19.5 %	51.0 %
Total	Observed	37	71	15	77	200
	% of total	18.5 %	35.5 %	7.5 %	38.5 %	100.0 %

	Value	df	p
χ^2	7.52	6	0.275

The table 9 shows that loops are most frequent in the left ring finger, with no significant association to ABO blood groups.

TABLE 10 - Distribution of ABO blood grouping in relation to finger print pattern in left Middle finger

Left Middle finger		A	B	AB	O	Total
Arch	Observed	3	2	2	9	16
	% of total	1.5 %	1.0 %	1.0 %	4.5 %	8.0 %
Loop	Observed	19	45	7	42	113
	% of total	9.5 %	22.5 %	3.5 %	21.0 %	56.5 %
Whorl	Observed	15	23	6	25	69
	% of total	7.5 %	11.5 %	3.0 %	12.5 %	34.5 %
Composite	Observed	0	1	0	1	2
	% of total	0.0 %	0.5 %	0.0 %	0.5 %	1.0 %
Total	Observed	37	71	15	77	200
	% of total	18.5 %	35.5 %	7.5 %	38.5 %	100.0 %

	Value	df	p
χ^2	6.72	9	0.666

This table 10 indicates loops as the dominant fingerprint pattern in the left middle finger across all ABO blood groups, without significant correlation.

TABLE 11 - Distribution of ABO blood grouping in relation to finger print pattern in left Index finger

Left index finger		A	B	AB	O	Total
Arch	Observed	5	7	4	13	29
	% of total	2.5 %	3.5 %	2.0 %	6.5 %	14.5 %
Loop	Observed	15	37	3	33	88
	% of total	7.5 %	18.5 %	1.5 %	16.5 %	44.0 %
Whorl	Observed	17	26	7	30	80
	% of total	8.5 %	13.0 %	3.5 %	15.0 %	40.0 %
Composite	Observed	0	1	1	1	3
	% of total	0.0 %	0.5 %	0.5 %	0.5 %	1.5 %
Total	Observed	37	71	15	77	200
	% of total	18.5 %	35.5 %	7.5 %	38.5 %	100.0 %

	Value	df	p
χ^2	10.0	9	0.348

The table 11 highlights loops as the most common pattern in the left index finger, showing no significant relationship with ABO blood groups.

TABLE 12 - Distribution of ABO blood grouping in relation to finger print pattern in left thumb

Left Thumb		**A**	**B**	**AB**	**O**	**Total**
Arch	Observed	1	3	3	10	17
	% of total	0.5 %	1.5 %	1.5 %	5.0 %	8.5 %
Loop	Observed	11	34	6	37	88
	% of total	5.5 %	17.0 %	3.0 %	18.5 %	44.0 %
Whorl	Observed	23	29	4	23	79
	% of total	11.5 %	14.5 %	2.0 %	11.5 %	39.5 %
Composite	Observed	2	5	2	7	16
	% of total	1.0 %	2.5 %	1.0 %	3.5 %	8.0 %
Total	Observed	37	71	15	77	200
	% of total	18.5 %	35.5 %	7.5 %	38.5 %	100.0 %

	Value	**df**	**p**
χ^2	17.8	9	0.038

This table 12 presents the distribution of fingerprint patterns in the left thumb. Loops are predominant, with some significant association between patterns and ABO blood groups.

TABLE 13 - Distribution of ABO blood grouping in relation to finger print pattern in right index finger

Right index finger		A	B	AB	O	Total
Arch	Observed	3	8	2	9	22
	% of total	1.5 %	4.0 %	1.0 %	4.5 %	11.0 %
Loop	Observed	19	33	9	30	91
	% of total	9.5 %	16.5 %	4.5 %	15.0 %	45.5 %
Whorl	Observed	14	29	4	35	82
	% of total	7.0 %	14.5 %	2.0 %	17.5 %	41.0 %
Composite	Observed	1	1	0	3	5
	% of total	0.5 %	0.5 %	0.0 %	1.5 %	2.5 %
Total	Observed	37	71	15	77	200
	% of total	18.5 %	35.5 %	7.5 %	38.5 %	100.0 %

	Value	df	p
χ^2	4.64	9	0.865

The table 13 shows loops as the most frequent pattern in the right index finger, with no significant correlation to ABO blood groups.

TABLE 14 - Distribution of ABO blood grouping in relation to finger print pattern in right middle finger

Right middle finger		**A**	**B**	**AB**	**O**	**Total**
Arch	Observed	2	7	2	8	19
	% of total	1.0 %	3.5 %	1.0 %	4.0 %	9.5 %
Loop	Observed	25	44	12	56	137
	% of total	12.5 %	22.0 %	6.0 %	28.0 %	68.5 %
Whorl	Observed	10	20	1	11	42
	% of total	5.0 %	10.0 %	0.5 %	5.5 %	21.0 %
Composite	Observed	0	0	0	2	2
	% of total	0.0 %	0.0 %	0.0 %	1.0 %	1.0 %
Total	Observed	37	71	15	77	200

	Value	**df**	**p**
χ^2	10.6	9	0.305

The table 14 reveals loops as the most common fingerprint pattern in the right middle finger, with no significant association with ABO blood groups.

TABLE 15 - Distribution of ABO blood grouping in relation to finger print pattern in right ring finger

Right ring finger		A	B	AB	O	Total
Arch	Observed	2	1	0	2	5
	% of total	1.0 %	0.5 %	0.0 %	1.0 %	2.5 %
Loop	Observed	15	34	6	37	92
	% of total	7.5 %	17.0 %	3.0 %	18.5 %	46.0 %
Whorl	Observed	20	36	9	38	103
	% of total	10.0 %	18.0 %	4.5 %	19.0 %	51.5 %
Total	Observed	37	71	15	77	200
	% of total	18.5 %	35.5 %	7.5 %	38.5 %	100.0 %

	Value	df	p
χ^2	2.78	6	0.836

Table 15 shows ABO Blood Grouping and Fingerprint Patterns in Right Ring Finger. Loops are the dominant pattern in the right ring finger, and no significant correlation with ABO blood groups is observed.

TABLE 16 - Distribution of ABO blood grouping in relation to finger print pattern in right little finger

Right little finger		A	B	AB	O	Total
Arch	Observed	1	4	0	2	7
	% of total	0.5 %	2.0 %	0.0 %	1.0 %	3.5 %
Loop	Observed	22	45	11	51	129
	% of total	11.0 %	22.5 %	5.5 %	25.5 %	64.5 %
Whorl	Observed	13	22	4	24	63
	% of total	6.5 %	11.0 %	2.0 %	12.0 %	31.5 %
Composite	Observed	1	0	0	0	1
	% of total	0.5 %	0.0 %	0.0 %	0.0 %	0.5 %
Total	Observed	37	71	15	77	200
	% of total	18.5 %	35.5 %	7.5 %	38.5 %	100.0 %

	Value	df	p
χ^2	6.75	9	0.663

Table 16 shows ABO Blood Grouping and Fingerprint Patterns in Right Little Finger. The table shows loops as the most frequent pattern in the right little finger, with no significant correlation with ABO blood groups.

TABLE 17 - Distribution of ABO blood grouping in relation to finger print pattern in right thumb

Right thumb		**A**	**B**	**AB**	**O**	**Total**
Arch	Observed	2	0	2	5	9
	% of total	1.0 %	0.0 %	1.0 %	2.5 %	4.5 %
Loop	Observed	17	28	6	35	86
	% of total	8.5 %	14.0 %	3.0 %	17.5 %	43.0 %
Whorl	Observed	17	39	6	32	94
	% of total	8.5 %	19.5 %	3.0 %	16.0 %	47.0 %
Compo site	Observed	1	4	1	5	11
	% of total	0.5 %	2.0 %	0.5 %	2.5 %	5.5 %
Total	Observed	37	71	15	77	200

	Value	**df**	**p**
χ^2	9.27	9	0.413

Table 17 shows ABO Blood Grouping and Fingerprint Patterns in Right Thumb. This table demonstrates that loops are the most common fingerprint pattern in the right thumb, with no significant correlation to ABO blood groups.

TABLE 18 - Distribution of Rh blood typing in relation to finger print pattern in left little finger

Rh		Arch	Loop	Whorl	Composite	Total
Positive	Observed	9	133	40	2	184
	% of total	4.5 %	66.5 %	20.0 %	1.0 %	92.0 %
Negative	Observed	0	11	5	0	16
	% of total	0.0 %	5.5 %	2.5 %	0.0 %	8.0 %
Total	Observed	9	144	45	2	200
	% of total	4.5 %	72.0 %	22.5 %	1.0 %	100.0 %

	Value	df	p
χ^2	1.57	3	0.665

Table 18 shows Distribution of Rh blood typing in relation to finger print pattern in left little finger with no significant correlation

TABLE 19 - Distribution of Rh blood typing in relation to finger print pattern in left ring finger

Left ring finger		Rh Positive	Rh Negative	Total
Arches	Observed	11	0	11
	% of total	5.5 %	0.0 %	5.5 %
Loops	Observed	83	4	87
	% of total	41.5 %	2.0 %	43.5 %
Whorls	Observed	90	12	102
	% of total	45.0 %	6.0 %	51.0 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

	Value	df	p
χ^2	4.29	2	0.117

Table 19 shows Distribution of Rh blood typing in relation to finger print pattern in left ring finger with no significant correlation.

TABLE 20 - Distribution of Rh blood typing in relation to finger print pattern in left middle finger

Left middle finger		**Rh Positive**	**Rh Negative**	**Total**
Arches	Observed	15	1	16
	% of total	7.5 %	0.5 %	8.0 %
Loops	Observed	106	7	113
	% of total	53.0 %	3.5 %	56.5 %
Whorls	Observed	61	8	69
	% of total	30.5 %	4.0 %	34.5 %
Composite	Observed	2	0	2
	% of total	1.0 %	0.0 %	1.0 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

	Value	**df**	**p**
χ^2	1.95	3	0.582

Table 20 shows Distribution of Rh blood typing in relation to finger print pattern in left middle finger with no significant correlation.

TABLE 21 - Distribution of Rh blood typing in relation to finger print pattern in left index finger

Left index finger		Rh Positive	Rh Negative	Total
Arches	Observed	27	2	29
	% of total	13.5 %	1.0 %	14.5 %
Loops	Observed	81	7	88
	% of total	40.5 %	3.5 %	44.0 %
Whorls	Observed	73	7	80
	% of total	36.5 %	3.5 %	40.0 %
Composite	Observed	3	0	3
	% of total	1.5 %	0.0 %	1.5 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

	Value	df	p
χ^2	0.370	3	0.946

Table 21 shows Distribution of Rh blood typing in relation to finger print pattern in left index finger with no significant correlation.

