"A CROSS - SECTIONAL STUDY OF PALMAR DERMATOGLYPHIC PATTERN IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AT KLE'S DR PRABHAKAR KORE HOSPITAL AND MRC."

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This is to certify that the dissertation entitled **"A CROSS - SECTIONAL STUDY OF PALMAR DERMATOGLYPHIC PATTERN IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AT KLE'S DR PRABHAKAR KORE HOSPITAL AND MRC"** is a bonafide research work done by THE CANDIDATE REG. NO. BB0111001.

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ABSTRACT

Aim - To study dermatoglyphics of fingers and palms and to use it as a tool to screen the population for the pre-disposition to diabetes mellitus, for risk reduction and early therapy; thus reducing morbidity and mortality.

Materials and methods - The study was conducted on 100 patients with diabetes mellitus and 100 controls, age, sex matched. The following quantitative parameters like finger ridge count, a-b ridge count, total finger ridge count, absolute finger ridge count, atd, adt and dat angles were studied. The following qualitative parameters like finger ridge patterns, palmar flexion creases were studied. Dankmeijer's Index, Furuhata's Index and Pattern intensity index were calculated for the fingertip patterns.

Results - Difference of a-b ridge counts, Absolute Finger Ridge Counts and Total Finger Ridge Counts between cases and controls in both right and left hand was statistically not significant. An adt angle was significantly more in cases in right hand as compared to controls. The tad angle was less in cases in right hand as compared to controls. Fingertip patterns in all digits combined and in both hands combined in cases and controls showed that there was a statistically significant increase in the number of loops in controls as compared to cases, whereas the whorl and arch patterns did not show any statistically significant difference. Dankmeijer's index was significantly more in male and female controls as compared to cases. Furuhata's index was significantly more in male and female cases as compared to controls. Pattern intensity index was significantly more in female cases and controls as compared to males.

Conclusion - Findings of the present study after a careful analysis of different palmar dermatoglyphic variables highlight on the possible markers. There were many

supporting findings and many contradictory findings to studies conducted by other researchers, hence there is lot of scope for further studies on a larger sample size and other parameters.

Key words: Dermatoglyphics, Type 2 diabetes mellitus, Finger prints.

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LIST OF ABBREVIATIONS

AWL	-	Arch With Loop
AWW	-	Arch With Whorl
T2D	-	Type 2 Diabetes
IFG	-	Impaired Fasting Glucose
IGT	-	Impaired Glucose Tolerence
FPG	-	Fasting Plasma Glucose
A1C	-	Haemoglobin A1C
OGTT	-	Oral Glucose Tolerence Test
TFRC	-	Total Finger Ridge Count
AFRC	-	Absolute Finger Ridge Count

INTRODUCTION

In human beings skin on the palmar surface of hand is grooved by ridges, these are commonly called as fingerprints. Fingerprints will form a variety of configurations.[1]

The term 'Dermatoglyphics', was first coined by Cummins and Midlo from two greek words – derma = skin, glyphe = carving.[2] The science of dermatoglyphics involves the study of epidermal ridges present on the surface of palms, fingers, soles and toes.[3] These epidermal ridges form well-defined patterns that characterize individuals and they have been found useful in the clinical diagnosis of hereditary diseases.[4]

Patterns form early in fetal development and they remain unchanged throughout life and hence they could be used to indicate genetic or chromosomal abnormalities.[5]

The characteristic features of epidermal ridges are that they remain unchanged throughout the life of an individual. Development of the epidermal ridges is under genetic control, but is influenced by environmental factors. Dermatoglyphic investigation is absolutely cost effective and requires no hospitalization. For these amazing qualities they play a very crucial and important role in the personal identification, crime detection, twin diagnosis, racial variation and have applied values in various diseases and syndromes. Dermatoglyphic studies are used to detect certain multi-factorial disorders. Prominent study among this is about diabetes mellitus, to detect pre-diabetics.

Dermatoglyphic study thus can be a low-cost tool to detect this multi-factorial disorder at an earlier age. This is important because diabetes mellitus has become the foremost killer among other diseases today.

Dermatoglyphic anomalies have been reported in several other diseases like epilepsy, congenital heart defects, hypertension, cancer, bipolar disorder, etc.

Diabetes mellitus is a non-communicable disease. It is predicted that, India will have the greatest number of diabetic individuals globally by 2030 i.e. an increase from 31.7 million in 2000 to 79.4 million in 2030. In Indian population, 75% of diabetic patients have first degree family history of diabetes. Maturity onset diabetes mellitus has a strong hereditary background, hence dermatoglyphic variations are seen in type 2 diabetes mellitus.[6]

The age of onset of the maturity onset diabetes mellitus is during the peak productive years of life and there is no definite way of predicting who will develop the disease so that the susceptible person may be advised regarding prevention. The present study aims to primarily study the various dermatoglyphic patterns in the patients of type 2 diabetes mellitus and controls, and analyze the dermatoglyphic patterns both qualitatively and quantitatively and use it as a screening procedure to predict the possibility of developing type 2 diabetes mellitus in otherwise normal individuals.[7]

A significant amount of the health budget goes to non-communicable diseases, primarily among them is diabetes mellitus. Therefore, identifying at risk individuals and taking up the preventive measures is highly economical.

OBJECTIVES

PRIMARY OBJECTIVE: To study dermatoglyphics of fingers and palms and to use it as a tool to screen the population for the pre-disposition to diabetes mellitus, for risk reduction and early therapy; thus reducing morbidity and mortality.

SECONDARY OBJECTIVE: To study whether there is any significant difference in finger and palmar dermatoglyphics of patients with diabetes mellitus.

REVIEW OF LITERATURE

DERMATOGLYPHICS -

Finger ridge impressions were used as proof of a person's identity as early as 300 B.C. in China, as early as 702 A.D. in Japan, and since 1902 in United States. The Chinese were the first culture known to have used friction ridge impressions as a means of identification. The earliest example comes from a Chinese document entitled "The Volume of Crime Scene Investigation Burglary", from the Qin Dynasty (221 to 206 B.C.).[8]

Friction ridge impressions were first described in detail by Dr. Nehemiah Grew in the 1684 paper "Philosophical Transactions of the Royal Society of London". Although friction ridge skin had been studied for a number of years, the uniqueness of these skin impressions was recognized in Europe in 1788 by J. C. A. Mayer, a German doctor and anatomist, who wrote a book "Anatomical Copper-plates with Appropriate Explanations", which contained detailed drawings of friction ridge skin patterns.[8]

Dr. Johannes E. Purkinje, Professor at the University of Breslau in Germany, classified fingerprint patterns into 9 categories and gave each a name. His contribution is significant because his 9 pattern types were the precursor to the Henry classification system. Faulds was the first person to publish the value of friction ridge skin patterns for individualization, especially its use as an evidence. He wrote that friction ridges were unique and classifiable, and alluded to their permanence.[8]

In 17th century Nenemian Grew was the first person to describe pores, ridges and arrangements on palm and fingers.[9]

Fingerprints in India were first experimented in 1858 by William Herschel, a British Commissioner in India. He noticed the use of thumbprints as a form of signature amongst illiterate Indians and clearly established the fact that fingerprints did not change their form over time and therefore could be used as a reliable form of personal identification. In 1892 Sir Francis Galton conducted extensive research on the significance of skin ridge patterns, not only to demonstrate their permanence but also their use as a means of identification. He also demonstrated the hereditary significance of fingerprints and the biological variations of different finger print patterns amongst different racial groups.[11] He published the book "Fingerprints" in 1892 and in doing so, significantly advanced the science of fingerprint identification. In 1893 Sir Edward Henry published the book "The classification and uses of fingerprints" which established the modern era of finger print identification, which is now the basis for most of the other classification systems.[10] In 1902 Harris Hawthorne Wilder pioneered comprehensive studies on the methodology, inheritance and racial variation of palmar and plantar papillary ridge patterns, as well as finger prints.[10]

In 1926 Cummins and Midlo were the first to coin the term 'Dermatoglyphics' (from two Greek words- derma = skin, glyphe = carving). They described it as the science and art of the study of patterns of ridges on the skin of the fingers, palm, toes and soles. They did their research on Down's syndrome and studied the characteristic hand formations. They showed that the hand with significant dermatoglyphic configurations would assist the identification of Mongolism in the newborn. In 1929 Charles Midlo together with others published one of the most widely referred book "Fingerprints, Palms and Soles", a bible in the field of dermatoglyphics.[2]

In 1945 Penrose L. S. conducted his own dermatoglyphic investigations as a further aspect of his research into Down's syndrome and other congenital medical disorders. In 1965 Galton Center contributed to the development of dermatoglyphics and formulated the measurement to establish the position of displaced axial triradius in terms of atd angle, as well as in establishing the inheritance of its position in the palm. In 1968 Sarah Holt published the book "The Genetics of dermal ridges" and summarized the statistical distributions of dermatoglyphic patterns of the fingers and the palm in various people, both normal and congenitally affected individuals. The research focused on the identification of those features of the palm, which would indicate the genetic likelihood of a mother giving birth to a Down's syndrome child, and also concentrated on the study of twins. In 1976 Schaumann and Alter's published a book "Dermatoglyphics in Medical disorders" which summarized the findings of dermatoglyphic patterns in various medical disorders.[10] In 1982 Engler et al, conducted a study on patients with breast cancer and concluded that there was high risk for breast cancer in a women who had 6 or more whorls on their fingertips.[10]

Currently the state of medical dermatoglyphics is such that the diagnosis of some illnesses can now be done on the basis of dermatoglyphic analysis alone; several dermatoglyphic researchers claim a very high degree of accuracy in their prognostic ability of the disease condition from the hand features.

In 2001 Dr. Alexander Rodewald from Germany diagnosed many congenital abnormalities with 90% accuracy from the features of the hands alone.[10] In 2003 Dr. Stowens, Chief Pathologist at St. Luke's Hospital in New

York claimed to diagnose schizophrenia and leukemia with 90% accuracy from the patterns on the hands alone.[10]

DERMATOGLYPHICS IN DIABETES MELLITUS

In 1994 Bets L.V. et al, studied dermatoglyphic patterns among a group of Russian children with clinically diagnosed diabetes mellitus. Asymmetry of patterns was observed in children of both sexes compared to control group. The examined population was characterized by reduced incidence of loop patterns in hands.[12]

Studies in Indian populations have shown links between diabetes mellitus and dermatoglyphic features in hands.[13]

In 1995 Roopa Ravindranath and I. M. Thomas studied total finger ridge count, absolute finger ridge count and finger print pattern in 150 maturity onset diabetes mellitus patients and compared to 120 controls. He observed an increase in radial and ulnar loops and arches, and a decrease in whorls in males. An increase in ulnar loops and a decrease in whorls in the left hand were observed in females.[5]

In 1995 Vera M. et al, studied hand and palm dermatoglyphics in 158 insulin-dependent diabetic children. The findings in this group were compared with those in 400 controls with a similar racial distribution. They found an increase in the number of t'- axial triradii and ulnar loops in diabetics.[14]

In 2004 Mandasescu et al, used palmar prints to detect pre-diabetics. Palmar abnormalities in diabetics have been reported earlier, but the study by Mandasescu et al was the first full scale computer based study.[3]

In 2005 R. S. Bali et al, studied dermatoglyphic patterns of 108 male and 65 female patients with diabetes mellitus. The control population consisted of

536 males and 234 females from the same population. They found an increase in the ulnar loop patterns among diabetes mellitus patients.[15]

In 2006 Barta et al, studied dermatoglyphic features of 180 adults with diabetes mellitus. Their findings were that the loop and arch patterns were mostly observed on the thumbs in diabetes mellitus patients.[16]

Finger ridge patterns form early in the development of the fetus and they remain unchanged throughout life and hence they could be used to indicate chromosomal or genetic abnormalities.[5]

EMBRYOGENESIS OF DERMATOGLYPHIC PATTERNS

Earlier scientific studies showed that dermatological markers develop in the first 4 months of gestation. The process was more accurately described in detail by Schaumann and Alter. They concluded that dermatoglyphic patterns develop in early fetal life and they are genetically determined, but can be modified by environmental forces.[10]

In 1924, Bonnevie summarized the conclusions of the earlier investigators as “A very intimate connection between pads and patterns with regard to the degree of elevation of the pads and the special configurations of their pattern”.[9] In 1929, Bonnevie, speculated that fingerprint patterns were dependent upon the underlying arrangement of peripheral nerves.[10]

In 1935, Cummins observed the ridge configurations of congenitally malformed hands and proposed that direction of epidermal ridges was determined by growth forces and contour of volar skin at the time of ridge formation. In 1964, Humphrey studied the early function of the fetal hand and indicated that digital and palmar creases are related to flexion movements in the developing

hand between the 7th and 14th weeks of development and they are secondary features.[17]

In 1966, Gall and Associates stated that, the shape of volar pads determines fingertip patterns, the ridges covering the skin in the most economical way possible, according to strict topological principles.[9] In 1968, Penrose suggested that ridges are aligned at right angles to compression forces. They take the shortest routes on the embryonic surfaces, and the abnormal configurations may be the result of alterations in the fluid balance at an early embryonic stage.[9] So, ridge configuration is dependent on the shape of the volar pad at the time of initial primary ridge formation. A high volar pad would result in the formation of a whorl, while a low volar pad would result in the formation of an arch and an intermediate volar pad height offset to one side of the digit would result in formation of a loop.[9]

In 1973, Hirsch and J.V. Schweichel summarized that the arrangement of blood vessels and nerve pairs under the smooth epidermis exists shortly before glandular folds and speculated that the folds were induced by the blood vessel and nerve pairs. They also concluded that the pattern of papillary ridges is set after the development of the glandular folds usually after 4 months, although the growth pattern of the glandular folds is one of the 3 factors postulated to control the final highly arranged surface pattern. They also emphasized that the neuro-epithelium plays an important part in the development of the dermatoglyphic patterns.