TABLE 22 - Distribution of Rh blood typing in relation to finger print pattern in left thumb

Left thumb		Rh Positive	Rh Negative	Total
Arches	Observed	16	1	17
	% of total	8.0 %	0.5 %	8.5 %
Loops	Observed	84	4	88
	% of total	42.0 %	2.0 %	44.0 %
Whorls	Observed	68	11	79
	% of total	34.0 %	5.5 %	39.5 %
Composite	Observed	16	0	16
	% of total	8.0 %	0.0 %	8.0 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

	Value	df	p
χ^2	6.69	3	0.083

Table 22 shows Distribution of Rh blood typing in relation to finger print pattern in left thumb with no significant correlation.

TABLE 23 - Distribution of Rh blood typing in relation to finger print pattern in right index finger

Right index finger		Rh Positive	Rh Negative	Total
Arches	Observed	21	1	22
	% of total	10.5 %	0.5 %	11.0 %
Loops	Observed	82	9	91
	% of total	41.0 %	4.5 %	45.5 %
Whorls	Observed	76	6	82
	% of total	38.0 %	3.0 %	41.0 %
Composite	Observed	5	0	5
	% of total	2.5 %	0.0 %	2.5 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

	Value	df	p
χ^2	1.29	3	0.733

Table 23 shows Distribution of Rh blood typing in relation to finger print pattern in right index finger with no significant correlation.

TABLE 24 - Distribution of Rh blood typing in relation to finger print pattern in right middle finger

Right middle finger		**Rh Positive**	**Rh Negative**	**Total**
Arches	Observed	17	2	19
	% of total	8.5 %	1.0 %	9.5 %
Loops	Observed	125	12	137
	% of total	62.5 %	6.0 %	68.5 %
Whorls	Observed	40	2	42
	% of total	20.0 %	1.0 %	21.0 %
Composite	Observed	2	0	2
	% of total	1.0 %	0.0 %	1.0 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

	Value	**df**	**p**
χ^2	1.04	3	0.791

Table 24 shows Distribution of Rh blood typing in relation to finger print pattern in right middle finger with no significant correlation.

TABLE 25 - Distribution of Rh blood typing in relation to finger print pattern in right ring finger

Right Ring finger		**Rh Positive**	**Rh Negative**	**Total**
Arches	Observed	5	0	5
	% of total	2.5 %	0.0 %	2.5 %
Loops	Observed	88	4	92
	% of total	44.0 %	2.0 %	46.0 %
Whorls	Observed	91	12	103
	% of total	45.5 %	6.0 %	51.5 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

	Value	**df**	**p**
χ^2	3.97	2	0.138

Table 25 shows Distribution of Rh blood typing in relation to finger print pattern in right ring finger with no significant correlation.

TABLE 26 - Distribution of Rh blood typing in relation to finger print pattern in right little finger

Right little finger		Rh Positive	Rh Negative	Total
Arches	Observed	7	0	7
	% of total	3.5 %	0.0 %	3.5 %
Loops	Observed	123	6	129
	% of total	61.5 %	3.0 %	64.5 %
Whorls	Observed	53	10	63
	% of total	26.5 %	5.0 %	31.5 %
Composite	Observed	1	0	1
	% of total	0.5 %	0.0 %	0.5 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

	Value	df	p
χ^2	7.97	3	0.047

Table 26 shows Distribution of Rh blood typing in relation to finger print pattern in right little finger with significant correlation.

TABLE 27 - Distribution of Rh blood typing in relation to finger print pattern in right thumb

Right thumb		**Rh Positive**	**Rh Negative**	**Total**
Arches	Observed	9	0	9
	% of total	4.5 %	0.0 %	4.5 %
Loops	Observed	79	7	86
	% of total	39.5 %	3.5 %	43.0 %
Whorls	Observed	86	8	94
	% of total	43.0 %	4.0 %	47.0 %
Composite	Observed	10	1	11
	% of total	5.0 %	0.5 %	5.5 %
Total	Observed	184	16	200
	% of total	92.0 %	8.0 %	100.0 %

	Value	**df**	**p**
χ^2	0.836	3	0.841

Table 27 shows Distribution of Rh blood typing in relation to finger print pattern in right thumb with no significant correlation.

TABLE 28 - Distribution of Gender in relation to finger print pattern in left little finger

Left little finger		Male	Female	Total
Arches	Observed	6	3	9
	% of total	3.0 %	1.5 %	4.5 %
Loops	Observed	50	94	144
	% of total	25.0 %	47.0 %	72.0 %
Whorls	Observed	18	27	45
	% of total	9.0 %	13.5 %	22.5 %
Composite	Observed	2	0	2
	% of total	1.0 %	0.0 %	1.0 %
Total	Observed	76	124	200

	Value	df	p
χ^2	7.14	3	0.068

Tables 28-37 explains Gender-Based Distribution of Fingerprint Patterns by Finger - Each table in this series presents data on fingerprint pattern distributions for individual fingers by gender. These analyses allow the study to assess whether fingerprint pattern types show consistent variations between male and female participants, addressing the objective of understanding gender-based differences in dermatoglyphic features.

Table 28 shows Distribution of Gender in relation to finger print pattern in left little finger with no significant correlation.

TABLE 29 - Distribution of Gender in relation to finger print pattern in left ring finger

Left ring finger		Male	Female	Total
Arches	Observed	7	4	11
	% of total	3.5 %	2.0 %	5.5 %
Loops	Observed	29	58	87
	% of total	14.5 %	29.0 %	43.5 %
Whorls	Observed	40	62	102
	% of total	20.0 %	31.0 %	51.0 %
Total	Observed	76	124	200
	% of total	38.0 %	62.0 %	100.0 %

	Value	**df**	**p**
χ^2	3.94	2	0.140

Table 29 shows Distribution of Gender in relation to finger print pattern in left ring finger with no significant correlation.

TABLE 30 - Distribution of Gender in relation to finger print pattern in left middle finger

Left middle finger		**Male**	**Female**	**Total**
Arches	Observed	4	12	16
	% of total	2.0 %	6.0 %	8.0 %
Loops	Observed	43	70	113
	% of total	21.5 %	35.0 %	56.5 %
Whorls	Observed	28	41	69
	% of total	14.0 %	20.5 %	34.5 %
Composite	Observed	1	1	2
	% of total	0.5 %	0.5 %	1.0 %
Total	Observed	76	124	200
	% of total	38.0 %	62.0 %	100.0 %

	Value	**df**	**p**
χ^2	1.46	3	0.690

Table 30 shows Distribution of Gender in relation to finger print pattern in left middle finger with no significant correlation.

TABLE 31 - Distribution of Gender in relation to finger print pattern in left index finger

Left index finger		Male	Female	Total
Arches	Observed	7	22	29
	% of total	3.5 %	11.0 %	14.5 %
Loops	Observed	34	54	88
	% of total	17.0 %	27.0 %	44.0 %
Whorls	Observed	33	47	80
	% of total	16.5 %	23.5 %	40.0 %
Composite	Observed	2	1	3
	% of total	1.0 %	0.5 %	1.5 %
Total	Observed	76	124	200

	Value	df	p
χ^2	3.79	3	0.286

Table 31 shows Distribution of Gender in relation to finger print pattern in left index finger with no significant correlation.

TABLE 32 - Distribution of Gender in relation to finger print pattern in left thumb

Left thumb		**Male**	**Female**	**Total**
Arches	Observed	6	11	17
	% of total	3.0 %	5.5 %	8.5 %
Loops	Observed	28	60	88
	% of total	14.0 %	30.0 %	44.0 %
Whorls	Observed	32	47	79
	% of total	16.0 %	23.5 %	39.5 %
Composite	Observed	10	6	16
	% of total	5.0 %	3.0 %	8.0 %
Total	Observed	76	124	200
	% of total	38.0 %	62.0 %	100.0 %

	Value	**df**	**p**
χ^2	5.77	3	0.123

Table 32 shows Distribution of Gender in relation to finger print pattern in left thumb with no significant correlation.

TABLE 33 - Distribution of Gender in relation to finger print pattern in right index finger

Right index finger		Male	Female	Total
Arches	Observed	5	17	22
	% of total	2.5 %	8.5 %	11.0 %
Loops	Observed	34	57	91
	% of total	17.0 %	28.5 %	45.5 %
Whorls	Observed	36	46	82
	% of total	18.0 %	23.0 %	41.0 %
Composite	Observed	1	4	5
	% of total	0.5 %	2.0 %	2.5 %
Total	Observed	76	124	200
	% of total	38.0 %	62.0 %	100.0 %

	Value	df	p
χ^2	4.09	3	0.251

Table 33 shows Distribution of Gender in relation to finger print pattern in right index finger with no significant correlation.

TABLE 34 - Distribution of Gender in relation to finger print pattern in right middle finger

Right middle finger		Male	Female	Total
Arches	Observed	8	11	19
	% of total	4.0 %	5.5 %	9.5 %
Loops	Observed	50	87	137
	% of total	25.0 %	43.5 %	68.5 %
Whorls	Observed	18	24	42
	% of total	9.0 %	12.0 %	21.0 %
Composite	Observed	0	2	2
	% of total	0.0 %	1.0 %	1.0 %
Total	Observed	76	124	200

	Value	df	p
χ^2	1.91	3	0.590

Table 34 shows Distribution of Gender in relation to finger print pattern in right middle finger with no significant correlation.

TABLE 35 - Distribution of Gender in relation to finger print pattern in right ring finger

Right ring finger		Male	Female	Total
Arches	Observed	2	3	5
	% of total	1.0 %	1.5 %	2.5 %
Loops	Observed	33	59	92
	% of total	16.5 %	29.5 %	46.0 %
Whorls	Observed	41	62	103
	% of total	20.5 %	31.0 %	51.5 %
Total	Observed	76	124	200
	% of total	38.0 %	62.0 %	100.0 %

	Value	**df**	**p**
χ^2	0.328	2	0.849

Table 35 shows Distribution of Gender in relation to finger print pattern in right ring finger with no significant correlation.

TABLE 36 - Distribution of Gender in relation to finger print pattern in right little finger

Right little finger		**Male**	**Female**	**Total**
Arches	Observed	4	3	7
	% of total	2.0 %	1.5 %	3.5 %
Loops	Observed	48	81	129
	% of total	24.0 %	40.5 %	64.5 %
Whorls	Observed	23	40	63
	% of total	11.5 %	20.0 %	31.5 %
Composite	Observed	1	0	1
	% of total	0.5 %	0.0 %	0.5 %
Total	Observed	76	124	200
	% of total	38.0 %	62.0 %	100.0 %

	Value	**df**	**p**
χ^2	2.81	3	0.421

Table 36 shows Distribution of Gender in relation to finger print pattern in right little finger with no significant correlation.

TABLE 37 - Distribution of Gender in relation to finger print pattern in right thumb

Right thumb		Male	Female	Total
Arches	Observed	2	7	9
	% of total	1.0 %	3.5 %	4.5 %
Loops	Observed	31	55	86
	% of total	15.5 %	27.5 %	43.0 %
Whorls	Observed	38	56	94
	% of total	19.0 %	28.0 %	47.0 %
Composite	Observed	5	6	11
	% of total	2.5 %	3.0 %	5.5 %
Total	Observed	76	124	200
	% of total	38.0 %	62.0 %	100.0 %

	Value	**df**	**p**
χ^2	1.58	3	0.663

Table 37 shows Distribution of Gender in relation to finger print pattern in right thumb with no significant correlation.

DISCUSSION

- This study shows that the occurrence of Rh blood type together with the right little finger print patterning and the prevalence of ABO blood grouping together with the left thumb finger print patterning are the only two that show a statistically significant relationship. The distribution of ABO blood grouping with Rh type and the finger print pattern do not statistically significantly correlate with other finger patterns, according to our research.

- Karl Landsteiner was the one who initially discovered the grouping of the blood in 1901. The different human ethnicities have different frequency distributions for the 19 major blood types that have been recognised. In medicine, "ABO" and "Rhesus" are the two most important words. Furthermore, the presence of complementary antigens on red blood cells determines the further classification of the "ABO" system into A, B, AB, and O types. Depending on whether the antigen for the "D" antigen is present or not, the "Rhesus" system is classified as "Rh +ve" or "Rh -ve".[62]

- As to a research conducted by Hahne KW in 1929, blood group O is more correlative with loops & less frequent with whorls than blood group. Blood group-A has a high frequency of loops, according to a different research by Herch M (1932). Physical characteristics and blood types have some correlation, according to Bloterogel H and Bloterogel W (1934).[63,64]

- By examining 381 Germans, Geipel (1935) shown that there was no meaningful relationship between blood groups and dermatologic characteristics.[65]

- The Furuhata index was most in blood group AB and least in blood group A, according to research by Nayak SK. & Patel S (1973). Furthermore, it was noted that the AB blood type had more loops in fingers II and V and whorls in fingers I and II than other blood groups had in the IV finger. Moreover, loops were found to be the largest, and the least frequent among all forms are whorls and arches, in that order.[66]

- In a 1993 , Benes expressed his perception that there was a correlation between blood types and certain illnesses or cancers[67].
- A survey discovered a significant sodality between blood group with carcinoma of the breast women. Patients alongside blood groups B and AB had a higher early mortality risk, and AB had a higher preponderance of local recurrence risk. [68]
- This study aimed to establish a relationship between fingerprint patterns categorized under the Galton-Henry Dactylography System and blood groups determined by the Karl-Landsteiner System. The findings demonstrated that loops were the predominant fingerprint pattern observed across all blood groups, followed by whorls and arches. Specifically, blood group O exhibited the highest frequency of loop patterns, while whorls were notably associated with blood group AB. Furthermore, statistically significant correlations were observed between specific fingerprint patterns and blood groups, such as loops on the left thumb with blood group B and whorls on the right little finger with Rh-positive blood type.
- It was evident from earlier studies indicating that there had been a relationship between blood types and dermatoglyphics. The studies also revealed that the majority of common pattern is a loop, followed by a whorl, while the least common form is an arch. Gowda and Rao's (1996) further study on the Gowdasaraswat Brahmin group in Karnataka strengthened this one. Additionally, a significant relation of whorls in Rh -ve individuals and loops in Rh +ve individuals was found by the study.[69]
- A companion research by Gowda and Rao (1996) on the Gowdasaraswat Brahmin community of Karnataka strengthened this one. Rh +ve and Rh -ve persons had a high frequency of loops and whorls, according to the study. [70]
- The earlier research was further strengthened by Kshirsagar et al (2001). He said that those in blood type O experienced whorls more frequently than those in blood group AB. As opposed to this, blood type AB's fraction of wise individuals has more arches than B's.[71]

- Blood groups A and AB (Rh positive 54.26% and Rh negative 60%) and AB (Rh positive 43.34% and 60%, respectively) display cognation between dermatoglyphics with blood group, with blood group A having a greater number of loops as well as blood group AB having greater whorls. Blood group B had a much higher Total Finger Ridge Count (TFRC). An elevated prevalence of arches while a low frequency of whorls were found in A-negatives according to a supplementary research conducted by Prateek and Keerath (2010). The research on Maiduguri residents completed earlier was strengthened by further research. Research revealed that within that group, women exhibited arches, whereas men had a greater distribution of loops. In the instance of African Americans, males possessed a greater incidence with whorls whilst females displayed a larger frequency of loops and arches. The research also supported previous findings that loops were most common in all blood types, thereafter whorls and arches. Those distribution trends were also seen among African American as well as Indian groups of people.[72,73,74,75]

- According to the findings of Desai et al (2013), loops dominated all blood groups and the rhesus group, although whorls are more prevalent among the O negative groups. The research identified just one correlation between gender and fingerprint: females had higher frequencies of loops as well as arches, whereas males had higher frequencies of whorls. Students attending Delta State University in Nigeria had been the participants of a different study that connected fingerprint patterns with blood type and gender. The subjects' fingerprints had been gathered. The significant proportion of loops among female fingerprints as well as whorls among male fingerprints was not significantly correlated with gender, according to the study's findings. Additionally, they discovered no meaningful correlation among fingerprint patterns as well as ABO blood group. Nonetheless, a correlation has been shown between fingerprint patterns along with ABO Rhesus blood type, with loops occurring more frequently than arch and whorl, with the exception of the O negative blood group, which has high whorls.[76,77]

- A.D. Patil et al (2014) found that blood type O was more common than AB in their study involving 785 medical students. According to statistical analyses, there was a significant difference in the frequency of ulnar loops with whorls between boys and girls, indicating a sodality among gender with fingerprinting [78].

- According to study by Govindarajul et al. (2014), O +ve is the more frequent blood type while AB-ve is the least prevalent. Blood types A, B, AB, and O were distributed as follows in their fingerprint patterns: a high frequency of loops, a respectable amount of whorls, along with lowest, arches.[79]
- According to further studies on the sodality among fingerprinting with blood grouping, Deepa et al (2014)'s research involving 150 MBBS students in Haldwani demonstrated compassion. These results are consistent with prior studies, such as Deepa et al., who reported a strong association between loop patterns and blood group O and a higher frequency of whorls in blood group AB and highlighted the predominance of loops among Rh-positive individuals, reinforcing the genetic and embryological link between fingerprint patterns and blood group antigens.[80]
- The primary objective of this study was to determine the relationship between fingerprint patterns classified under the Galton-Henry Dactylography System and the Karl-Landsteiner blood group system. The results revealed that loops were the most frequently observed pattern across all blood groups, particularly dominant in blood group O, while whorls were more prevalent in blood group AB.
- Statistically significant associations, such as the correlation of loops on the left thumb with blood group B and whorls on the right little finger with Rh-positive blood type, provide a measurable link between dermatoglyphic features and blood group characteristics. These findings align with previous research by Bharadwaja et al. and Rastogi et al., which similarly identified loops as dominant in Rh-positive and O blood groups.[36,41]
- Such associations suggest an underlying genetic interplay between dermatoglyphic and serological traits, though these relationships may not be universally consistent across populations.
- Furthermore, the study successfully met its secondary objective of exploring the relationship between fingerprint patterns and gender. It was observed that loops were more prevalent in females, while whorls were dominant in males,

corroborating earlier studies by Jantz RL and Igbigbi et al., which attributed these variations to genetic and hormonal influences during embryological development. These findings underscore the practical relevance of fingerprint analysis in forensic and medico-legal investigations. Fingerprints, being unique and immutable, offer a reliable, non-invasive supplementary method for identifying probable blood group and gender traits, especially in scenarios where direct methods, such as DNA analysis or blood typing, may be unavailable or impractical.

- This study highlights the potential of integrating dermatoglyphic analysis into forensic science as a cost-effective and efficient tool to support identification efforts.
- However, it is worth noting that certain studies, such as Thakur et al., did not find statistically significant associations between fingerprint patterns and blood groups, suggesting that these relationships may vary across populations or be influenced by environmental and genetic factors.[34]
- The implications of these findings are significant in forensic science and medical identification. Fingerprints, being immutable and unique, offer an additional layer of evidence that can complement traditional blood typing techniques.
- However, the observed associations, though noteworthy, lack the specificity required for conclusive identification and should be interpreted as probabilistic indicators rather than definitive markers.
- This study underscores the potential of integrating dermatoglyphic analysis with serological methods for enhanced individualization in forensic investigations. Relationship Between Galton-Henry Dactylography System and Gender The investigation into gender-based differences in fingerprint patterns revealed distinct trends that align with established literature.
- Loops were more prevalent among female participants, whereas males exhibited a higher frequency of whorls. Arches, as expected, were the least common pattern observed, regardless of gender. These findings reflect the inherent biological and genetic variations influencing dermatoglyphic traits.

- The embryological formation of fingerprint patterns, influenced by genetic factors and environmental conditions, provides a plausible explanation for these observed disparities.

- In forensic contexts, these gender-based distinctions are invaluable. When biological remains are fragmented or when direct DNA analysis is unavailable, fingerprint patterns serve as a reliable, non-invasive method for preliminary sex determination. Combined with other forensic techniques, dermatoglyphic analysis enhances the accuracy and reliability of gender identification, making it a vital tool in medico-legal investigations.