The following explanations were offered by them:

1) failure of nerves to grow into the epithelium may be expressed through dermatoglyphic aplasia,

2) both qualitative and quantitative deviations of sub-epithelial nerve branches to form may be evidenced by dermatoglyphic dysplasia, and
3) where dermatoglyphics are distorted, there may be a disturbance of the spatial arrangement.[10]

In 1976, William J. Babler indicated that the epidermal ridges first appear in the form of localized cell proliferations around the 10^{th} to 11^{th} week of gestation. These proliferations form shallow corrugations, then they project into the superficial layer of the dermis. Now the number of ridges continue to increase, being formed either between or adjacent to existing ridges. It is during this period of primary ridge formation, that the characteristic patterns are formed. At about 14^{th} week, the primary ridge formation stops and secondary ridge formation begins. Secondary ridges begin to form as sweat gland, and develop along the apices of the primary ridges at uniform intervals. At this time, the epidermal ridges first start to appear on the volar surfaces. Around 24^{th} week the dermal papillae develop in the valleys between the ridges on the deep surface of the epidermis. The morphology of primary and secondary ridges appear as a smooth ridge of tissue and thereafter peg-like structures, the dermal papillae, characteristic of the definitive dermal ridges, are progressively formed.[10]

In 1987, Babler reported that there is a relationship between the volar pad shape and the epidermal ridge configuration. He specifically suggested that narrow volar pads are related to whorl patterns. He also suggested the association between the pattern type and shape of the distal phalanx. He also found significant correlations between the bony skeleton of the hand and the epidermal ridge dimensions and time of ossification and suggested this correlation may be a key factor in ridge patterning.[10]

PATTERN CONFIGURATIONS

FINGERS: Fingertip pattern configurations:

In 1892, Galton divided the ridge patterns on the distal phalanges of the fingertips into 3 groups namely arches, loops and whorls. Even though numerous sub-classifications have been subsequently offered, his simple classification is still recognized and used by majority of investigators today.

(1) Arches :

It is the simplest pattern which is formed by succession of more or less parallel ridges, which traverse the pattern area and form a curve that is concave proximally. Sometimes the curve is gentle, at other times it swings more sharply so that it may also be designated as a low or high arch respectively.[2]

The 2 subtypes of arches are:

a) Simple arch or plain arch - composed of ridges that cross the fingertip from one side to the other without recurving, and

b) Tented arch - composed of ridges that meet at a point so that their smooth sweep is interrupted.

Triradius is the point of confluence of ridges, the ridges usually radiate from this point in 3 different directions. The triradius is located near the midline axis of the distal phalanx in the tented arch. The distal radiant of the triradius usually points vertically toward the apex of the fingertip. Ridges passing over this radiant are abruptly elevated and form a tent-like pattern and are designated as 'tented arch'.

(2) Loops:

Loop is the most common fingertip pattern. Series of ridges enter the pattern on one side of the digit, recurve abruptly, and leave the pattern area on the same side. In ulnar loop the ridge opens on the ulnar side. If the ridge opens toward the radial side, it is called a radial loop. A loop has a confluence point of ridges or single triradius. Usually the triradius is located laterally on the fingertip and always on the side where the loop is closed. There is considerable variation in the size and shape of loops. They may be large or small, tall or short, vertically or horizontally oriented, plain loop or double loop.

Occasionally, 'transitional' loops can be found which resemble whorls or complex patterns.[2]

(3) Whorls:

Whorl is any ridge configuration with 2 or more triradii. One triradius is on radial side and the other is on the ulnar side of the finger tip pattern. In 1937, Henry limited the designation of the term 'whorl' to those configurations having ridges that actually encircle a core. He named more complex patterns as "composites".[2] In a plain or simple whorl the ridges are commonly arranged as a succession of concentric rings or ellipses. Such patterns are described as concentric whorls. Another configuration spirals around the core in either a clockwise or an anticlockwise direction. This pattern is called a spiral or a double whorl. Sometimes, both circles and ellipses or circles and spirals are present in the similar pattern. The size of the whorl can vary considerably, and is determined by the ridge count.[2]

A central pocket loop (CPL) or whorl is a pattern containing a loop within which a smaller whorl is located. They are classified as ulnar or radial according

to the side on which the outer loop opens. The significance of separating these 2 varieties of loop whorls for medical diagnosis remains disproved. Therefore, they are ordinarily grouped together as a central pocket loop. Another type is composed of interlocking loops, which may form either a lateral pocket, twinned or twin loop pattern. Each has 2 triradii and the 2 types of whorls are morphologically similar.[2]

Patterns which cannot be classified as one of the above patterns are called accidentals. Some of them represent a combination of 2 or more configurations such as a loop and a whorl, triple loops and other unusual formations.[2]

They are classified as:

a) arch with loop (AWL),

b) arch with whorl (AWW)

DERMATOGLYPHIC LANDMARKS

Three basic dermatoglyphic landmarks are found on the fingertip patterns. Those are triradii, cores and radiant.

(1) Triradius:

Triradius is formed by the confluence of 3 ridge systems. Triradial point is the geometric centre of the triradius. It is the meeting point of 3 ridges that form angles of approximately 120 degree with one another.[2] The triradial point forms one terminus of the line along which ridges are counted. These are commonly seen in the hypothenar areas of the palms and the hallucal areas of soles.[2]

(2) Core:

Core is in the approximate center of the pattern. It may be of different shapes:

a) in a loop pattern, the core is represented by a straight, rod like ridge or a series of 2 or more such parallel ridges, over which other recurving ridges pass. If a straight ridge is absent in the center of the loop, the innermost recurving ridge is designated as a core,

b) in a whorl, the core can appear as a dot or a short ridge, either bent or straight or it can be shaped as a circle or an ellipse in the center of the pattern.[2]

(3) Radiants:

Radiants are the ridges that emanate from the triradius and enclose the pattern area. They constitute the 'skeletal' framework of the pattern area.[2]

PALMAR PATTERN CONFIGURATION

The palm has been divided into several anatomically designed areas, in order to carry out dermatoglyphic analyses that can be compared in different individuals. This includes thenar area, hypothenar area, first, second, third and fourth interdigital areas.[2]

(1) Thenar and first interdigital areas:

Ridges follow a mild curve around the base of the thumb. A vestige or a true pattern can be found. Patterns when present are usually loops and rarely whorls.[2]

(2) Second, third and fourth interdigital areas:

Each of these is bordered laterally by digital triradii, proximal to the base of digits 2 to 5, labelled a, b, c, and d, starting from the triradius located at the base of digit 2 and moving towards the triradius associated with digit 5.

Interdigital area 2 lies between triradii a and b, interdigital area 3 lies between b and c, and interdigital area 4 between c and d. If the digital triradius is absent, the midpoint of the base of the corresponding digit can be used to separate the interdigital areas.

Configurations are loops, whorls, vestiges and open fields. Loops are the most common opening distally into the nearest interdigital space. Loops can be labelled as loop distal, loop proximal, loop ulnar, loop radial. Sometimes a loop is accompanied by accessory triradius. Whorls are rarely found, whereas vestiges are common. Vestiges consist of straight, parallel or converging ridges having a direction different from the neighbouring ridged areas. Open fields are formed by parallel ridges. True patterns are commonly seen in interdigital areas 3 and 4.[2]

(3) Hypothenar area:

True patterns are whorls, loops and tented arches. Simple arches, open fields, vestiges, ridge multiplication also occur. Arches are the most common pattern. The triradius close to the palmar axis is termed axial triradii (t), accessory axial triradii are designated as t', t'' respectively.[2]

PALMAR LANDMARKS –

In the distal portion of the palm there are 4 triradii. They are in the metacarpal region at the base of the digits 2, 3, 4 and 5. Each triradius is termed a, b, c, d, in a radioulnar direction. There are 4 palmar main lines, each emanating

from one of the digital triradii and labelled A, B, C, D corresponding to the triradius having the same lower case letter.[2]

QUANTITATIVE ANALYSIS –

(1) Ridge count:

It is used to indicate the pattern size. They are counted along a straight line connecting the triradial point to the point of core. The ridges containing the point of core and triradial point are both excluded from the count. Ridges are often counted between 2 digital triradii. Loops have 1 ridge count and whorls have 2 ridge counts. Arches have zero count, sometimes loops and tented arches have zero count. The ridge count most frequently obtained is between triradii a and b, and is referred to as the a-b ridge count.

(2) Angle atd:

This angle is formed by lines drawn from the digital triradius (a) to the axial triradius (t) and from this triradius to the digital triradius (d). The more distal the position of't', the larger the atd angle. Sometimes accessory 'a' or 'd' triradii are present on the palm[2]. Depending on the atd angle, position of the triradius is designated as t when angle is <45 degrees, t' when angle is 45 to 56 degrees and t'' when angle is more than 56 degrees.

(3) Flexion creases –

Flexion creases represent the location of firmer attachment of the skin to the underlying structures.[2]

They are classified into 3 groups:

(a) major creases – there are 3 major creases:

- radial longitudinal crease – a curved crease encircling the thenar eminence and ending at the radial side of the hand, somewhat above the distal wrist crease,
- proximal transverse crease – found distal to the middle of the palm and its radial end is either fused with or shifted distally from the thenar crease,
- distal transverse crease – located between the proximal crease and the heads of the underlying metacarpals. If the proximal and distal transverse creases are replaced by 1 transverse crease, it is called simian crease. A Sydney line is a proximal transverse crease that extends beyond the hypothenar eminence to ulnar border of the palm. The distal transverse crease appears normal. This was reported in Down's syndrome, congenital rubella and leukemias.

(b) minor creases – there are 4 groups:

- longitudinal creases – 3 longitudinal creases when present, run from central part of wrist toward the 3rd, 4th and 5th digits, called middle, ring and little finger creases,
- accessory distal crease – found beyond the distal transverse crease,
- E lines – located at distal ulnar edge of the palm between the origin of the distal transverse crease and the metacarpophalangeal crease of the 5th finger,
- hypothenar crease – present in the hypothenar eminence running proximo-distally,

(c) secondary creases –

Phalangeal crease at the interphalangeal joint, metacarpophalangeal crease at the metacarpophalangeal joint, wrist creases at the wrist joint, etc.

White lines – a variable number of shallow grooves of different length, width and directions which cross the epidermal pattern areas of the fingertips independently of the direction of papillary ridges.[2, 18]

INHERITANCE OF DERMATOGLYPHIC TRAITS –

Evidence from identical twins has shown that dermatoglyphic traits to a large extent are determined by heredity. Complete genetic processes are involved but still inheritance of pattern is little understood. Quantitative methods, based on counting ridges and measurements of angles have provided a lot of information on inheritance of dermatoglyphic traits.[2]

Total finger ridge count, inspite of its continuous variation, is the sum of a heterogenous combination of values (fingers with different means, standard deviations and frequency distribution) with complicated interrelations, such a heterogenous term cannot pass for a homogenous biologically meaningful character. Total finger ridge count follows polygenic inheritance. [19]

Over half the variations of quantitative phenotype absolute finger ridge count are accounted for by a simple major autosomal locus with 2 additive alleles. By measurement of maximal atd angle on palms, it has been shown that position of axial triradius is determined by heredity. Size of ridge count between palmar triradii a and b has also been shown to be genetically controlled. It appears, however, the palmar ridge arrangements are affected to a greater extent by environmental influences rather than finger patterns, but still they have a strong hereditary component. The atd angle varies with sex. Ridge counts are affected by age, but width of atd angle does change. Hence, allowance should be made for age.[2]

METHODS OF RECORDING DERMATOGLYPHICS –

Broadly they can be classified into 3 methods:

1. Inkless methods (Walker 1957).
2. The Holister system for young and new born infants.
3. The Indian ink method (Cumins and Midlow, 1961).

1.Inkless methods (Walker 1957) [20] **-**

This saved the subject from the inconvenience of the staining or the discolouration of the hands. Macarthur and Ford (1937)[21], described a procedure for making prints in the latent form from face cream which was spread on a kymograph paper. The latter was fixed in shellac after developing an impression with lampblack fine powder.

The X-Ray (Roentgen's method) **–**

Roentgen's method is more useful than other unsuccessful techniques for finger printing in the advanced states of decomposed bodies. They used the X-Ray record for the indirect correlation of the position of the triradii and the hand skeleton by fastening lead pallets with adhesives at the point of the triradii.

In 1939, Castellanos mentioned Beclare's procedure which consisted of smearing the skin with lanolin and bismuth carbonate and taking shadow graphs by the usual X-Ray method. The above 3 methods are not applicable easily because of the non availability of the appliances which are required for taking the prints.

2. The Holister system for young and new born infants -

In infants, prints have been developed on photographic paper from a moistened blotter, which was pressed against the fingers and passed through a

developing mixture which was prepared from a stock solution which consisted of sodium sulphide, sodium hydroxide, starch and distilled water. This was made permanent by fixation in hypo solution.

3. The Indian ink method (Cumins and Midlow, 1961) [22]**-**

In 1961, Cumins and Midlow developed the Indian ink method which was used for taking impressions with camel duplicating ink. The materials used were: a double plain paper (8.5"×11"), a glass plate (8.5"×11"), a round bottle (10"×4"), a roller for spreading the ink, a table, a scale, a biological pointer, a pointed H.B. pencil, a mercury lamp, a protractor, soap and ether for washing hands and a good quality magnifying lens.

Ink was squeezed out on an inking slab of the roller onto a thin film for the direct inking of the fingers. The palm was uniformly smeared with the inked roller to cover the whole area of the palm which had to be printed for the examination. The paper was set over the bottle and the moderately opened fingers and the palm were successively rolled by applying some pressure on them for permitting the bottle and the paper to move forward. The rolled finger prints were taken by the rotation of fingers, both in the inking and the printing to get a complete impression of the finger tips. This method enables to record the complete imprints of the palm, including the palmar surface of all the 5 digits in single attempt.