- While the study establishes meaningful associations between fingerprint patterns, blood groups, and gender, certain limitations must be acknowledged. The sample size, although statistically significant, represents a specific demographic and may not encompass the full spectrum of genetic and environmental diversity. Additionally, the correlations, while present, are not strong enough to warrant standalone identification methods but rather serve as supplementary evidence. Future research should focus on larger, more diverse populations and explore advanced analytical techniques to validate and extend these findings

- This study carries profound implications and practical applications across several critical domains, especially forensic science, disaster victim identification, medical research, and population genetics. By establishing connections between fingerprint patterns, blood group systems, and gender, it bridges the gap between dermatoglyphics and serology, presenting an innovative approach to individual identification.

- The findings are particularly valuable in forensic investigations, where quick and accurate identification of individuals can mean the difference between solving and prolonging a case. Fingerprint patterns are immutable, easily obtainable, and unique to every individual. When combined with the established relationships with blood groups and gender, they serve as a robust supplementary tool for suspect profiling. For example, forensic experts can hypothesize an individual's blood group based on predominant fingerprint patterns, such as loops correlating with blood group O, or identify gender-specific traits, such as a higher prevalence of whorls in males. This integration offers investigative leads, especially in cases involving unclaimed bodies, skeletal remains, or decomposed corpses where DNA analysis is delayed or unavailable.

- In scenarios of mass disasters, such as earthquakes, plane crashes, or terrorist attacks, where rapid identification of victims is crucial, the study's findings become particularly indispensable. The combination of fingerprint patterns and blood group correlations allows for a preliminary identification system when traditional methods, such as facial recognition or dental records, are rendered ineffective. This not only accelerates the process of identification but also aids in providing closure to families and streamlining legal documentation.
- In the medical field, this study contributes to understanding genetic markers and hereditary patterns. Fingerprints, formed during early fetal development, are influenced by both genetic and environmental factors. Their association with blood groups provides insights into the genetic interplay that governs embryological development. This opens avenues for population-level studies to explore the links between dermatoglyphic traits and susceptibility to certain diseases, paving the way for predictive diagnostics and personalized medicine.
- The bulk of the subjects in a recent research conducted on 400 people in Nigeria by Ekanem A.U. et al (2014) belonging to the O group. The blood group O has been determined to be mostly linked to loops and least likely to AB. It was discovered that females had arches, while men tended to have loops as well as whorls, which allowed for the gender prediction, thereby proving the similarity of blood group, gender, and fingerprints [81].
- The study holds relevance in anthropological and genetic research by shedding light on the diversity of fingerprint patterns and their correlation with blood groups across genders. Such findings enrich the understanding of human evolutionary biology, enabling researchers to map genetic traits and variations across populations. This could lead to identifying population-specific markers, which are crucial in migration studies and understanding genetic drift.
- One of the most compelling utilities of this study lies in its simplicity and accessibility. Fingerprints can be collected without specialized equipment, and blood groups are easily determined, making this approach particularly effective in

resource-limited settings. It provides law enforcement agencies, disaster response teams, and healthcare providers with a cost-effective, efficient method to supplement advanced technologies like DNA sequencing, thus making identification more universally accessible.

- While the study findings should be used in conjunction with other identification methods for greater reliability, they undeniably represent a significant step toward creating a more integrated and multidimensional framework for human identification and profiling. While these findings should be used in conjunction with other identification methods for greater reliability, they undeniably represent a significant step toward creating a more integrated and multidimensional framework for human identification and profiling.

CONCLUSION

The area of forensic medicine and toxicology known as "Dermatoglyphics" studies fingerprints, meaning the marks made by the friction ridges upon the fingers of humans. Fingers impressions play an essential and vital part in a crime investigation circumstance. It may give rise to a major clue that can assist to solve an unsolved case and identify the perpetrator. Without a question, fingerprint evidence is currently the most trustworthy and recognised type of evidence according a court of law. Since the fingerprints of every person are unique and cannot be faked, pattern identification is crucial. The latest advances within fingerprint-sensing technological advances, along with enhancements to the precision and speed using fingerprint-matching computations, have made automatic personal identification a desirable alternative to conventional identifying techniques. Our voices discovered there exists a lack of relationship between a people's fingerprint pattern with their ABO blood group and gender, as well as there is no relationship among an individual's finger prints and blood grouping, which means that relationship between patterns of the fingerprint along with gender & ABO blood grouping cannot be useful for identification purposes. Based on the outcomes, we found that loops have the highest frequency in common, followed by whorls, arches and composite respectively. A greater number of participants with equal proportions of men and women from this region should be used for similar studies to better forecast the exact connection between gender, ABO with Rh blood groups and Dermatoglyphic patterns. The study's two main limitations were the somewhat different population from different region and an uneven sex distribution.

SUMMARY

- The O blood group comprised the majority of the subjects, AB group is least.
- This original investigation demonstrated that Rh positive blood groups were more numerous than Rh negative blood groups, and the statistical data also supported this finding.
- Females had the largest loops and arches.
- Fingerprints commonly had loops, although composite were rare.
- Blood groups AB had the lowest levels of loops.
- The blood types with the greatest amounts of loops were O and B.
- Blood group AB, B had the lowest arches while blood group O had the greatest.
- The O blood type had the greatest number of whorls, whereas the AB blood group had the least number of them.
- To investigate the potential genetic influence on these correlations, more research with a larger sample size of participants needs to be done.

BIBLIOGRAPHY

1) Ashbaugh, David (1991). "Ridgeology" (Online). Journal of Forensic Identification. 41 (1): 16–64. Available from: https://chance.dartmouth.edu/chance_news/for_chance_news/ChanceNews12.05/ridgeology.pdf

2) Dror, I.E., Charlton, D. and Péron, A.E. (2006) "Contextual information renders experts vulnerable to making erroneous identifications Archived July 9, 2019, at the Wayback Machine", Forensic Science International, Vol. 156, Iss. 1, pp. 74–78.

3) Cadd, Samuel; Islam, Meez; Manson, Peter; Bleay, Stephen (July 1, 2015). "Fingerprint composition and aging: A literature review". Science & Justice. 55 (4): 219–238. doi:10.1016/j.scijus.2015.02.004. ISSN 1355-0306. PMID 26087870.

4) Khare, Vartika; Singla, Anu (January 27, 2022). "A review on the advancements in chemical examination of composition of latent fingerprint residues". Egyptian Journal of Forensic Sciences. 12 (1): 6. doi:10.1186/s41935-021-00262-2. ISSN 2090-5939. S2CID 246292738.

5) Federal Bureau of Investigation. The science of fingerprints: classification and uses. Washington (DC): U.S. Government Printing Office; 1984.

6) Modi NJ. Textbook of medical jurisprudence and toxicology. 16th ed. Bombay: Tripathi Pvt Ltd; 1967. p. 46–7.

7) Herschel WJ. Skin furrows of the hand. Wahul. 1880;23:76.

8) Faulds H. The skin furrows of the hand. Nahest. 1880;22:605.

9) Galton F. Fingerprints. London: Macmillan and Co.; 1892..

10) H.T.F Rhodes, Alphonse Bertillon : Father of Scientific Detection. Abelard-Schuman, New York, 1956.

11) Forest HP. The Evolution of Dactylogy in United States with an Historical note on First Fingerprint and Bibliography of Personal Identification. Prointernet. Association for Identification, 1930 and 1931.

12) Ross M.H., Edward and Lynn J., Histology text and Atlas. 2nd Ed., William and Wilkins; London: 1989: 347-350.

13) Nandy A. Principles of Forensic Medicine. 1st Ed, Kolkatta: New Central Book Agency; 1995:92.

14) Mukherjee JB. Forensic Medicine and Toxicology, vol-1, 2nd Ed, New Delhi: Gulab Vazirani; 1994: 132.

15) Subrahmanyan BV. Personal Identity: Modi's Medical Jurisprudence and Toxicology. 22nd Ed. Butterworths, New Delhi 2001: 37-90.

16) Nadar D.S. Forensic Science in Crime Investigation 3rd Ed. Hyderabad: Asia Law House; 2002: 48-49.

17) Kitson S. The Development of Fingerprint system. The Indian Police Journal: July-Sept: 1983:29.

18) Cummins H., Midlo C.Fingerprints, Palms and soles: An Introduction to Dermatoglyphics. New York: Dover Publication; 1961:272.

19) Jantz RL. Sex and Race differences in finger ridge-count correlations. Am J Phys Anthropol; 1975 Mar:42(2): 297-80.

20) Gangadhar MR, Rajashekara Reddy K. Finger dermatoglyphics of Adikarnatakas: a scheduled caste population of Mysore City, Karnataka. Man India. 1983;83(1&2):183–93.

21) Mark A. Acree. Is there a gender difference in fingerprint ridge density Forensic Sci Int: 1999 May: 102(1) : 35-44.

22) Igbigbi PS., Msamati BC. Palmer and Digital Dermatoglyphic pattern in Malawian subjects. East Afr. Med.J. 1999 Dec; 76(12):668- 71.

23) Kralik M., Novothy V.Epidermal Ridge Breath : An Indicator of Age and Sex in paleodermatoglyphics. Variability and Evolution. 2003 Vol- 11; 5-30.

24) Cox HMV. Medical Jurisprudence and Toxicology. 6th Ed India: Law Book Company; 1998:192-194.

25) Saferstein R.Criminalistics an Introduction to Forensic Science. 4th Ed. New Jersey: Prentice Hall, Englewood Cliffs; 1990:363-364.

26) Nath S. Fingerprint Identification. 1st Ed New Delhi : C.G.O Pvt. Ltd; 1991:7-8.

27) Wang M, Li M, Yu A, Zhu Y, Yang M, Mao C. Fluorescent nanomaterials for the development of latent fingerprints in forensic sciences. Adv Funct Mater. 2017;27(14):1606243.

28) Jindal, R., & Singla, S. An Optimised Latent Fingerprint Matching System Using Cuckoo Search.

29) Bridges BC., Vollmer A., Monir M.Criminal Investigations, Practical fingerprinting, Thumb impression, Hand writing, Expert testimony, opinion evidence. 1st Ed. Allahabad: The University Book Agency; 1995:54-58.

30) Al-Zewary MS: Computer Processing Techniques for Fingerprints image identification. M.Sc Thesis College of Science, University of Baghdad, 1996.

31) Bloterogel H and Bloterogel W. Blutgrype and Dactylogramm: Konstitutions Merk Male Derpoliomyelitis. Krapan Zt Rehsf Hindrih, 1934; 56:143-163.

32) Relation between fingerprints and different blood groups ,Noor Eldin Fayrouz , Noor Farida ,A.H. Irshad. January 2012 Journal of Forensic and Legal Medicine 19(1):18-21DOI: 10.1016/j.jflm.2011.09.004(SourcePumbed).