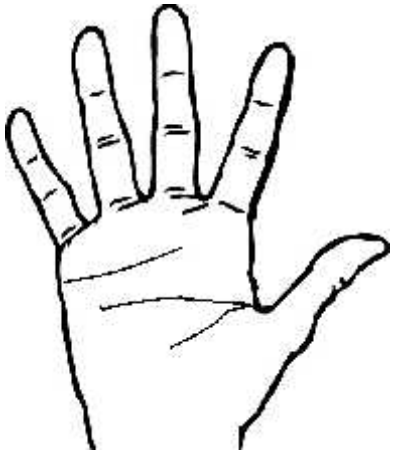
SPECIAL METHODS –

1. **Hygrophotography** – in this method, an image can be obtained on a sensitized surface by the combined action of light and humidity. It

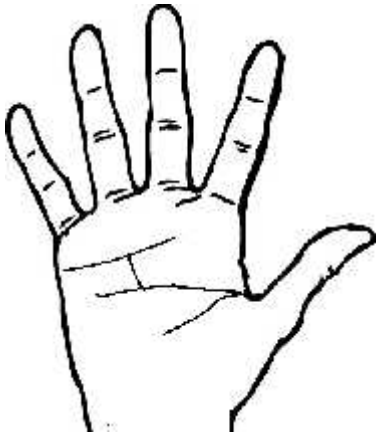
demonstrates epidermal patterns, as well as pores and the sites of active sweat glands.[23]

2. **Plastic mold** – this studies dermatoglyphics and sweat gland activity.[24] In 1972, Sands found the dental impression alginate compounds a much less expensive molding material than latex materials used.[25,26] Mechanical methods have been developed for pattern recognition automatically where ridge minutiae form the basis for the analysis.[2]

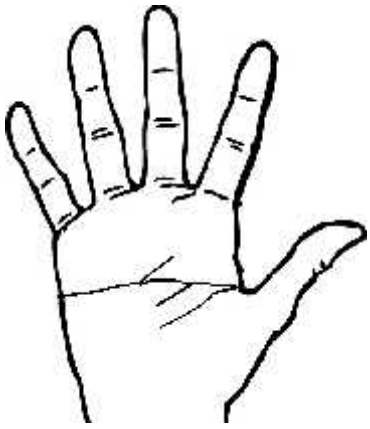
FIGURE 1- FLEXION CREASES



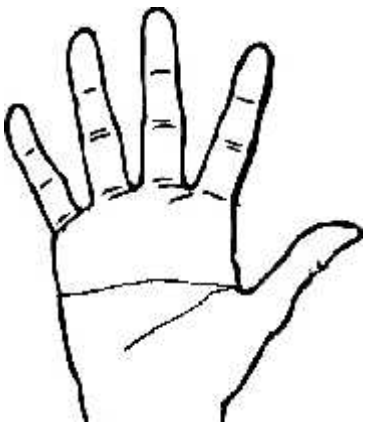
NORMAL



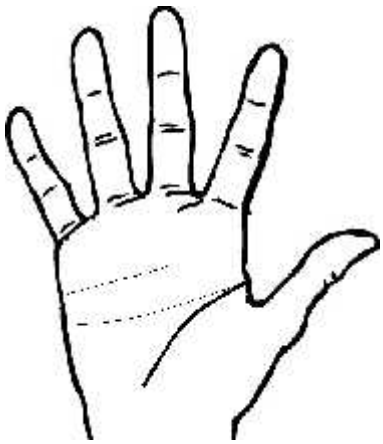
TRANSITIONAL TYPE 1



TRANSITIONAL TYPE 2



SINGLE FLEXION CREASE



SYDNEY LINE

FIGURE 2 – FINGERTIP PATTERNS

ARCH

WHORL

DOUBLE LOOP

LOOP

DIABETES MELLITUS –

Diabetes has become one of the common global health problem that affects >170 million people worldwide and is one of the leading causes of death and disability. It is estimated that by 2030 the number will increase to 366 million. The majority of diabetes is type 2 diabetes (T2D) caused by a combination of impaired insulin secretion from pancreatic beta cells and insulin resistance of the peripheral target tissues, especially muscle and liver. According to Wild et al (2004) the 'top' 3 countries in terms of the number of type 2 diabetes individuals are India (31.7 million in 2000; 79.4 million in 2030), US (17.7 million in 2000; 30.3 million in 2030) and China (20.8 million in 2000; 42.3 million in 2030). Clearly, type 2 diabetes has become an epidemic in the 21st century where India leads the world with largest number of diabetic subjects.[7]

Type 2 diabetes:

It is the most common form of diabetes, accounting for 90 - 95% of cases. In this type, the body does not respond properly to insulin, a condition known as insulin resistance.

In type 2 diabetes the first stage is the insulin resistance. Even if insulin can attach normally to receptors on liver and muscle cells, certain mechanisms prevent insulin from moving glucose into these cells where it can be used. Most patients with type 2 diabetes produce variable, still normal or high amounts of insulin. In starting stage this amount is usually enough to overcome such resistance. Over the time, the pancreas becomes unable to produce adequate insulin to overcome resistance. Finally, the cycle of elevated glucose further damages beta cells, thereby drastically reducing insulin production and causing

full-blown diabetes. This is made obvious by fasting hyperglycemia, in which glucose levels are high most of the time.

Type 2 diabetes is thought to result from a combination of genetic factors along with lifestyle factors, such as obesity, high alcohol intake, poor diet and sedentary life. Genetic mutations have an effect on parts of the insulin gene and various other physiologic components that are involved in the regulation of blood sugar. Some rare types of diabetes are directly linked to genes.

According to the National Institutes of Health, people have an increased risk for type 2 diabetes if they have:

- age of 45 years or older
- overweight
- family history of diabetes
- inactive lifestyle
- African-American, Hispanic/Latin American, American Indian and Alaska Native, Asian-American, or Pacific Islander ethnicity
- high blood pressure (140/90 mm Hg or elevated)
- HDL cholesterol less than 35 mg/dl or triglyceride level 250 mg/dl or elevated
- had gestational diabetes or have given birth to a baby that weighed more than 9 pounds
- polycystic ovary syndrome (metabolic disorder that affects female reproductive system)
- acanthosis nigricans (dark, thickened skin around neck or armpits)
- diabetes test history of impaired fasting glucose (IFG) or impaired glucose tolerance (IGT)

Symptoms:

Symptoms in adults include: increased urination, excessive thirst, fatigue, blurred vision, weight loss, in women fungal infections, severe gum problems, itching, erectile dysfunction in men, tingling or burning in the extremities.

Complications:

Patients with diabetes have higher death rates than people who do not have diabetes regardless of age, sex, or other factors. Stroke and heart disease are the leading causes of death in these patients. People with type 2 diabetes are also at risk for neuropathy and vascular injuries that occur as part of the diabetic disease process. They are more prone for heart diseases, nephropathy, neuropathy, diabetic retinopathy, infections, dementia, etc.

Investigations - Tests that can be used to diagnose diabetes are:

- fasting plasma glucose (FPG)
- hemglobin A1C (A1C)
- oral glucose tolerance test (OGTT)

Until recently, type 2 diabetes was typically observed as a disease of the middle-aged and elderly. Though this age-group maintains a higher risk than younger adults, evidence is accumulating that children and adolescents aged less than 30 years are now becoming caught up in the diabetes epidemic, which has mainly been attributed to the high level of obesity in these groups. The decrease in the age of onset of diabetes is of huge concern as future generations may be burdened with morbidity and mortality at the height of their productivity, potentially affecting the workforce and healthcare resources of the countries across the world.[7]

In type 2 diabetes pathogenesis is complex, involving the interaction of genetic and environmental risk factors that strongly contribute to the development of insulin resistance in the muscle and liver as well as to β-cell failure, the 2 core pathophysiological defects in type 2 diabetes. The development of alterations in glucose metabolism results from the steady fall in β-cell function occurring within a background of insulin resistance. The 2 chief components of the blood glucose regulation pathway are insulin secretion and insulin sensitivity.[28]

Even if the pathophysiological mechanism of type 2 diabetes is not completely understood, it is clear that insulin resistance plays an important role in its development. Evidence of this comes from cross-sectional and longitudinal studies representing that insulin resistance occurs 10–20 years before the onset of the disease and that it is the best predictor of whether or not an individual will later become diabetic.[29]

In adding together, insulin resistance, by placing an increased demand on the β-cell to hypersecrete insulin, influences the progressive β-cell failure of type 2 diabetes[31]. The precise mechanisms by which insulin resistance leads to β-cell failure remains unidentified, however a possible hypothesis is that the cause of insulin resistance is also directly responsible for the β-cell failure (i.e. lipotoxicity).[28]

Obesity is the main important cause in the development of insulin resistance and it has been demonstrated that the critical determinant of insulin sensitivity is not the degree of obesity per se but the distribution of fat partitioning.[30]

The insulin gene located on the short arm of chromosome 11 has been investigated as a possible genetic marker for non-insulin dependent diabetes mellitus. However, although one allele seems to affect blood glucose homeostasis, its relationship to the development of non-insulin dependent diabetes is uncertain. Yet if one discovered a reliable indicator of genetic damage or abnormality, one might be able to predict the probability of a disease.[14]

So, prevention must be the main strategy for the future.

METHODOLOGY

The present study was conducted in KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum on patients of type 2 diabetes mellitus attending Medicine Out Patient Department during the period during January to December 2012.

Study design:

Cross sectional study.

Study period:

The present study was conducted from January to December 2012.

Method of collection of data:

Source of Data:

Patients attending Medicine Out Patient department at KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum.

Sample size:

The study was conducted on 100 patients with diabetes mellitus and 100 controls, age, sex matched and those who do not have diabetes mellitus.

Sampling procedure:

A sample size of 100 cases and 100 controls was calculated using the formula:

$n = 4pq/ d^2$

n = sample size

p = prevalence of the disease

q = 100 – p

d = error i.e. 10% of ‘p’ (if prevalence is not known it is taken as 50%).

Selection Criteria:

Inclusion Criteria:

Patients aged between 40 to 70 years diagnosed with type 2 diabetes mellitus.

Exclusion Criteria:

Patients with hypertension, heart disease, neurological disorders, psychiatric illness, tuberculosis, asthma, breast cancer and skin disorders were excluded from the study.

Procedure :

Permission was obtained from Head of Department of Anatomy and the Principal, J. N. Medical College, Belgaum to conduct the study. The project was submitted to Independent Ethics Committee of J. N. Medical College, Belgaum. After getting the approval letter from Independent Ethics Committee the study was commenced.

The patients were asked to wash their hands clean and dry. The method adopted for printing palm was modified ink method by Purvis Smith (1969).

Printers duplicating ink from Kores was used for taking prints. Other materials like cardboard roller, gauze pads and sheets of paper were used.

Fingertips were rolled manually to ensure full prints of ridges, then the palm was rolled on cardboard roller with paper, taking care that the cupped regions of the palm were printed properly.

Method of counting:

In a loop – line was drawn from the core to the triradius and the ridges crossing the line were counted. The opening of the loop to the ulnar or radial side was noted as ‘lu’ and ‘rl’ respectively.

In a whorl – whorl has 2 triradii, hence counting was done by drawing 2 lines from core to the 2 triradii.

In an arch – the triradius is a core, hence the count is zero.

Angles –

adt, dat, atd – a line was drawn from axial triradius 't' to the digital triradii 'a' and 'd' and all the 3 angles in the triangle were measured using a protractor.

a-b ridge count –

The number of ridges crossing the line drawn from 'a' to 'b' were counted.

Total finger ridge count (TFRC) –

Was recorded by adding the finger ridge counts taking the highest count of a whorl of all 10 fingers.

Absolute finger ridge count (AFRC) –

Was recorded by adding the finger ridge counts of all 10 fingers taking both the counts of a whorl if present, into consideration.

The following quantitative parameters were taken:

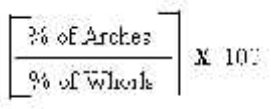
- finger ridge count,
- a-b ridge count,
- total finger ridge count,
- absolute finger ridge count and
- atd, adt and dat angles.

The following qualitative parameters were taken:

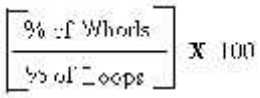
- finger ridge patterns and
- palmar flexion creases.

Dankmeijer's Index, Furuhata's Index and pattern intensity index were calculated for the fingertip patterns as follows:

1. Dankmeijer's Index -



2. Furuhata's Index -



3. Pattern intensity index –

   2 x (whorls + loops) ÷ n

STATISTICAL ANALYSIS

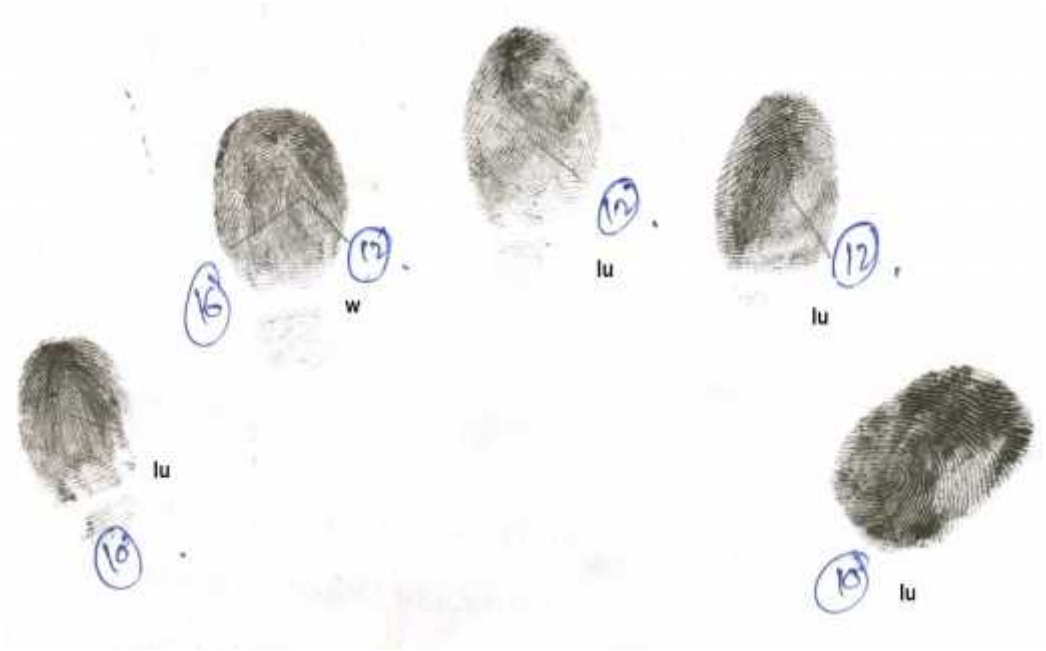
For quantitative analysis the arithmetic mean and standard deviation was calculated and the Student 't' test was applied. For qualitative analysis the Chi squared test was applied.