33) Rastogi A, Bashar MA, Sheikh NA. Relation of Primary Fingerprint Patterns With Gender and Blood Group: A Dermatoglyphic Study From a Tertiary Care Institute in Eastern India. Cureus. 2023 May 2;15(5):e38459. doi: 10.7759/cureus.38459. PMID: 37273387; PMCID: PMC10238317.

34) Thakur A, Yadav J, Tiwari G. Fingerprint patterns in relation to gender and blood group among residents of central Indian district. Indian J Forensic Med Toxicol. 2019;13(3):73–7.

35) N S, A A, Srinivas G V, Devi R S. Correlation among lip print pattern, finger print pattern and abo blood group. J Clin Diagn Res. 2014 Mar;8(3):49-51. doi: 10.7860/JCDR/2014/7502.4104. Epub 2014 Mar 15. PMID: 24783079; PMCID: PMC4003684.

36) Pattern of finger-prints in different ABO blood groups. A Bharadwaja, PK Saraswat, SK Agrawal, P Banerji, S Bharadwaja. Journal of Forensic Medicine and Toxicology 21 (2), 1-4, 2004

37) Shrestha I, Malla BK. Study of Fingerprint Patterns in Population of a Community. JNMA J Nepal Med Assoc. 2019 Sep-Oct;57(219):293-296. doi: 10.31729/jnma.4621. PMID: 32329450; PMCID: PMC7580431.

38) Garg P, Mustaria PS, Kumar N, Bansal MK, Yadav M. Analysis of Primary Fingerprint Patterns in Medical Students of Banda District Uttar Pradesh. J For Med Sci L aw 2022;31(1):28-32.

39) Manikandan S, Devishamani L, Vijayakumar S, Palanisamy GS, Ponnusamy P, Lalpettai Jayakar SL. Dermatoglyphics and Their Relationship With Blood Group: An Exploration. J Pharm Bioallied Sci. 2019 May;11(Suppl 2):S285-S288. doi: 10.4103/JPBS.JPBS_13_19. PMID: 31198354; PMCID: PMC6555323.

40) Kc S, Maharjan N, Adhikari N, Shrestha P. Qualitative Analysis of Primary Fingerprint Pattern in Different Blood Group and Gender in Nepalese. Anat Res Int. 2018 Jan 18;2018:2848974. doi: 10.1155/2018/2848974. PMID: 29593909; PMCID: PMC5822922.

41) Rastogi, P., & Pillai, K. R. (2010). A study of fingerprints in relation to gender and blood group. J Indian Acad Forensic Med, 32(1), 11-4.

42) Sangam Muralidhar Reddy, Babu A. Ramesh,Krupadanam K,Anasuya K,Asst. Prof., Anatomy, NRI Medical College Chinakakani, Guntur. Finger Print Pattern in Different Blood Groups.17 August 2012.

43) Sandip k Raloti , Kalpesh A Sha ,Viras C Patel,Anand k Menat,Rakesh N Maori,Nishith K Chaudhari. Fingerprints, gender, blood group association.(2012) Google scholar.

44) Fayrouz, I. N. E., Farida, N., & Irshad, A. H. (2012). Relation between fingerprints and different blood groups. Journal of forensic and legal medicine, 19(1), 18-21.

45) Bhavana, D., Ruchi, J., Prakash, T., & JL, K. (2013). Study of fingerprint patterns in relationship with blood group and gender-a statistical review. Arches, 1(1), 15-17.

46) Eboh, D. E. (2013). Fingerprint patterns in relation to gender and blood group among students of Delta State University, Abraka, Nigeria. Journal of experimental and clinical Anatomy, 12(2), 82.

47) Nathan Isaac Dibal. University of Maiduguri · Department of Human Anatomy.Journal of dental and medical science. January 2014

48) Fingerprint pattern examination of right hand thumb in relation to Blood Group .L Jha, KD Das, Z Ahamad .Janaki Medical College Journal of Medical Science 3 (2), 58-61, 2015.

49) Chaudhary S, Deuja S, Alam M, Karmacharya P, Mondal M. Fingerprints as an Alternative Method to Determine ABO and Rh Blood Groups. JNMA J Nepal Med Assoc. 2017 Oct-Dec;56(208):426-31. PMID: 29453474.

50) Pattern of Fingerprints in different ABO and Rh blood groups .Venkatesh Maled, Vitthal Khode, Dundesh Maled, Ambuj Jain, Shilpa Male, Komal Ruikar.Journal of Indian Academy of Forensic Medicine 37 (2), 124-126, 2015.

51) Manju Sahu, Akhilesh Tiwari and Isukapatla Arjun Distribution of Fingerprint patterns in ABO blood groups.2010.

52) Bandameedi Lakshmi Narayana, Yerukala Komera Chinna Rangaiah and Mohammed Abdul Khalid.Study of Fingerprint patterns in relation to gender and blood group. Journal of Evolution of Medical and Dental Sciences(Vol. 5, Issue 14). Feb. 18, 2016.

53) Sahu M, Tiwari A, Arjun I. Distribution of fingerprint patterns in ABO blood groups. 2016.

54) Deepalaxmi Salmani, Suja Purushothaman, Ravindra L Gopalakrishna, Santhi Reghu Nath, Bishar Pushkar, Suja Purushothaman .Indian Journal of Clinical Anatomy and Physiology 3 (3), 348-50, 2016.

55) Fingerprints as an Alternative Method to Determine ABO and Rh Blood Groups Sonam Chaudhary, Sajana Deuja, Munna Alam, Poonam Karmacharya, Monami Mondal J Nepal Med Assoc 56 (208), 426-31, 2017.

56) Fingerprint patterns in relation to gender and blood groups-A study in Navi Mumbai.Amit Patil, Amrit Malik, Treza Shirole .Indian Journal of Forensic and Community Medicine 4 (3), 204-208, 2017.

57) Rani, Smitha; Balaraj, B. M Journal of Punjab Academy of Forensic Medicine & Toxicology . Jan2018, Vol. 18 Issue 1, p6-9. 4p.

58) Shrestha, Rami & Hirachan, N. & Koju, Sharmila & Shrestha, Nirmala & Lamichhane, A.. (2019). Association of Fingerprints with the ABO Blood grouping among students in Gandaki Medical College. Journal of Gandaki Medical College-Nepal. 12. 63-66. 10.3126/jgmcn.v12i2.27212.

59) Abbasi, M.H. & Mengal, M.A. & Khan, R.M.A. & Hammad, Muhammad & Habib, Hira & Bhatti, Y.A.. (2012). Comparative study of dactylography among the students of avicenna medical college Lahore. Pakistan Journal of Medical and Health Sciences. 6. 362-365.

60) Sandhu H, Verma P, Padda S, Raj SS. Frequency and correlation of lip prints, fingerprints and ABO blood groups in population of Sriganganagar District, Rajasthan. Acta Med Acad. 2017 Nov;46(2):105-115. doi: 10.5644/ama2006-124.195. PMID: 29338274.

61) Sisodia M, Bommanavar S, Baad R, Vibhute N, Belgaumi U, Kadashetti V. Correlation and Comparison of Cheiloscopy and Dactyloscopy with Blood Groups – An Institutional Study. Indian J Dent Res. 2020 Sep-Oct;31(5):728-733. doi: 10.4103/ijdr.IJDR_368_18. PMID: 33433510.

62) Bijlani RL., “Textbook of physiology”, 2nd ed. Blood groups: 93-94.

63) Hahne KW., "Die Befung der Blutgramppen and test figures in vaterschafts process", Dissertation Bern 1929.

64) Herch M., "Papillarmusterbei Engeotorenen der loyalty Inschm, Berichungan Swischen Papillarmuster and Bluntgrainppenbeidiessenan liner dentschem Vergleichsgrmppe. Ztschr". F. Rasseh Physio: 1932; 5: 163-68.

65) Geipel G., "Anleitung Zurerbbiologischen Beuteilungder der finger- und-Handleisten", Munchen: JF Lehmanns.1935.

66) Nayak SK, Patel S., "Genetic inter correlation between finger ball patterns and blood groups", J. Indian M.A. 1973; 61(3): 119-121.

67) A. Bener, "The investigation of linkage between dermatoglyphics and blood groups using family data from three generations", International Journal of Anthropology , 1987-06-01, Volume 2, Issue 2 , pp 137-140.

68) Tryygvadottir, L., Tulinius, H. and Robertson, J. M., "Familial and sporadic breast cancer cases in Iceland: a comparison related to ABO blood groups and risk of bilateral breast cancer", Int. J. Cancer. 1988;42: 499-501.

69) Gowda MST and Rao CP, "A study to evaluate relationship between dermatoglyphic features and blood groups", J Anat Society of Ind. 1996; 45: 39.

70) Gowda MST and Rao CP, "A study to evaluate relationship between dermatoglyphic features and blood groups", J Anat Society of Ind. 1996; 45: 39.

71) Kshirsagar SV, "Study of fingerprint pattern in ABO blood group", J. AnatSoc India. 2003; 52(1)

72) Bharadwaja A, Saraswat PK, Agarwal SK, Banerji P, Bharadwaja S., "Pattern of finger-prints in different ABO blood groups", Journal of Forensic Medicine and Toxicology. 2004; 21(2): 49-52.

73) Mahajan AA., "Dermatoglyphics and ABO blood group", Thesis submitted for MS Anatomy, Aurangabad, 1986.

74) Prateek R, Keerthi R Pillai., "A study of fingerprints in relation to gender and blood group", J Indian Acad Forensic Med. 2010; 32(1): 11- 14.

75) L Wang, and C. A. Alexander, "Study of Fingerprints in Relation to Gender and blood group", Journal of Indian Academy of Forensic Medicine, 32(1), 2010, 11-14.

76) Dr. Y. U. Umraniya, Dr. H. H. Modi, Dr. H. K. Prajapati, "Study of Correlation of Fingerprint Patterns in Different ABO, Rh Blood groups", J Medica lScience, 2011; 2(9): 337-339.

77) Dennis E. O. Eboh, "Fingerprints patterns in relation to gender and blood group among students of Delta State Univeristy, Abraka, Nigeria", Journal of Experimental & Clinical Anatomy, Vol. 12, Issue-2, pg. 82-86, 2013.\

78) A. D. Patil1, D. S. Joshi, S. A. Patwardhan, "Palmar Dermatoglyphics in ABO Blood Groups", International Journal of Recent Trends in Science And Technology. 2014; 10 (2): 396-398.