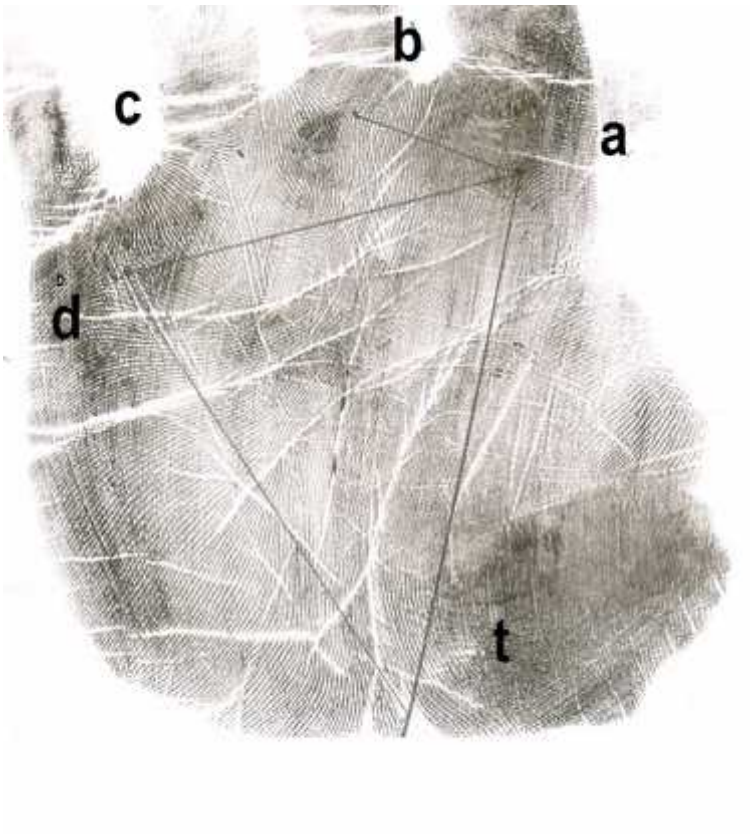
FIGURE 3 - MATERIALS FOR RECORDING FINGERPRINTS – ROLLER, LENS MAGNIFIER, PROTRACTOR AND DUPLICATING INK

FIGURE 4 - METHOD OF RECORDING PALM PRINTS USING ROLLER, PAPER AND DUPLICATING INK

FIGURE 5 - METHOD OF RECORDING FINGER PRINTS WITH DUPLICATING INK

FIGURE 6 - METHOD OF RIDGE COUNTING AND MEASUREMENT OF ANGLES





RESULTS

The present study was conducted in KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum on patients of type 2 diabetes mellitus attending Medicine Out Patient Department during the period of January 2012 to December 2012.

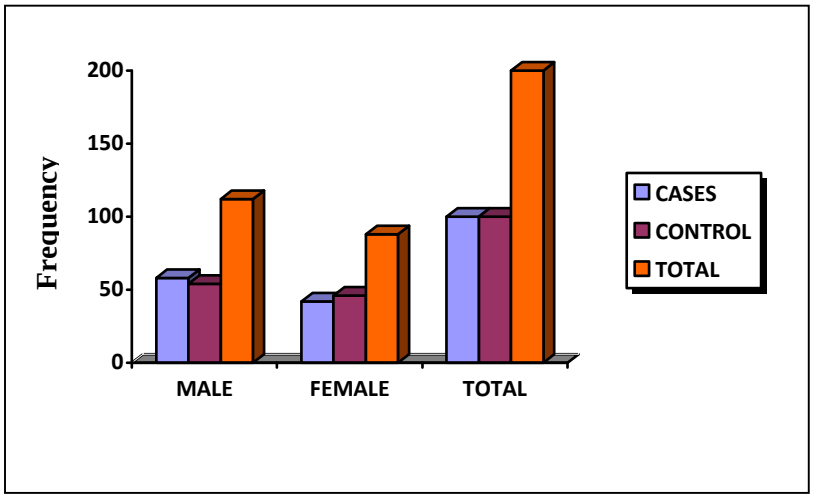
For quantitative analysis the arithmetic mean and standard deviation was calculated and the Student‘t’ test was applied. For qualitative analysis the Chi squared test was applied.

The data obtained is tabulated as follows:

TABLE 1 – SEX RATIO

SEX	MALE	FEMALE	TOTAL
CASES	58	42	100
CONTROL	54	46	100
TOTAL	112	88	200

GRAPH 1: Bar diagram showing comparison of males and females

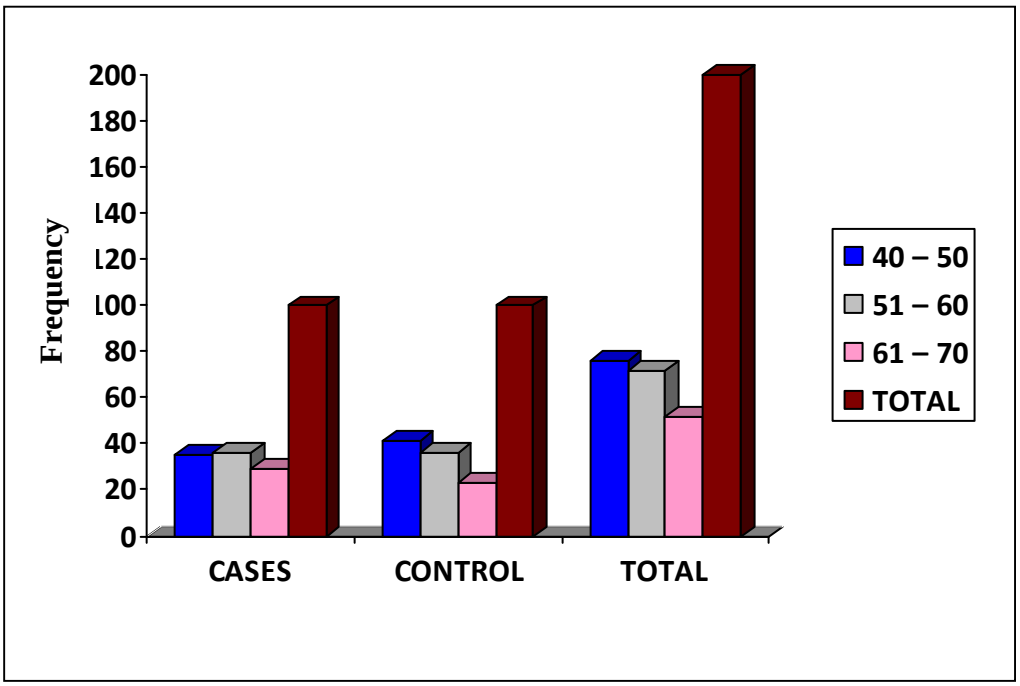


Out of 100 diabetic patients 58% were male, and 42% were female. And out of 100 controls 54% were male, and 46% were female. A total of 56% were male in both groups combined and 44% were female.

TABLE 2 – AGE GROUP

AGE GROUP	CASES	CONTROL	TOTAL
40 – 50	35	41	76
51 – 60	36	36	72
61 – 70	29	23	52
TOTAL	100	100	200

GRAPH 2: Bar diagram showing comparison of age group of cases and controls



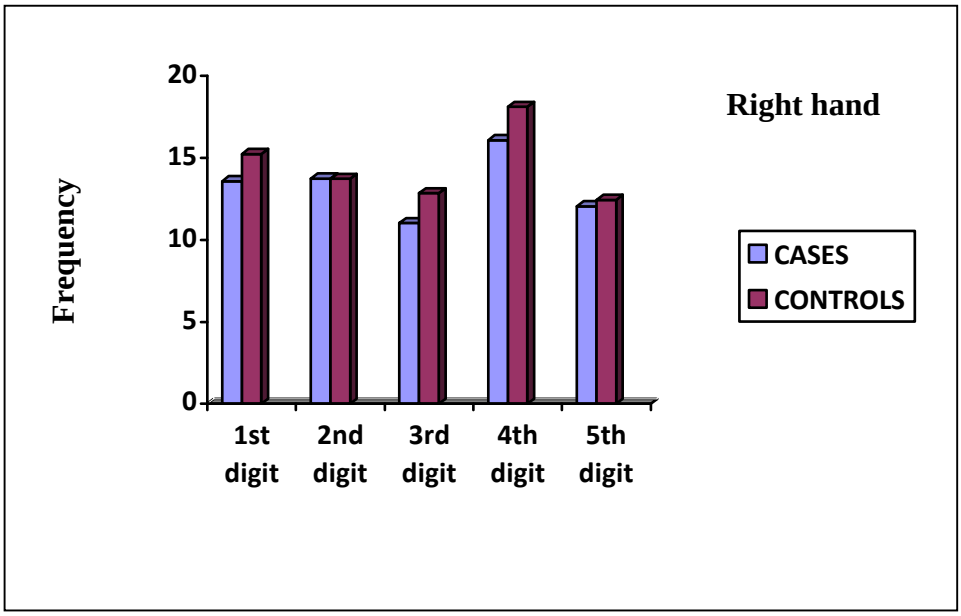
Out of total cases 35% were in the age group 40 – 50, 36% were in the age group 51 – 60 and 29% were in the age group 61 – 70. Out of total controls 41% were in the age group 40 – 50, 36% were in the age group 51 – 60 and 23% were in the age group 61 – 70.

Out of total patients, 38% were in age group 40 - 50, 36% were in age group 51 – 60 and 26% were in age group 61 – 70.

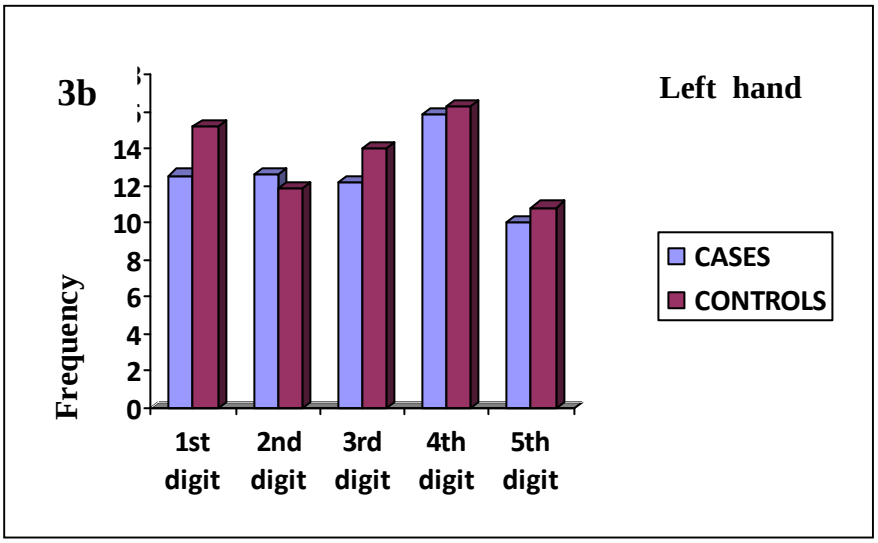
TABLE 3 – MEAN FINGER RIDGE COUNTS OF CASES AND CONTROLS IN DIGITS AND HANDS SEPARATE

FINGER RIDGE COUNT	CASES MEAN+/-SD	CONTROL MEAN+/-SD	P - VALUE	t
RIGHT HAND				
1st digit	13.58+/-7.38	15.24+/-9.96	0.182	1.338
2nd digit	13.74+/-9.16	13.72+/-10.56	0.989	0.014
3rd digit	11.03+/-8.02	12.85+/-9.09	0.135	1.500
4th digit	16.08+/-9.75	18.11+/-9.71	0.142	1.475
5th digit	12.04+/-8.13	12.43+/-8.28	0.737	0.336
TOTAL	66.47+/-29.23	72.35+/-35.85	0.205	1.271
LEFT HAND				
1st digit	12.56+/-6.67	15.21+/-9.42	0.023	2.294
2nd digit	12.60+/-9.77	11.85+/-10.19	0.596	0.531
3rd digit	12.22+/-8.30	13.97+/-8.60	0.145	1.436
4th digit	15.86+/-9.03	16.27+/-9.33	0.753	0.316
5th digit	10.02+/-6.96	10.84+/-7.36	0.419	0.809
TOTAL	63.26+/-25.55	68.14+/-29.75	0.215	1.244

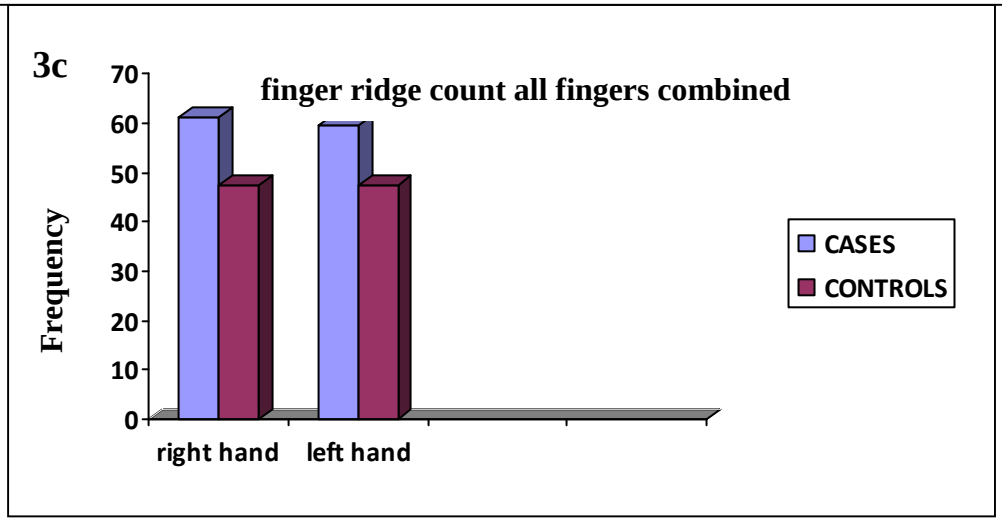
GRAPH 3a: Bar diagram showing comparison of mean finger ridge counts of cases and controls in digits in right hand



GRAPH 3b: Bar diagram showing comparison of mean finger ridge counts of cases and controls in digits in left hand



GRAPH 3c: Bar diagram showing comparison of mean finger ridge counts of cases and controls in all digits combined



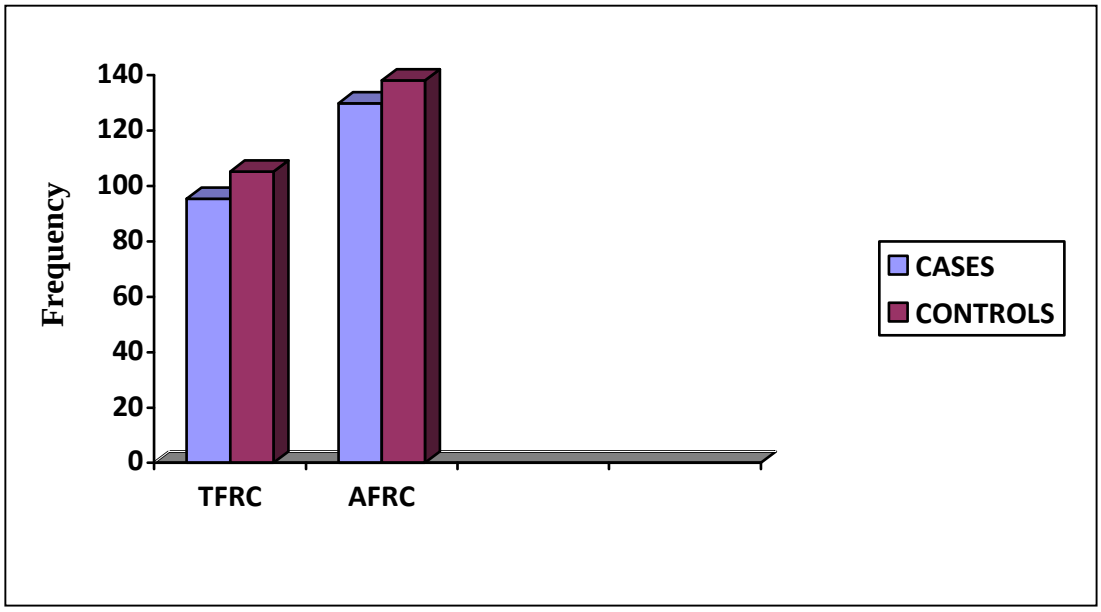
Finger ridge counts in each digit with hands separate reveals the difference between cases and controls which was statistically not significant ($p > 0.05$).

Finger ridge counts in all digits with hands separate in cases had a mean of 66.47 in right hand with standard deviation of 29.23 and in the left hand the mean was 63.26 with standard deviation of 25.55. In controls the mean in right hand was 72.35 with standard deviation of 35.85 and in the left hand the mean was 68.14 with standard deviation of 29.75. The difference was statistically not significant.

TABLE 4 – MEAN TOTAL FINGER RIDGE COUNTS AND ABSOLUTE FINGER RIDGE COUNT IN CASES AND CONTROLS

FINGER RIDGE COUNT	CASES – MEAN+/-SD	CONTROL – MEAN+/-SD	t	P VALUE
TOTAL	95.37+/-36.12	105.18+/-41.09	1.393	0.074
ABSOLUTE	129.65+/-56.65	137.95+/-66.05	0.949	0.344

GRAPH 4: Bar diagram showing comparison of mean total finger ridge counts and absolute finger ridge count in cases and controls



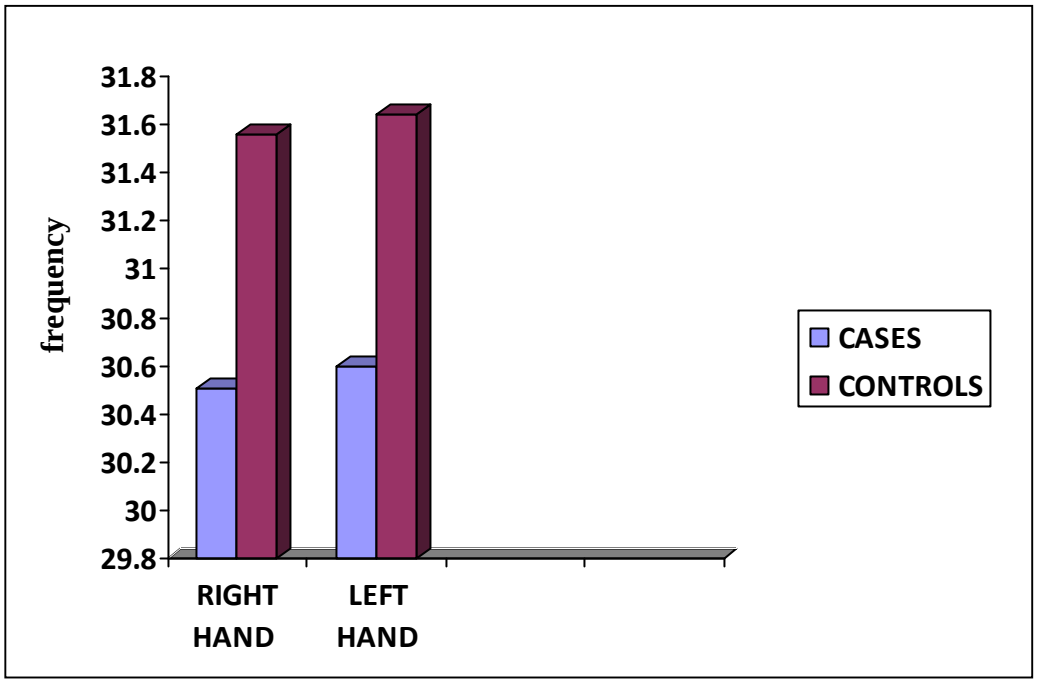
The mean of total finger ridge count in cases was 95.37 with standard deviation of 36.12 and in controls the mean was 105.18 with standard deviation of 41.09, the difference in total finger ridge count between cases and controls was statistically not significant indicating decrease in total finger ridge counts in cases as compared to controls.

The mean of absolute finger ridge count in cases was 129.65 with standard deviation of 56.65 and in controls the mean was 137.95 with standard deviation of 66.05, the difference was not statistically significant.

TABLE 5 – MEAN A-B – RIDGE COUNT OF RIGHT AND LEFT HANDS OF CASES AND CONTROLS

AB – RIDGE COUNT	CASES MEAN+/-SD	CONTROL MEAN+/-SD	t	P VALUE
RIGHT HAND	30.51+/-4.38	31.56+/-3.83	1.803	0.073
LEFT HAND	30.60+/-4.18	31.64+/-3.54	1.898	0.059

GRAPH 5: Bar diagram showing comparison of mean a-b ridge count of right and left hands of cases and controls



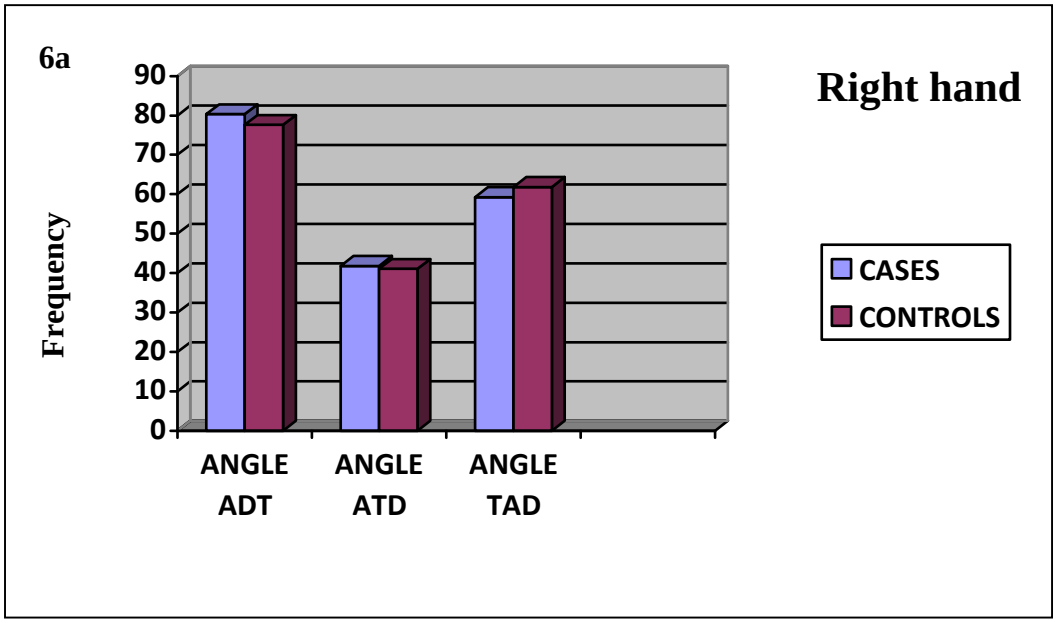
The mean a-b ridge count in right hand of cases was 30.51 with standard deviation of 4.38 and in controls the mean was 31.56 with standard deviation of 3.83. In the left hand of cases the mean was 30.60 with standard deviation of 4.18 and in controls the mean was 31.64 with standard deviation of 3.54.

The difference of a-b ridge count between cases and controls in both right and left hand was statistically not significant indicating a-b ridge count in cases was comparatively less than that in controls.

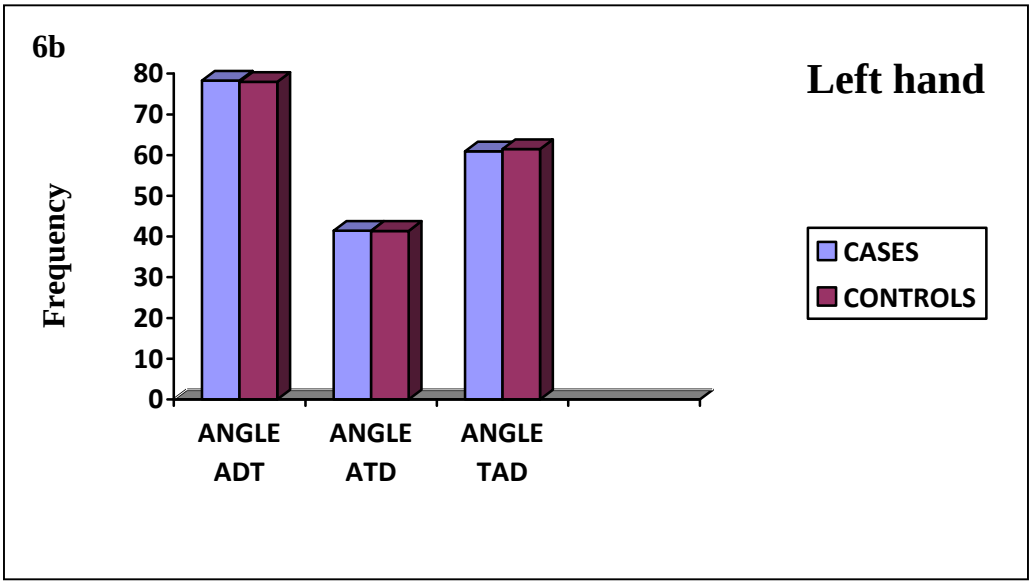
TABLE 6 – MEAN ANGLES OF PALMAR TRIRADII IN RIGHT AND LEFT HANDS IN CASES AND CONTROLS

ANGLES	CASES MEAN+/-SD	CONTROL MEAN+/-SD	t	P VALUE
RIGHT HAND				
ADT	80.29+/-5.68	77.59+/-4.87	3.608	0.001
ATD	41.80+/-5.80	41.08+/-5.14	0.928	0.354
TAD	59.24+/-5.84	61.84+/-6.05	3.281	0.001
LEFT HAND				
ADT	78.28+/-5.61	77.96+/-5.00	0.426	0.671
ATD	41.41+/-5.84	41.37+/-6.01	0.047	0.962
TAD	60.91+/-6.16	61.48+/-5.92	0.666	0.506

GRAPH 6a: Bar diagram showing comparison of mean angles of palmar triradii in right hand in cases and controls



GRAPH 6b: Bar diagram showing comparison of mean angles of palmar triradii in left hand in cases and controls



The mean of adt angle of right hand of cases was 80.29^0 with standard deviation of 5.68^0, whereas in controls the mean was 77.59^0 with standard deviation of 4.87^0, the difference was statistically significant with p- value <0.001 indicating that adt angle was more in cases in right hand as compared to that in controls.

The mean of adt angle of left hand of cases was 78.28^0 with standard deviation of 5.61^0, whereas in controls the mean was 77.96^0 with standard deviation of 5.00^0, the difference was statistically not significant.

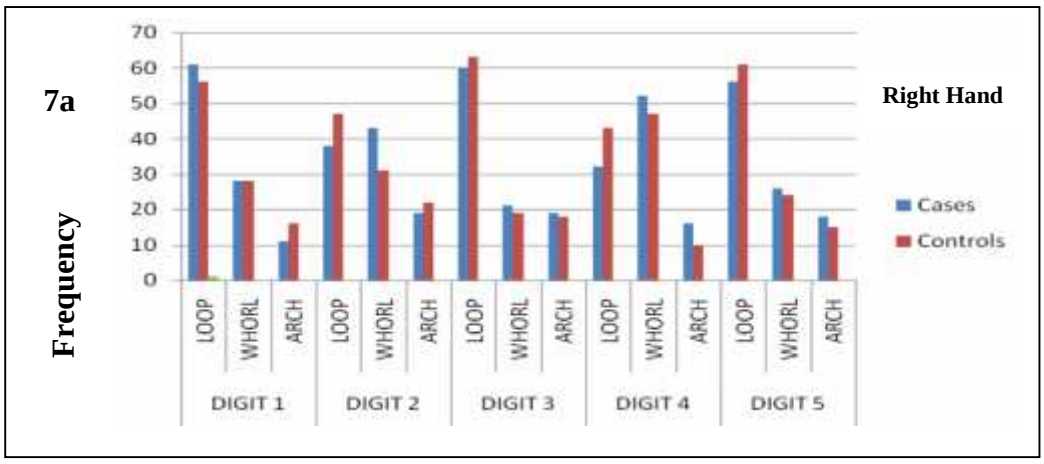
The mean of atd angle of right hand of cases was 41.80^0 with standard deviation of 5.80^0, whereas in controls the mean was 41.08^0 with standard deviation of 5.14^0, the difference was statistically not significant. The mean of atd angle of left hand of cases was 41.41^0 with standard deviation of 5.84^0, whereas in controls the mean was 41.37^0 with standard deviation of 6.01^0.The difference was statistically not significant.

The mean of tad angle of right hand of cases was 59.24^0 with standard deviation of 5.84^0, whereas in controls the mean was 61.84^0 with standard deviation of 6.05^0, the difference was statistically significant. It indicates that tad angle is less in cases in right hand as compared to controls. The mean of tad angle of left hand of cases was 60.91^0 with standard deviation of 6.16^0, whereas in controls the mean was 61.48^0 with standard deviation of 5.92^0. The difference was statistically not significant.