79) H. C. Govindarajul, Dayananda R, Prince M. Paul, P. Sampath Kumar. "Palmar Dermatoglyphics in ABO blood group", Medicolegal update. 2014; 14 (1): 100 – 103.

80) Deepa Deopa, Chandra Prakash, Ishwer Tayal, "A Study of Fingerprint in Relation to Gender and Blood Group among Medical Students in Uttarakhand Region", J Indian Acad Forensic Med. 2014; 36(1): 23-27.

81) Ekanem AU, Abubakar H, Dibal NI, "A study of fingerprints in relation to gender and blood group among residents of Maiduguri, Nigeria", IOSR J of Dental and Medical Science 2014; 13(8):18-20.

ANNEXURES

ANNEXURE I - INFORMED WRITTEN CONSENT

KAHER's

JAWAHARLAL NEHRU MEDICAL COLLEGE, BELAGAVI

DEPARTMENT OF FORENSIC MEDICINE & TOXICOLOGY

INFORMED WRITTEN CONSENT FORM

"A CROSS SECTIONAL STUDY TO DETERMINE THE RELATIONSHIP BETWEEN GALTON-HENRY DACTYLOGRAPHY SYSTEM WITH KARL-LANDSTEINER SYSTEM AND GENDER AMONG MEDICAL STUDENTS, BELAGAVI"

Guide:

Dr.__________________________

Professor & head of the department

Primary Investigator:

REG. NO – BF0121002, Post graduate Student, Department of Forensic Medicine and Toxicology, J.N. Medical College, KAHER, Belagavi-590010.

Introduction:

You are being invited to participate in this study to find out "The relationship between Galton-Henry Dactylography system with Karl-Landsteiner system and Gender". Identification is the determination of the individuality of a person based on certain physical characteristics. The fact that the skin of the palm and soles have ridges that are unique to each individual has been used for personal identification.

Explanation of procedures:

A unique enrollment number for all students will be given. Each subject will be asked to wash his/her hands thoroughly with soap and water and air dry them. The tips of the finger, that is the entire area above the crease of the first phalangeal joint, will be painted with black ink with the help of a roller. Then a rolled fingerprint from radial to ulnar border [from inwards to outwards] will be obtained on to the specified space of a proforma with normal pressure. In this manner, fingerprints of all the ten fingers will be obtained for everyone on the proforma. Care will be taken to avoid sliding of fingers to prevent smudging of the print. After the fingerprints are acquired, details such as sex and age will be noted. The details of their blood group will be noted from their previous laboratory blood reports.The fingerprint patterns will be studied with the help of a magnifying lens and classified as: Loops, Whorls, Arches and composite based on the appearance of ridge lines as explained by Henry's classification system.

Possible Benefits:

Personal identification through fingerprints has been recognized since long time and is regarded as the greatest contribution to the law enforcement. Through its unique characteristics, the science of fingerprint provides a special service in the admission of justice and also in other areas where positive identification is of paramount importance. As a future medical fraternity, you will be able to educate the general public and the medical students to develop deeper knowledge, understanding, capabilities and attitudes in the context of Galton-Henry Dactylography system with Karl- Landsteiner system and Gender.

Incentives:

You will not be eligible for any kind of monetary benefits or free services by virtue of your participation in the study.

Possible Risks:

There are no risks involved in this study.

Privacy and Confidentiality:

The results of the study may be published for scientific purposes. However, your identity will not be revealed and all information collected will be coded so that no one other than the investigator will know your identity.

Withdrawal:

You can withdraw from the study at any point of time if you wish to do so.

Costs of Participation:

- The cost of the study will be borne by the researcher.
- There will be no additional cost to you for participating in this study.

Payment of Participation:

There will be no incentives to you for participating in this study.

Authorization to publish the results:

The researcher may use the information gathered from this study for presentation or publication in scientific journals. However, your personal identity will not be revealed.

Legal Rights:

By signing this consent form, you are not waiving off any of your legal rights.

Questions:

If you have any questions regarding the study,

you should contact: REG. NO – BF0121002, post-graduate student, MD Forensic Medicine and Toxicology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka - 590010.

Professor & Head of the department, Forensic Medicine and Toxicology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka - 590010.

If you have any question about your rights as a study participant, you may contact: Dr. Harsha Hegde, Chairperson, Ethical committee of JNMC. Contact: 0831-2473777 Extension 4052.

CONSENT STATEMENT

I am making a voluntary decision to participate in the study **" A CROSS SECTIONAL STUDY TO DETERMINE THE RELATIONSHIP BETWEEN GALTON-HENRY DACTYLOGRAPHY SYSTEM WITH KARL-LANDSTEINER SYSTEM AND GENDER AMONG MEDICAL STUDENTS, BELAGAVI "**. My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Roll number of the Participant:

Signature or Left Thumb Impression of the Participant:

Name of the Witness:

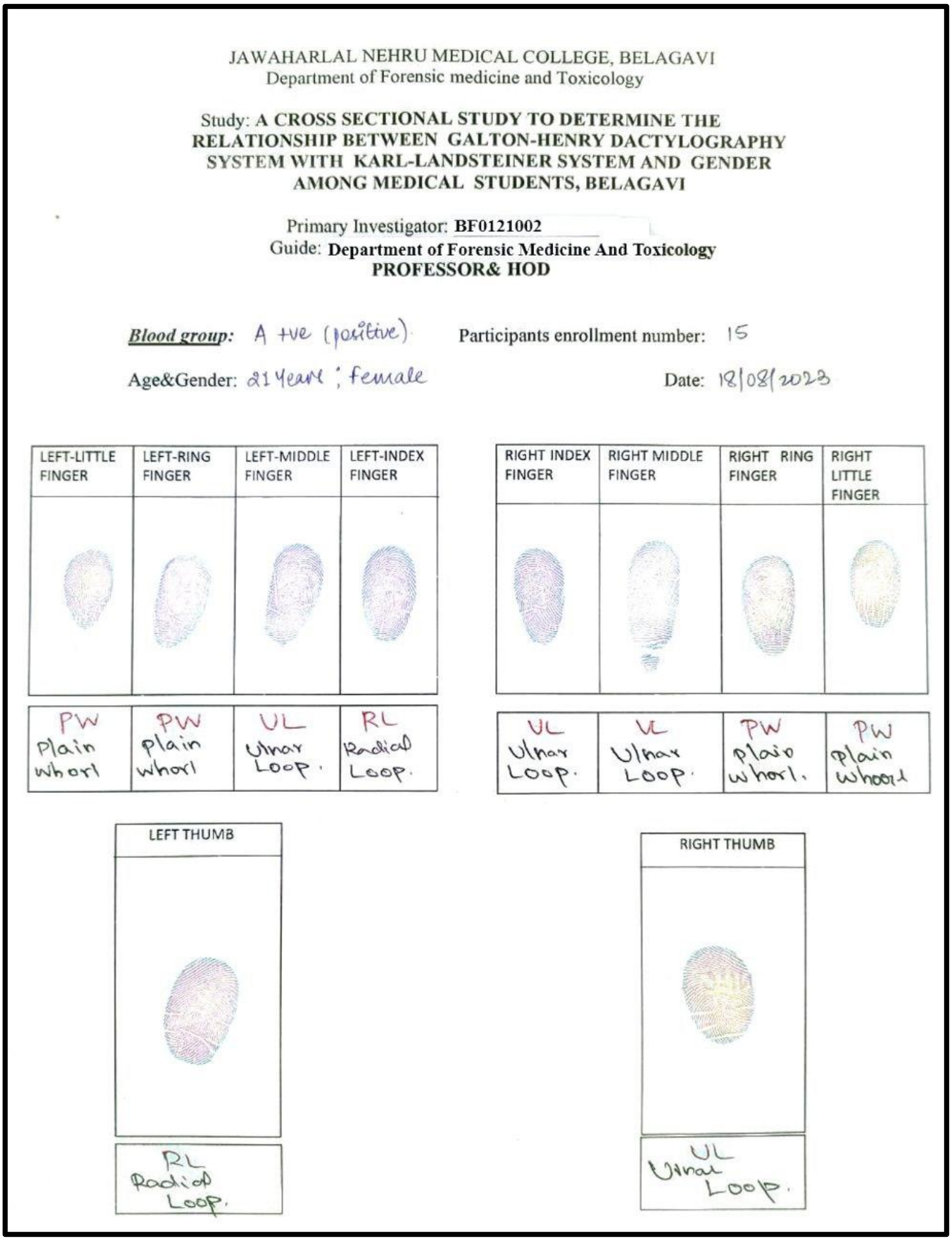
Signature or Left Thumb Impression of the Witness:

Name of the Investigator:

Signature of the Investigator:

Date & Place:

ANNEXURE II- Proforma



JAWAHARLAL NEHRU MEDICAL COLLEGE, BELAGAVI
Department of Forensic medicine and Toxicology

Study: **A CROSS SECTIONAL STUDY TO DETERMINE THE RELATIONSHIP BETWEEN GALTON-HENRY DACTYLOGRAPHY SYSTEM WITH KARL-LANDSTEINER SYSTEM AND GENDER AMONG MEDICAL STUDENTS, BELAGAVI**

Primary Investigator: **BF0121002**
Guide: **Department of Forensic Medicine And Toxicology**
PROFESSOR& HOD

Blood group: A +ve (positive) **Participants enrollment number:** 15

Age&Gender: 21 Years ; female **Date:** 18/08/2023

LEFT-LITTLE FINGER	LEFT-RING FINGER	LEFT-MIDDLE FINGER	LEFT-INDEX FINGER
PW Plain whorl	PW plain whorl	UL Ulnar Loop.	RL Radial Loop.

RIGHT INDEX FINGER	RIGHT MIDDLE FINGER	RIGHT RING FINGER	RIGHT LITTLE FINGER
UL Ulnar Loop.	UL Ulnar Loop.	PW plain whorl.	PW plain whorl

LEFT THUMB	RIGHT THUMB
RL Radial Loop.	UL Ulnar Loop.