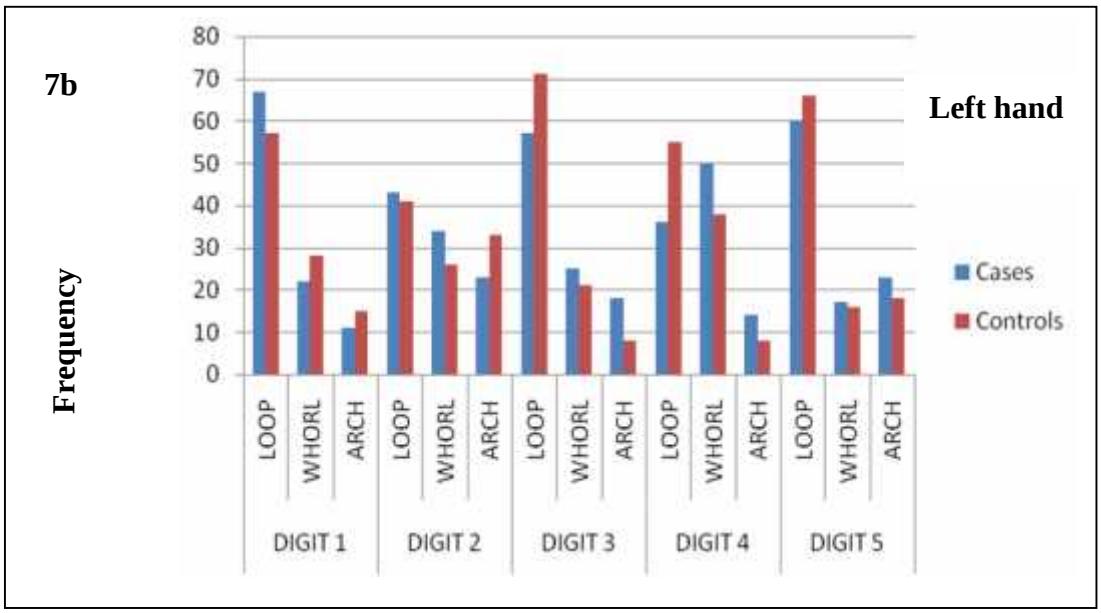
TABLE 7 – FINGERTIP PATTERN IN DIGITS SEPARATE AND HANDS SEPARATE IN CASES AND CONTROLS

DIGIT	TYPE	RIGHT HAND CASES	RIGHT HAND CONTROLS	P VALUE	LEFT HAND CASES	LEFT HAND CONTROLS	P VALUE
DIGIT 1	LOOP	61	56	0.515	67	57	0.145
	WHORL	28	28	1.000	22	28	0.327
	ARCH	11	16	0.301	11	15	0.400
DIGIT 2	LOOP	38	47	0.192	43	41	0.774
	WHORL	43	31	0.079	34	26	0.183
	ARCH	19	22	0.599	23	33	0.115
DIGIT 3	LOOP	60	63	0.663	57	71	0.039
	WHORL	21	19	0.724	25	21	0.502
	ARCH	19	18	0.856	18	08	0.036
DIGIT 4	LOOP	32	43	0.108	36	55	0.007
	WHORL	52	47	0.479	50	38	0.087
	ARCH	16	10	0.207	14	08	0.175
DIGIT 5	LOOP	56	61	0.515	60	66	0.380
	WHORL	26	24	0.744	17	16	0.849
	ARCH	18	15	0.568	23	18	0.381

GRAPH 7a: Bar diagram showing comparison of finger tip pattern in digits separate in right hand of cases and controls



GRAPH 7b: Bar diagram showing comparison of finger tip pattern in digits separate in left hand of cases and controls

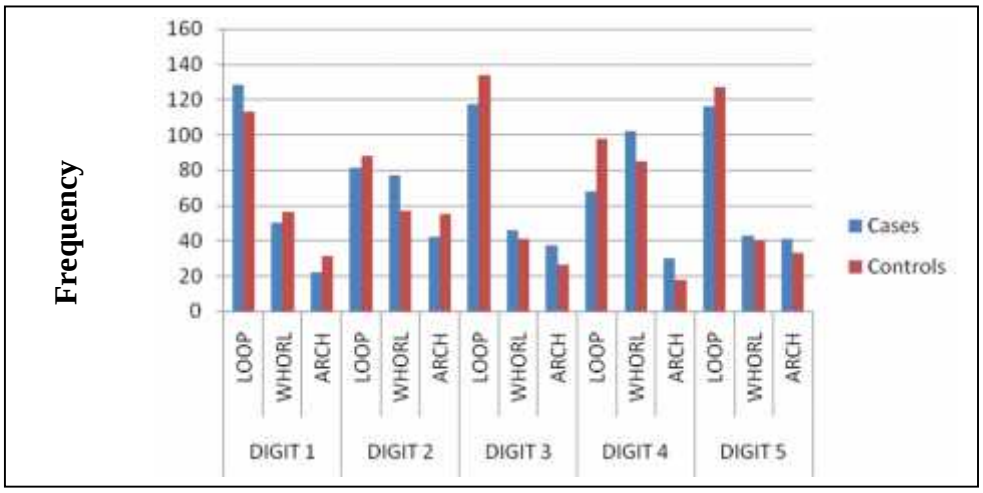


Fingertip pattern in digits separate and hands separate in cases and controls showed that there was a statistically significant increase in loops of 3rd digit of left hand of controls as compared to cases (p – 0.039). There was a statistically significant increase in loops of 4th digit of left hand of controls as compared to cases (p – 0.036). There was a statistically significant increase in the arches in 3rd digit of left hand of cases as compared to controls (p – 0.007), whereas other digits in cases and controls did not show statistically significant difference.

TABLE 8 – FINGERTIP PATTERN IN DIGITS SEPARATE AND HANDS COMBINED IN CASES AND CONTROLS

DIGIT	TYPE	CASES	CONTROLS	P VALUE
DIGIT 1	LOOP	128	113	0.125
	WHORL	50	56	0.497
	ARCH	22	31	0.184
DIGIT 2	LOOP	81	88	0.479
	WHORL	77	57	0.034
	ARCH	42	55	0.129
DIGIT 3	LOOP	117	134	0.079
	WHORL	46	41	0.545
	ARCH	37	26	0.131
DIGIT 4	LOOP	68	98	0.002
	WHORL	102	85	0.088
	ARCH	30	18	0.065
DIGIT 5	LOOP	116	127	0.260
	WHORL	43	40	0.711
	ARCH	41	33	0.303

GRAPH 8: Bar diagram showing comparison of fingertip pattern in digits separate and hands combined in cases and controls

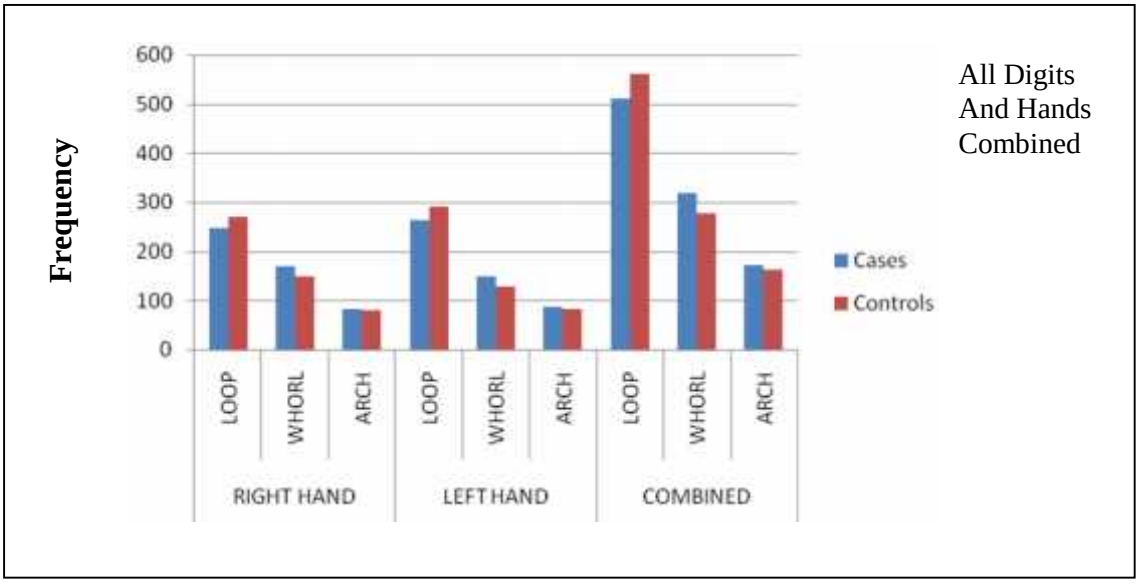


Fingertip pattern in digits separate and hands combined in cases and controls showed that there was a statistically significant increase in number of whorls in 2nd digit of cases as compared to controls (p – 0.034). The number of loops in 4th digit of controls was more as compared to cases, which was statistically significant (p – 0.002). The fingertip patterns in other digits of cases and controls did not show any statistically significant difference.

TABLE 9 – FINGERTIP PATTERN IN ALL DIGITS COMBINED AND IN BOTH HANDS COMBINED IN CASES AND CONTROLS

DIGIT	TYPE	CASES	CONTROLS	P VALUE
RIGHT HAND	LOOP	247	270	0.146
	WHORL	170	149	0.154
	ARCH	83	81	0.864
LEFT HAND	LOOP	263	290	0.086
	WHORL	148	129	0.179
	ARCH	88	82	0.613
COMBINED	LOOP	510	560	0.025
	WHORL	318	278	0.050
	ARCH	171	163	0.632

GRAPH 9: Bar diagram Showing Comparison of Finger Tip Pattern in All Digits combined and in both hands combined in cases and controls



Fingertip patterns in all digits combined and in both hands combined in cases and controls showed that there was statistically significant increase in the number of loops in controls as compared to cases (p – 0.025), whereas the whorl and arch patterns did not show any statistically significant difference between cases and controls.

The results of various indices were:

1. Dankmeijer's Index - Cases - 171/318 X 100 = 53.77

   Controls – 163/278 X 100 = 58.63

   Dankmeijer's index was significantly less in cases as compared to controls.

2. Furuhata's Index - Cases – 318/510 X 100 = 62.35

   Controls – 278/560 X 100 = 49.64

   Furuhata's index was significantly more in cases as compared to controls.

3. Pattern intensity index – Cases – 2 X (318 + 510)/100 = 16.56

   Controls – 2 X (278 + 560)/100 = 16.76

   Pattern intensity index was comparatively less in cases than in controls.

TABLE 10 - FINGERTIP PATTERN IN DIGITS SEPARATE AND HANDS SEPARATE AND SEX SEPARATE IN CASES AND CONTROLS

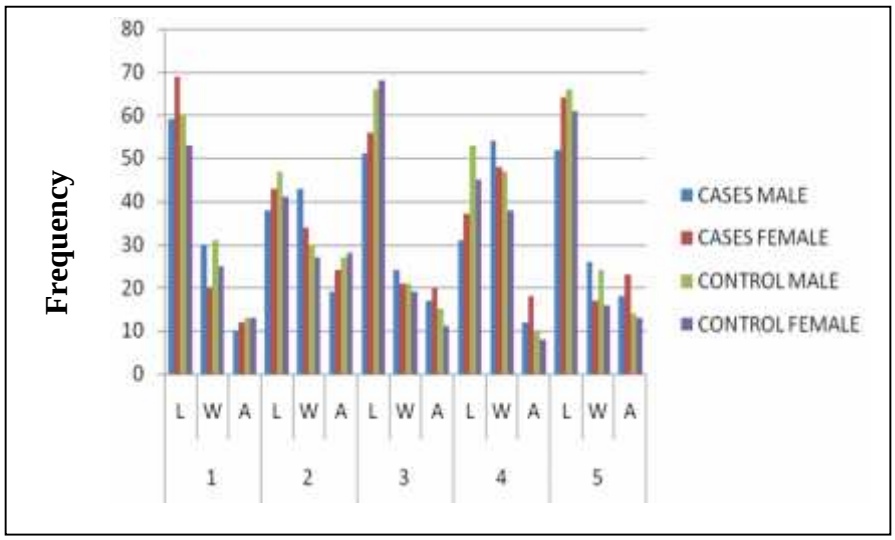
DIGIT	TYPE	CASES				CONTROLS				P VALUE		P VALUE	
		MALE		FEMALE		MALE		FEMALE		MALE		FEMALE	
		RH	LH	RH	LH	RH	LH	RH	LH	RH	LH	RH	LH
1	L	29	30	32	37	30	30	26	27	0.971	0.726	0.716	0.085
	W	15	15	13	7	15	16	13	12	0.895	0.983	0.658	0.153
	A	5	5	6	6	6	7	5	8	0.803	0.612	0.951	0.482
2	L	18	20	20	23	27	20	20	21	0.126	0.935	0.798	0.821
	W	23	20	20	14	15	15	16	11	0.063	0.265	0.544	0.563
	A	9	10	10	14	11	16	11	17	0.724	0.191	0.725	0.434
3	L	28	23	32	24	30	36	33	35	0.866	0.068	0.639	0.050
	W	11	14	10	11	10	11	9	10	0.725	0.263	0.873	0.677
	A	9	8	10	10	10	5	8	3	0.875	0.239	0.669	0.026
4	L	15	16	17	20	23	30	20	25	0.267	0.025	0.235	0.136
	W	27	27	25	23	27	20	20	18	0.468	0.055	0.720	0.552
	A	6	6	10	8	5	5	5	3	0.576	0.601	0.270	0.155
5	L	26	26	30	34	31	35	30	31	0.507	0.218	0.698	0.237
	W	16	10	10	7	14	10	10	6	0.533	0.795	0.745	0.832
	A	8	10	10	13	8	6	7	6	0.899	0.186	0.508	0.121

Fingertip pattern in digits separate and hands separate and sex separate in cases and controls showed statistically significant decrease in number of arches in the 3rd digit of left hand of females in controls as compared to left hand of females in cases (p – 0.026). There was statistically significant decrease in the number of loops in the 4th digit of left hand of males in cases as compared to left hand of males in controls (p – 0.025). The other fingertip patterns did not show any statistically significant difference between the sexes of cases and controls.

TABLE 11 – FINGERTIP PATTERN IN DIGITS SEPARATE AND SEX SEPARATE AND HANDS COMBINED IN CASES AND CONTROLS

DIGIT	TYPE	CASES		CONTROL		P VALUE	P VALUE
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
1	L	59	69	60	53	0.783	0.148
	W	30	20	31	25	0.939	0.210
	A	10	12	13	13	0.590	0.621
2	L	38	43	47	41	0.298	0.985
	W	43	34	30	27	0.035	0.401
	A	19	24	27	28	0.234	0.389
3	L	51	56	66	68	0.188	0.091
	W	24	21	21	19	0.365	0.696
	A	17	20	15	11	0.480	0.073
4	L	31	37	53	45	0.018	0.044
	W	54	48	47	38	0.063	0.498
	A	12	18	10	8	0.445	0.076
5	L	52	64	66	61	0.182	0.365
	W	26	17	24	16	0.513	0.791
	A	18	23	14	13	0.308	0.171

GRAPH 10: Bar diagram showing comparison of fingertip pattern in all digits separate and sex separate and hands combined in cases and controls

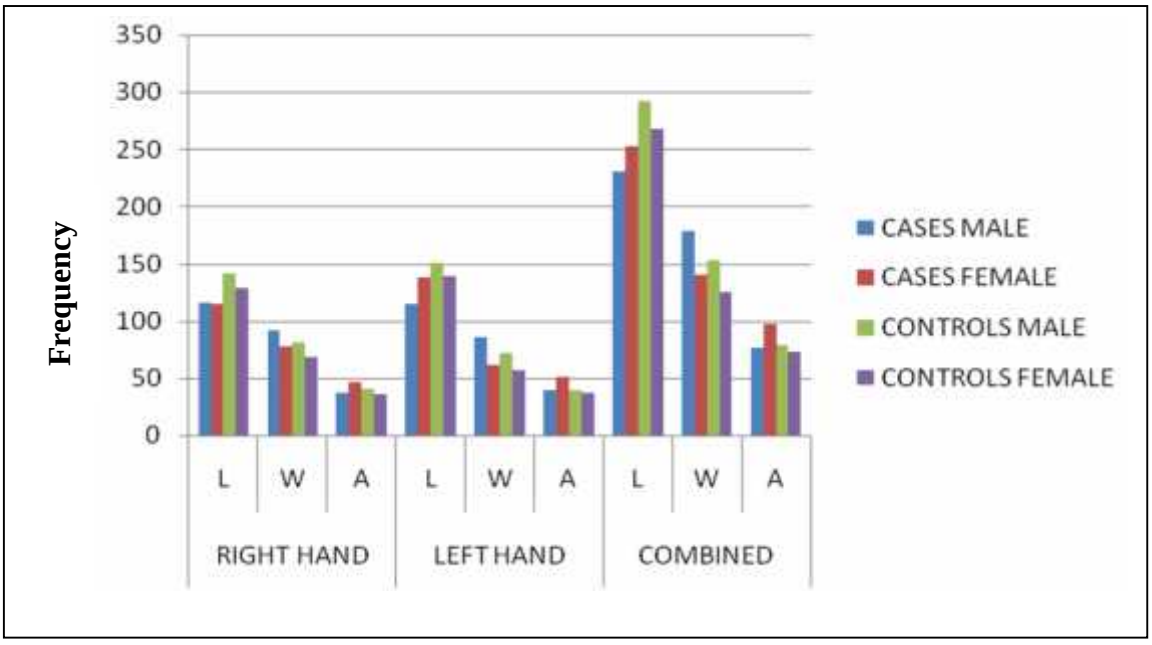


Fingertip pattern in digits separate and sex separate and hands combined in cases and controls showed a statistically significant increase in the number of whorls of 2nd digit of males in cases as compared to males in controls (p – 0.035). There was statistically significant decrease in number of loops of 4th digit of males in cases as compared to males in controls (p – 0.018). There was statistically significant increase in the number of loops of 4th digit of females in controls as compared to females in cases (p – 0.044). Other fingertip patterns in males and females in other digits of cases and controls did not show any statistically significant difference.

TABLE 12 – FINGERTIP PATTERN IN ALL DIGITS COMBINED AND IN BOTH HANDS COMBINED IN BOTH SEXES IN CASES AND CONTROLS

HAND	TYPE	CASES		CONTROLS		P VALUE	P VALUE
		MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
RIGHT HAND	L	116	115	141	129	0.145	0.115
	W	92	78	81	68	0.115	0.417
	A	37	46	40	36	0.959	0.276
LEFT HAND	L	115	138	151	139	0.029	0.298
	W	86	62	72	57	0.044	0.951
	A	39	51	39	37	0.673	0.205
COMBINED	L	231	253	292	268	0.010	0.068
	W	178	140	153	125	0.011	0.546
	A	76	97	79	73	0.794	0.095

GRAPH 11: Bar diagram showing comparison of fingertip pattern in all digits combined and in both hands combined in both sexes in cases and controls



Fingertip pattern in all digits combined and in both hands combined in both sexes in cases and controls showed a statistically significant decrease in the number of loops in the left hand of males in cases as compared to left hand of males in controls

(p – 0.029). There was statistically significant increase in the number of whorls in the left hand of males in cases as compared to the left hand of males in controls (p – 0.044). There was statistically significant decrease in the number of loops in both hands combined of males in cases as compared to both hands combined of males in controls (p – 0.010). There was statistically significant increase in the number of whorls in both hands combined of males in cases as compared to both hands combined of males in controls (p – 0.011), whereas there was no statistically significant difference between hands and between cases and controls in females.

1. Dankmeijer's index – Male cases – 76/178 X 100 = 42.69

   Male controls – 97/140 X 100 = 69.28

   Female cases – 79/153 X 100 = 51.63

   Female controls – 73/125 X 100 = 58.14

   Dankmeijer's index was significantly more in male and female controls as compared to cases.

2. Furuhata's index – Male cases – 178/231 X 100 = 77.05

   Male controls – 140/253 X 100 = 55.33

   Female cases – 153/292 X 100 = 52.39

   Female controls – 125/268 X 100 = 46.64

   Furuhata's index was significantly more in male and female cases as compared to controls.

3. Pattern intensity index – Male cases – 2 X (231 + 178)/ 58 = 14.10

   Male controls – 2 X (253 + 140)/ 54 = 14.55

   Female cases – 2 X (292 + 153)/ 42 = 21.19

   Female controls – 2 X (268 + 125)/46 = 17.08

   Pattern intensity index was significantly more in female cases and controls as compared to males.

DISCUSSION

The present study was conducted in KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum on patients of type 2 diabetes mellitus attending Medicine Out Patient Department during the period of January to December 2012.

Diabetes is a hereditary disease with a multifactorial inheritance. Hence, the heredity of the dermatoglyphic features conforms to the polygenic system with an additive effect for its prediction, whether a person is prone to diabetes or not.[32]

Out of 100 diabetic patients 58% were male and 42% were female. And out of 100 controls 54% were male and 46% were female. A total of 56% were male in both groups combined and 44% were female in both groups combined.

Out of total cases 35% were in the age group 40 – 50, 36% were in the age group 51 – 60 and 29% were in the age group 61 – 70. Out of total controls 41% were in the age group 40 – 50, 36% were in the age group 51 – 60 and 23% were in the age group 61 – 70. Out of total patients, 38% were in age group 40 - 50, 36% were in age group 51 – 60 and 26% were in age group 61 – 70.

Finger ridge counts in each digit with hands separate reveals that the difference between cases and controls was statistically not significant.

Finger ridge counts in all digits with hands separate in cases had a mean of 66.47 in right hand with standard deviation of 29.23 and in the left hand the mean was 63.26 with standard deviation of 25.55. In controls the mean in right hand was 72.35

with standard deviation of 35.85 and in the left hand the mean was 68.14 with standard deviation of 29.75. The difference was statistically not significant. This was in conformity to findings in other studies.

The mean of total finger ridge count in cases was 95.37 with standard deviation of 36.12 and in controls the mean was 105.18 with standard deviation of 41.09, the difference in total finger ridge count between cases and controls was statistically not significant, indicating decrease in total finger ridge counts in cases as compared to controls.

This was in contradiction to the findings of Ahuja and Chakarvarti et al (1981)[34], Iqbal et al (1978)[35], and Barta et al (1970)[16], where the mean total finger ridge count was higher in the diabetics than in the controls.

The mean of absolute finger ridge count in cases was 129.65 with standard deviation of 56.65 and in controls the mean was 137.95 with standard deviation of 66.05. The difference was not statistically significant.

These findings were not in accordance with those of Roopa. Ravindranath and I. M. Thomas (1995)[5], where the mean absolute finger ridge count was higher in the patients.

The mean a-b ridge count in right hand of cases was 30.51 with standard deviation of 4.38 and in controls the mean was 31.56 with standard deviation of 3.83. In the left hand of cases the mean was 30.60 with standard deviation of 4.18 and in

controls the mean was 31.64 with standard deviation of 3.54. The difference of a-b ridge count between cases and controls in both right and left hand was statistically not significant.

Similar findings were observed by Manoj Kumar et al in their study.[31] But this was in contrast with Ziegler et al (1993)[36] findings, which showed a significantly low a-b ridge count.

The mean of adt angle of right hand of cases was 80.29^0 with standard deviation of 5.68^0, whereas in controls the mean was 77.59^0 with standard deviation of 4.87^0, the difference was statistically significant with p- value <0.001 indicating that adt angle was more in cases in right hand as compared to that in controls. The mean of adt angle of left hand of cases was 78.28^0 with standard deviation of 5.61^0, whereas in controls the mean was 77.96^0 with standard deviation of 5.00^0, the difference was statistically not significant. Similar findings were observed by Manoj Kumar et al, in their study.[31]

The mean of atd angle of right hand of cases was 41 $.80^0$ with standard deviation of 5.80^0, whereas in controls the mean was 41.08^0 with standard deviation of 5.14^0, the difference was statistically not significant. The mean of atd angle of left hand of cases was 41.41^0 with standard deviation of 5.84^0, whereas in controls the mean was 41.37^0 with standard deviation of 6.01^0, the difference was statistically not significant. Other studies done by Manoj Kumar et al[31], Sant S.M. et al (1983)[37] and

Rajnigandga V. et al (2006)[38] showed that atd angles of patients were significantly higher.

The mean of tad angle of right hand of cases was 59.24^0 with standard deviation of 5.84^0, whereas in controls the mean was 61.84^0 with standard deviation of 6.05^0, the difference was statistically significant. It indicated that tad angle was less in cases in right hand as compared to controls. The mean of tad angle of left hand of cases was 60.91^0 with standard deviation of 6.16^0, whereas in controls the mean was 61.48^0 with standard deviation of 5.92^0. The difference was statistically not significant. In study done by Manoj Kumar et al[31], the maximum right side tad angle distribution in diabetics fell in the range of 60^0–69^0 (46%) as compared to that in the controls [50^0-59^0 (46%)], but it was reversed on the left side. Only the left 'tad' angle in the diabetic females differed significantly (p>.01) from that in the normal females. Study done by Pramila et al[33] showed higher incidences of dat angles on right hand and left hand of both sexes. The statistically significant differences in adt and tad angles were not found in many other studies.

Fingertip pattern in digits separate and hands separate in cases and controls showed that there was a statistically significant increase in loops of 3rd digit of left hand of controls as compared to cases (p – 0.039). There was a statistically significant increase in loops of 4th digit of left hand of controls as compared to cases (p – 0.036). There was a statistically significant increase in the arches in 3rd digit of left hand of

cases as compared to controls (p – 0.007), whereas other digits in cases and controls did not show statistically significant difference.

Fingertip pattern in digits separate and hands combined in cases and controls showed that there was a statistically significant increase in number of whorls in 2nd digit of cases as compared to controls (p – 0.034). The number of loops in 4th digit of controls was more as compared to cases, which was statistically significant (p – 0.002). The fingertip patterns in other digits of cases and controls did not show any statistically significant difference.

Fingertip patterns in all digits combined and in both hands combined in cases and controls showed that there was statistically significant increase in the number of loops in controls as compared to cases (p – 0.025), whereas the whorl and arch patterns did not show any statistically significant difference between cases and controls.

Dankmeijer's index was significantly less in cases as compared to controls. Furuhatas index was significantly more in cases as compared to controls. Pattern intensity index was comparatively less in cases than in controls.

In the study done by Pushpa et al[33] the percentage of arches was more in diabetic group than in the control group. Their study showed an increased frequency of arches in diabetic males and females. The difference observed in male group was not statistically significant. The difference was more marked in diabetic females,

difference being more on the left side. S. M. Sant et al[37] and Jullian Verbov[39] found an increased frequency of arches in female diabetic patients. Roopa Ravindranath and I. M. Thomas[5] found increased frequency of arches in diabetic males and females than controls while Sarthak Sengupta[40] found increased frequency of arches in male diabetics. Our findings do not correlate with findings of above workers.

Fingertip pattern in digits separate and hands separate and sex separate in cases and controls showed statistically significant decrease in number of arches in the 3rd digit of left hand of females in controls as compared to left hand of females in cases (p – 0.026). There was statistically significant decrease in the number of loops in the 4th digit of left hand of males in cases as compared to left hand of males in controls (p – 0.025). The other fingertip patterns did not show any statistically significant difference between the sexes of cases and controls.

Fingertip pattern in digits separate and sex separate and hands combined in cases and controls showed a statistically significant increase in the number of whorls of 2nd digit of males in cases as compared to males in controls (p – 0.035). There was statistically significant decrease in number of loops of 4th digit of males in cases as compared to males in controls (p – 0.018). There was statistically significant increase in the number of loops of 4th digit of females in controls as compared to females in cases (p – 0.044). Other fingertip patterns in males and females in other digits of cases and controls did not show any statistically significant difference.

Fingertip pattern in all digits combined and in both hands combined in both sexes in cases and controls showed a statistically significant decrease in the number of loops in the left hand of males in cases as compared to left hand of males in controls (p – 0.029). There was statistically significant increase in the number of whorls in the left hand of males in cases as compared to the left hand of males in controls (p – 0.044). There was statistically significant decrease in the number of loops in both hands combined of males in cases as compared to both hands combined of males in controls (p – 0.010). There was statistically significant increase in the number of whorls in both hands combined of males in cases as compared to both hands combined of males in controls (p – 0.011), whereas there was no statistically significant difference between hands and between cases and controls in females.

In the study done by Pushpa et al[33] the frequency of ulnar loops was found to be more in diabetic group than control group. Roopa Ravindranath and I. M. Thomas[5] found statistically significant increased frequency of ulnar loops in both sexes, more marked in left hand of diabetic females in contradiction to our study. S. M. Sant et al[37] observed that the frequency of ulnar loops and radial loops is decreased in both sexes.