CONSENT STATEMENT

I am making a voluntary decision to participate in the study **"A CROSS SECTIONAL STUDY TO DETERMINE THE RELATIONSHIP BETWEEN GALTON-HENRY DACTYLOGRAPHY SYSTEM WITH KARL-LANDSTEINER SYSTEM AND GENDER AMONG MEDICAL STUDENTS, BELAGAVI"**. My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the Participant: 15

Signature or Left Thumb Impression of the Participant: [signature]

Name of the Witness: Dr. Aravind Narman.pa. [signature]

Signature or Left Thumb Impression of the Witness: [signature]

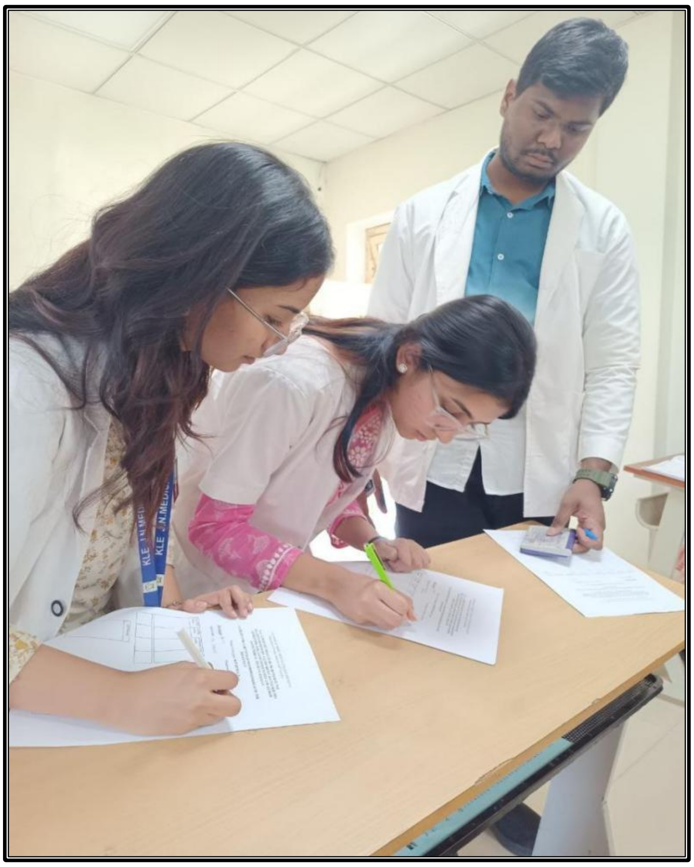
Name of the Investigator: **BF0121002**

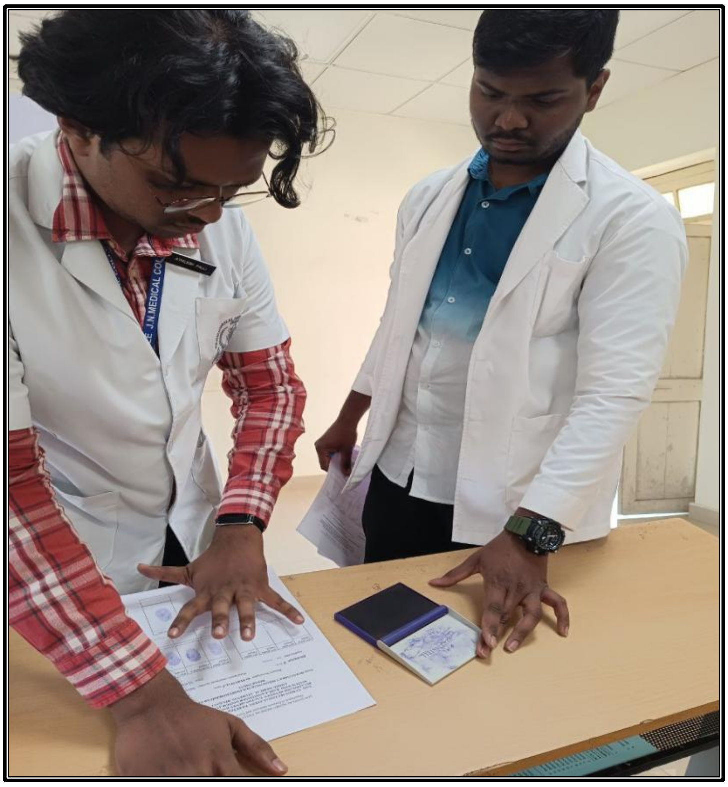
Signature of the Investigator: [signature] 18/8/23.

Date: 18th August 2023

Place: JNMC, Belgaum.

ANNEXURE III- Photos





ANNEXURE IV - KEY TO MASTER CHART

AGE CODE	
0 to 10 Years	1
11 to 20 Years	2
21 to 30 Years	3
31 to 40 Years	4
GENDER	
Male	1
Female	2
ABO Blood group	
A	1
B	2
AB	3
O	4
Rh Blood typing	
Positive	1
Negative	2

Patterns	
Arches	1
Loops	2
Whorls	3
Composite	4
Others	
LL	Left little finger
LR	Left ring finger
LM	Left middle finger
LI	Left index finger
LT	Left thumb
RI	Right index finger
RM	Right middle finger
RR	Right ring finger
RL	Right little finger
RT	Right thumb

ANNEXURE V - MASTER CHART

E.NO	Age	Age Code	Gender	ABO	Rh	LL	LR	LM	LI	LT	RI	RM	RR	RL	RT
1	19	2	1	1	1	3	3	3	3	3	3	3	3	2	3
2	19	2	1	1	1	3	3	2	2	3	2	2	3	2	3
3	20	2	1	3	1	2	3	3	3	3	3	3	3	3	3
4	21	3	2	4	1	2	1	1	1	1	2	1	2	2	2
5	19	2	2	2	2	2	3	2	1	3	1	2	3	3	2
6	19	2	2	4	1	2	2	2	2	3	3	2	2	2	2
7	21	3	2	2	1	2	3	2	2	2	2	2	2	3	2
8	21	3	2	1	1	3	3	2	2	2	2	2	3	3	2
9	21	3	1	2	1	2	2	2	2	2	2	2	2	2	2
10	20	2	2	2	1	2	3	2	2	3	2	2	2	2	2
11	19	2	2	4	1	2	2	2	3	2	2	2	2	2	2
12	21	3	2	4	1	3	3	2	3	3	3	2	3	3	3
13	21	3	2	4	1	3	3	3	2	2	3	3	3	3	2
14	21	3	2	2	1	2	2	2	3	2	3	2	2	2	3
15	20	2	2	3	1	2	2	3	3	2	3	2	2	2	3
16	20	2	2	2	1	2	3	2	2	2	2	2	3	3	2
17	20	2	2	3	1	2	2	2	3	2	2	2	3	2	2
18	19	2	1	4	1	2	1	2	3	1	1	1	1	2	2

19	20	2	2	4	1	2	2	2	2	2	2	2	1	2	3
20	20	2	2	2	1	2	3	3	3	3	3	3	3	3	3
21	19	2	2	3	1	2	2	1	1	4	2	2	2	2	2
22	20	2	1	2	1	2	2	2	2	4	2	2	3	3	4
23	21	3	1	4	1	2	3	2	3	3	3	2	2	2	3
24	20	2	2	1	1	3	3	2	1	2	2	2	2	3	2
25	21	3	2	4	1	2	3	3	2	2	1	2	3	2	1
26	20	2	1	4	1	4	2	3	3	2	3	3	3	2	3
27	19	2	1	1	1	2	3	2	2	3	3	2	3	2	2
28	22	3	2	4	1	1	1	1	2	1	1	1	2	2	2
29	21	3	2	1	1	2	3	2	2	2	2	2	2	2	2
30	20	2	1	2	1	2	1	2	2	1	1	1	2	1	3
31	19	2	1	2	1	1	2	1	3	3	2	1	2	2	2
32	19	2	2	4	1	2	3	4	2	3	3	4	3	3	4
33	20	2	1	4	1	1	1	1	1	4	2	2	2	2	4
34	19	2	2	1	1	2	3	2	1	2	1	2	1	2	1
35	20	2	1	4	1	2	1	1	2	2	2	1	2	1	2
36	19	2	2	2	1	3	3	2	3	2	3	2	2	2	2
37	21	3	2	3	1	2	3	2	1	1	2	2	3	2	2
38	20	2	2	4	1	2	2	2	2	2	2	2	3	2	2
39	22	3	1	2	1	2	2	2	2	2	2	2	2	2	2
40	21	3	1	1	1	4	2	3	3	4	4	3	3	4	2

41	22	3	2	2	1	2	3	2	2	2	2	2	3	3	4
42	21	3	2	4	2	2	2	3	3	3	3	3	3	3	3
43	21	3	2	2	1	2	2	2	2	3	1	3	3	1	3
44	20	2	1	2	1	2	3	3	3	3	2	3	3	2	3
45	20	2	2	1	1	2	2	3	3	3	3	2	2	2	2
46	19	2	2	1	1	3	3	3	3	3	3	3	3	3	3
47	20	2	1	4	1	2	3	3	1	2	3	2	3	2	2
48	20	2	2	1	1	2	3	3	2	2	2	2	3	2	2
49	19	2	2	3	1	2	2	1	1	1	1	2	2	3	1
50	20	2	2	4	1	3	3	3	3	3	4	3	3	3	3
51	21	3	1	4	2	2	3	2	3	2	3	2	3	2	2
52	20	2	2	4	1	2	3	2	2	2	2	1	2	2	2
53	20	2	1	4	1	3	3	2	3	2	3	2	3	3	2
54	26	3	1	1	1	3	3	3	3	3	3	2	2	3	3
55	22	3	1	2	1	2	2	3	2	4	2	2	2	2	4
56	20	2	2	1	1	3	2	2	2	2	2	2	2	2	2
57	21	3	2	4	1	2	2	2	2	2	2	2	2	2	2
58	20	2	2	1	1	2	2	2	3	3	2	2	2	2	2
59	21	3	1	4	1	2	2	2	2	2	3	2	3	2	2
60	19	2	2	2	1	2	2	3	2	3	3	2	3	2	3
61	19	2	2	4	1	2	2	2	2	2	3	2	3	2	4
62	20	2	2	2	1	2	3	2	3	3	2	3	3	2	3

63	20	2	2	2	1	2	2	2	2	2	2	2	3	2	2
64	20	2	2	2	1	2	2	3	2	3	2	2	3	3	3
65	20	2	2	2	2	3	2	2	2	3	3	2	3	3	3
66	21	3	2	4	1	3	3	3	3	3	3	3	3	3	3
67	20	2	2	2	1	2	2	3	2	2	2	3	3	1	3
68	21	3	2	2	1	2	2	2	2	4	2	2	2	2	4
69	20	2	2	2	1	2	3	3	2	4	3	2	3	2	3
70	21	3	2	1	1	2	2	1	1	3	1	2	2	2	3
71	19	2	2	2	1	2	2	2	2	2	2	2	2	3	2
72	19	2	2	1	1	2	3	2	3	1	3	2	3	2	1
73	21	3	2	1	1	2	2	3	2	4	3	3	3	3	3
74	19	2	2	4	1	2	3	3	3	4	3	2	3	2	3
75	21	3	1	2	1	2	3	3	3	2	3	2	3	3	3
76	22	3	2	4	1	3	3	3	3	2	2	2	3	3	2
77	21	3	2	1	1	2	3	2	2	3	2	3	3	3	2
78	19	2	2	2	1	2	2	2	2	3	2	2	2	2	3
79	20	2	2	4	1	1	2	2	2	3	2	2	2	2	3
80	21	3	2	4	1	2	3	3	3	3	2	2	2	3	3
81	21	3	2	2	1	2	3	3	2	2	1	2	3	2	3
82	20	2	2	4	1	2	3	2	3	2	2	2	2	3	3
83	20	2	1	3	1	2	3	2	4	2	2	1	3	2	4
84	21	3	2	2	1	2	2	1	1	2	1	2	2	2	2

85	21	3	1	4	1	2	3	2	2	3	2	2	2	2	2
86	22	3	2	1	1	2	2	3	3	3	3	3	3	3	4
87	20	2	2	3	1	2	2	3	1	2	1	1	2	2	2
88	20	2	2	4	1	2	3	2	2	2	4	2	3	2	3
89	22	3	1	4	1	1	2	2	1	1	2	2	2	2	2
90	20	2	2	4	1	2	2	2	1	2	1	1	2	2	2
91	19	2	2	2	1	2	3	2	2	3	2	3	3	3	3
92	19	2	1	2	1	2	2	2	1	3	2	2	2	3	2
93	19	2	2	2	1	2	3	2	2	2	2	2	3	2	2
94	21	3	1	2	1	2	3	2	2	2	3	2	2	3	2
95	20	2	2	4	1	3	3	3	3	4	3	3	3	3	3
96	20	2	2	4	1	2	2	2	1	1	2	2	2	2	3
97	19	2	1	3	1	2	2	2	2	4	2	2	2	2	3
98	21	3	2	2	1	2	2	2	3	2	3	2	3	2	3
99	21	3	1	4	1	3	3	2	2	2	2	3	2	2	3
100	19	2	2	2	1	2	3	2	3	3	2	2	2	2	3
101	20	2	2	4	1	2	3	2	2	1	2	2	2	3	2
102	19	2	1	4	1	3	3	3	3	4	3	3	3	3	3
103	20	2	1	2	1	2	2	2	2	2	1	2	3	2	2
104	21	3	1	2	1	2	3	2	2	3	3	2	3	2	2
105	21	3	1	2	1	2	2	2	3	1	2	2	2	2	3
106	20	2	2	2	1	2	2	2	2	1	3	2	2	2	2

107	20	2	1	2	1	3	3	2	3	2	3	3	3	3	3
108	19	2	2	2	1	3	3	2	2	3	3	3	2	1	3
109	21	3	2	1	2	2	3	1	2	2	2	1	3	3	3
110	21	3	2	1	1	2	2	2	1	3	3	2	2	2	3
111	20	2	1	4	1	2	3	2	3	2	3	2	3	2	2
112	20	2	2	1	1	1	3	1	3	3	2	2	2	2	3
113	21	3	2	4	1	3	3	3	3	3	3	4	3	2	2
114	21	3	2	2	1	3	3	3	3	3	4	3	3	3	3
115	20	2	2	3	1	3	3	3	3	2	3	2	3	2	2
116	19	2	2	4	1	2	2	1	2	3	3	2	3	3	1
117	19	2	1	4	1	1	1	1	1	1	1	2	2	1	1
118	20	2	2	1	1	2	2	2	3	2	2	2	1	2	2
119	20	2	1	4	1	3	2	2	3	3	3	2	3	2	3
120	20	2	2	2	1	3	3	2	2	3	2	2	2	2	3
121	22	3	1	1	1	1	2	2	1	2	2	2	2	1	2
122	20	2	1	2	1	2	2	2	2	2	2	1	2	2	2
123	21	3	2	4	1	2	2	3	3	2	4	3	2	2	2
124	21	3	1	2	1	2	2	2	3	3	2	2	3	2	3
125	20	2	2	4	1	2	2	1	3	2	1	2	2	2	2
126	21	3	2	2	1	3	3	3	4	3	3	2	2	2	2
127	19	2	1	2	1	3	3	4	3	2	3	1	3	3	3
128	20	2	2	4	1	2	3	2	2	2	2	2	2	2	3

129	21	3	2	2	1	2	2	2	1	2	2	2	2	2	2
130	20	2	2	4	2	2	2	2	1	1	2	2	2	2	2
131	19	2	2	4	1	2	2	2	1	2	2	2	2	3	3
132	21	3	2	1	1	2	3	3	3	3	3	3	3	2	3
133	20	2	2	2	1	2	2	2	3	2	3	2	2	2	2
134	21	3	2	4	1	2	2	2	2	2	3	2	2	2	2
135	20	2	2	4	1	2	3	2	3	2	3	2	3	3	3
136	19	2	1	4	2	2	3	3	2	3	2	3	2	3	2
137	20	2	2	2	1	2	1	2	1	2	2	1	2	2	2
138	23	3	1	1	1	2	2	2	2	3	2	3	3	3	2
139	22	3	2	2	1	2	2	2	3	2	3	2	3	2	3
140	21	3	1	4	1	2	3	3	3	2	3	2	3	2	2
141	21	3	2	3	1	2	2	2	2	2	2	2	2	2	2
142	21	3	1	3	1	1	3	2	3	1	2	2	3	2	1
143	20	2	1	2	1	2	2	3	1	3	3	2	2	2	3
144	22	3	1	2	1	3	3	3	3	3	3	3	3	3	3
145	21	3	1	3	1	3	3	2	2	3	2	2	3	2	3
146	21	3	1	4	1	2	2	2	2	3	3	2	2	2	3
147	21	3	2	1	1	2	2	3	3	3	3	3	3	3	3
148	22	3	2	4	1	3	3	2	2	3	3	2	2	2	3
149	21	3	1	4	1	3	3	3	2	3	3	2	3	3	3
150	21	3	1	2	1	3	3	3	3	3	3	3	3	3	3

151	21	3	2	4	1	3	3	2	2	3	2	2	3	3	2
152	21	3	2	4	1	2	3	3	3	2	3	2	3	2	3
153	22	3	2	1	1	2	2	3	2	3	2	2	2	2	3
154	21	3	1	1	1	3	3	3	3	3	3	3	3	3	3
155	22	3	1	2	1	2	2	2	2	3	2	3	2	2	3
156	22	3	1	4	1	2	1	2	2	4	3	2	2	2	3
157	21	3	1	1	1	2	3	3	3	3	1	2	2	2	2
158	22	3	1	2	1	2	3	3	3	3	3	3	1	2	3
159	21	3	2	2	1	3	2	3	2	2	2	2	2	2	3
160	22	3	1	1	1	2	3	2	3	3	2	2	3	2	3
161	20	2	1	1	2	2	3	3	2	3	2	1	2	2	2
162	22	3	2	4	1	2	2	2	3	1	2	2	2	2	2
163	22	3	1	2	1	3	1	2	2	2	3	2	2	2	2
164	21	3	2	3	1	3	3	3	3	3	3	2	3	3	3
165	21	3	1	4	2	3	3	3	2	3	3	2	3	3	3
166	21	3	2	2	1	2	2	3	3	2	3	2	2	2	2
167	22	3	2	4	2	3	3	3	3	3	2	2	3	2	3
168	21	3	2	2	1	3	3	2	3	3	2	3	3	2	3
169	21	3	2	2	1	2	3	3	3	2	3	3	3	2	3
170	20	2	2	4	2	2	3	2	2	3	3	2	3	3	3
171	21	3	1	2	1	3	3	3	3	3	3	3	3	3	3
172	22	3	1	1	1	2	2	2	2	2	3	2	3	3	3

173	21	3	2	2	1	3	3	3	3	2	3	3	3	3	3
174	18	2	2	2	2	2	2	2	2	2	2	2	3	2	2
175	21	3	2	4	1	2	2	2	3	3	3	2	2	2	3
176	21	3	1	4	1	2	3	3	3	2	2	2	2	2	2
177	21	3	2	4	1	2	2	1	1	2	1	2	3	3	1
178	20	2	2	4	1	2	2	1	1	1	1	1	2	2	1
179	20	2	2	4	1	2	3	2	2	2	3	2	3	2	2
180	21	3	2	1	2	2	3	3	3	2	2	2	2	2	2
181	20	2	2	4	1	2	1	2	1	2	2	1	2	2	2
182	21	3	1	1	2	2	3	2	3	3	3	2	3	3	3
183	22	3	2	2	1	2	3	3	2	3	3	3	2	2	3
184	20	2	1	4	1	2	2	2	2	2	2	2	2	2	2
185	20	2	2	2	1	3	3	3	3	3	3	3	3	3	3
186	20	2	2	4	1	2	2	2	1	2	1	2	2	2	2
187	20	2	2	1	1	2	2	2	2	3	2	2	3	2	2
188	20	2	1	1	1	2	2	2	2	3	2	2	2	2	3
189	21	3	2	2	1	2	2	2	2	2	1	1	2	2	3
190	20	2	1	2	1	2	3	3	3	4	3	3	3	3	3
191	22	3	2	2	1	2	3	2	1	2	1	1	3	2	2
192	21	3	1	4	1	2	3	3	3	2	3	3	3	3	3
193	21	3	1	4	1	2	2	2	2	2	2	2	2	2	2
194	22	3	1	2	1	2	2	2	2	2	2	2	2	2	2

195	27	3	1	4	1	2	3	3	4	4	3	2	3	2	4
196	23	3	1	3	2	3	3	3	3	3	2	2	3	3	3
197	19	2	2	4	2	3	3	3	3	3	2	2	3	3	4
198	29	3	1	2	1	2	2	2	2	2	2	2	2	2	2
199	26	3	1	4	1	2	2	3	2	4	3	2	3	2	3
200	23	3	1	4	1	2	2	2	2	2	2	2	3	2	3