S. M. Sant et al and Roopa Ravindranath and I. M. Thomas reported reduced frequency of radial loops. In our study difference in frequency of radial loops was minimal.

Pushpa et al[33] reported that the frequency of whorls was significantly reduced in diabetic group than control group. Jullian Verbov[39] found a decreased frequency of whorls in diabetic females. Roopa Ravindranath and I. M. Thomas[5] reported a decreased frequency of whorls in diabetic males and in left hands of diabetic females. Sarthak Sengupta[40] found increased frequency of whorls in male diabetics. S.M. Sant et al[37] reported an increased frequency of whorls in diabetic males and females. In the present study whorls are significantly increased in diabetics than controls.

In our study the Dankmeijer's index was significantly more in male and female controls as compared to cases. Furuhatas index was significantly more in male and female cases as compared to controls. Pattern intensity index was significantly more in female cases and controls as compared to males. In the study done by Pushpa et al[34], they showed that the Dankmeijer's Index was highest in female diabetic group and Furuhata's Index was highest in the male control group. Pattern intensity index was not studied by them.

CONCLUSION

Though dermatoglyphics generally does not play any major role in clinical diagnosis of diabetes mellitus, yet it can serve as a screening tool to select individuals from a larger population for further investigations to confirm or rule out diabetes mellitus.

The present study was undertaken to comparatively analyze the dermatoglyphic patterns in maturity onset diabetes mellitus patients and normal healthy controls and find a possible association between dermatoglyphic patterns and maturity onset diabetes mellitus. The aim was to find out if there are any markers, and the feasibility of the markers as a screening procedure to predict the possibility of developing maturity onset diabetes mellitus in otherwise normal individuals.

The present study showed that adt angle was significantly more in cases in right hand as compared to controls. The tad angle was less in cases in right hand as compared to controls. These statistically significant differences in adt and tad angles were not found in many other studies.

Fingertip patterns in all digits combined and in both hands combined in cases and controls showed that there was a statistically significant increase in the number of loops in controls as compared to cases, whereas the whorl and arch patterns did not show any statistically significant difference.

Our study showed a statistically significant decrease in the number of loops in the left hand of males in cases. There was statistically significant increase in the number of whorls in the left hand of males in cases. There was statistically significant decrease in the number of loops in both hands combined of males in cases. There was statistically significant increase in the number of whorls in both hands combined of males in cases.

In our study the Dankmeijer's index was significantly more in male and female controls as compared to cases. Furuhata's index was significantly more in male and female cases as compared to controls. Pattern intensity index was significantly more in female cases and controls as compared to males.

Contradictory findings have been observed mostly from different populations and studies due to a vast difference among the patterns or ridge counts in various populations. This calls for more caution in using dermatoglyphic patterns as markers or diagnostic tools. Findings of the present study after a careful analysis of different palmar dermatoglyphic variables highlight on the possible markers. There were many supporting findings and many contradictory findings to studies conducted by other researchers, hence there is lot of scope for further studies on a larger sample size and with other parameters.

SUMMARY

Finger print pattern study is part of dermatoglyphics and its association with type 2 diabetes mellitus is one of the current research areas. As both diabetes mellitus and dermatoglyphics are influenced by genetic and environmental factors, this study was intended to identify the various markers in dermatoglyphics for identifing the risk of developing type 2 diabetes mellitus.

The pathogenesis of type 2 diabetes involves the interaction of genetic and environmental risk factors that strongly contribute to the development of insulin resistance in the muscle and liver as well as to β-cell failure.

The study was conducted on 100 patients with diabetes mellitus and 100 controls, age, sex matched and those who do not have diabetes mellitus. The following quantitative parameters like finger ridge count, a-b ridge count, total finger ridge count, absolute finger ridge count, atd, adt and dat angles were studied. The following qualitative parameters like finger ridge patterns, palmar flexion creases were studied. Dankmeijer's Index, Furuhata's Index and Pattern intensity index were calculated for the fingertip patterns. For quantitative analysis the arithmetic mean and standard deviation was calculated and the Student 't' test was applied. For qualitative analysis the Chi squared test was applied.

The present study showed :

- Difference of a-b ridge count between cases and controls in both right and left hand was statistically not significant.
- An adt angle was significantly more in cases in right hand as compared to controls.

- The tad angle was less in cases in right hand as compared to controls. This statistically significant difference in adt and tad angles was not found in many other studies.
- Absolute Finger Ridge Counts and Total Finger Ridge Counts were lower in diabetics than in controls, but they were not statistically significant.
- Fingertip patterns in all digits combined and in both hands combined in cases and controls showed that there was a statistically significant increase in the number of loops in controls as compared to cases, whereas the whorl and arch patterns did not show any statistically significant difference.
- There was statistically significant increase in loops of 3^{rd} digit of left hand of controls.
- There was a statistically significant increase in loops of 4^{th} digit of left hand of controls.
- There was a statistically significant increase in the arches in 3^{rd} digit of left hand of cases.
- There was a statistically significant increase in number of whorls in 2^{nd} digit of cases.
- The number of loops in 4^{th} digit of controls was significantly more.
- There was statistically significant decrease in the number of loops in the left hand of males in cases.
- There was statistically significant increase in the number of whorls in the left hand of males in cases.
- There was statistically significant decrease in the number of loops in both hands combined of males in cases.

- There was statistically significant increase in the number of whorls in both hands combined of males in cases.
- There was statistically significant decrease in number of arches in the 3rd digit of left hand of females in controls.
- There was statistically significant decrease in the number of loops in the 4th digit of left hand of males in cases.
- There was a statistically significant increase in the number of whorls of 2nd digit of males in cases.
- There was statistically significant decrease in number of loops of 4th digit of males in cases.
- There was statistically significant increase in the number of loops of 4th digit of females in controls.
- Dankmeijer's index was significantly more in male and female controls as compared to cases.
- Furuhata's index was significantly more in male and female cases as compared to controls.
- Pattern intensity index was significantly more in female cases and controls as compared to males.

Limitations of this study were that this study did not considered the other aspects of dermatoglyphics like thenar patterns, hypothenar patterns and digital asymmetry and more research is required on this with larger sample size.

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ANNEXURE I

CONSENT FORM

CONSENT FOR PARTICIPATION IN RESEARCH STUDY

Mr./Mrs./Ms._____

You are invited to participate in our research study entitled **"A CROSS - SECTIONAL STUDY OF PALMAR DERMATOGLYPHIC PATTERN IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AT KLE'S DR PRABHAKAR KORE HOSPITAL AND MRC."** Respected Sir/Madam we request you to enroll yourself to participate in our study as you are eligible for doing so.

Your participation in research is voluntary. Your decision whether or not to participate in the study will not affect your relationship with J.N. Medical College. If you decide to participate, you are free to withdraw at any time.

The purpose of research is to study dermatoglyphics of fingers and palms and to use it as a tool to screen the population for the pre-disposition to diabetes mellitus, for risk reduction and early therapy; thus reducing morbidity and mortality.

If you agree to enroll yourself in this study, you will be asked to give detailed history. You will be asked to wash your hands clean and dry. The method adopted for printing palm will be modified ink method by Purvis Smith Printers duplicating ink from Kores will be used for taking prints. Other materials like cardboard roller, gauze pads and sheets of paper will be used. Fingertips will be rolled manually to ensure full prints of ridges, then the palm will be rolled on cardboard roller with paper, taking care that the cupped regions of the palm are printed properly. The following quantitative parameters like finger ridge count, a-b ridge count, total finger ridge count, absolute finger ridge count, atd adt and dat angles will be studied. The

following qualitative parameters like finger ridge patterns, palmar patterns of interdigital areas 2, 3 and 4, hypothenar area, palmar flexion creases will be studied.

Your participation may benefit you and others suffering from same ailment in future, by helping us learn more about the disease process and better treatment modalities.

There will not be any extra cost incurred by the participant. There is no commitment for any reimbursement or any other compensation for the participant.

The only people to know that you are a research subject are members of the research team. No information about you or information provided by you during the research will be disclosed to others without your written permission.

When the results of the research are published or discussed, in a conference, no information will be displayed that would disclose your identity. Any information that is obtained in connection with this study and that can be identified with you will remain confidential.

Consent for participation in research trial:

I, Mr./Ms./Mrs. _____ voluntarily agree for the participation as a subject of study. By signing this consent form I am not giving up any of my legal rights, I may withdraw from the study anytime. I am signing the consent form after having read or been read for me in vernacular language, including the risks and the benefits and having all my questions answered.

Subject Name: _____

Signature or the Left Thumb Print of Subject: _____

Witness Name: _____

Signature of Witness: _____

Investigator's Name: _____

Signature of Investigator: _____

Date: _____

Place: _____

ANNEXURE II

PROFORMA

SUMMARY SHEET

NAME: _____

AGE: _____ yrs. **WEIGHT**: _____ kgs.

SEX: ☐ (1-Male; 2-Female)

ADDRESS: _____

OPD NO: _____

DATE OF STUDY: _____

IS THE PATIENT ELIGIBLE FOR STUDY? ☐ 1-YES 2-NO

HAS INFORMED CONSENT BEEN GIVEN? ☐ 1-YES 2-NO

FINAL RESULT INFORMATION:

1. Ineligible ☐
2. Eligible, refusal ☐
3. Eligible, participating ☐

Doctor's name: _____

Doctor's signature: _____

Date: / /

DATA COLLECTION

CHIEF COMPLAINTS –

HISTORY OF PRESENT ILLNESS –

TREATMENT HISTORY-

PAST HISTORY –

FAMILY HISTORY –

PERSONAL HISTORY –

Diet -

Appetite –

Sleep –

Bowel & Bladder –

Habits –

MENSTRUAL HISTORY -

EXAMINATION –

GENERAL PHYSICAL EXAMINATION –

Vitals – BP –

Pulse –

Respiratory rate –

Temperature –

Pallor -

Icterus –

Cyanosis –

Clubbing –

Edema –

Lymphadenopathy –

Skin lesions –

SYSTEMIC EXAMINATIONS –

1. **CVS –**
2. **RS –**
3. **CNS –**
4. **PER ABDOMEN –**

INVESTIGATIONS –

MASTER CHART - CASES

S.NO	AGE	SEX	RIGHT HAND															LEFT HAND														AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
1.	63	F	24	26	14	26	26	36	78	36	66	W	W	L	W	W		26	10	12	26	12	36	82	36	64	W	L	L	W	L	206	138
2.	60	F	14	24	10	0	12	29	76	40	62	L	W	L	A	L		10	10	26	14	12	27	80	30	64	L	L	W	L	L	132	110
3.	61	F	10	22	24	26	10	26	80	58	45	L	W	W	W	L		12	10	12	8	10	27	80	40	62	L	L	L	L	L	144	110
4.	70	F	0	12	10	0	0	24	90	46	48	A	L	L	A	A		12	0	10	24	20	24	80	36	62	L	A	L	W	W	88	66
5.	60	M	10	10	10	18	0	27	60	45	56	L	L	L	W	A		14	18	12	8	10	36	75	36	70	L	W	L	L	L	110	94
6.	47	M	20	14	14	28	12	29	76	38	64	DL	L	L	W	L		9	26	14	24	22	32	82	32	64	L	W	L	W	W	195	193
7.	50	F	12	10	10	26	26	32	82	40	58	L	L	L	W	W		14	14	10	28	10	29	78	44	60	L	L	L	W	L	164	128
8.	61	M	26	12	12	10	8	24	85	38	62	W	L	L	L	L		12	10	0	10	12	32	76	34	72	L	L	A	L	L	110	98
9.	55	F	16	10	10	12	14	36	78	42	60	L	L	L	L	L		10	30	12	24	12	36	78	42	60	L	W	L	W	L	150	126
10.	50	F	16	24	12	30	14	32	78	48	58	L	W	L	W	L		14	10	12	26	10	36	76	45	68	L	L	L	W	L	168	130
11.	45	F	10	10	14	22	26	30	78	38	66	L	L	L	W	W		10	22	26	24	20	34	85	38	58	L	W	W	W	W	182	118
12.	60	M	8	6	6	14	10	32	85	36	62	L	L	L	L	L		8	6	8	12	12	36	78	34	70	L	L	L	L	L	90	90
13.	55	F	16	14	16	26	20	29	90	34	60	L	L	L	W	W		10	12	12	28	10	29	82	34	62	L	L	L	W	L	164	130
14.	42	F	14	12	10	16	10	34	85	46	54	L	L	L	L	L		26	10	12	14	12	34	78	42	55	W	L	L	L	L	136	124
15.	55	M	22	28	12	30	12	29	80	38	62	W	W	L	W	L		16	26	10	12	10	32	80	38	60	L	W	L	L	L	178	132
16.	50	M	0	0	0	0	12	34	85	34	65	A	A	A	A	L		12	0	8	8	12	27	70	40	70	L	A	L	L	L	52	52
17.	45	M	14	0	12	22	12	32	82	46	52	L	A	L	W	L		12	12	12	14	14	32	82	42	55	L	L	L	L	L	124	114
18.	61	M	12	0	8	6	10	26	85	32	62	L	A	L	L	L		10	0	0	10	12	27	80	40	60	L	A	A	L	L	68	68
19.	70	F	22	0	0	0	0	32	72	42	70	W	A	A	A	A		0	0	0	0	0	32	80	42	52	A	A	A	A	A	22	12
20.	65	M	8	6	10	8	0	32	82	40	55	L	L	L	L	L		0	0	10	8	6	30	90	35	60	A	A	L	L	L	62	62

S.NO	AGE	SEX	RIGHT HAND															LEFT HAND														AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
21.	65	F	20	12	20	22	6	30	65	50	60	W	L	W	W	L		0	0	10	0	0	27	65	58	62	A	A	L	A	A	84	54
22.	52	F	14	16	22	22	10	30	80	42	60	L	L	W	W	L		14	14	12	12	18	34	78	40	66	L	L	L	L	W	154	126
23.	55	F	16	26	26	22	14	36	90	30	64	L	W	W	W	L		12	20	14	26	12	34	88	30	62	L	W	L	W	L	186	132
24.	55	F	32	14	10	10	10	22	78	38	64	W	L	L	L	L		8	10	10	8	8	24	80	38	60	L	L	L	L	L	110	104
25.	65	F	10	0	0	0	8	29	78	48	62	L	A	A	A	L		12	0	8	22	0	29	70	48	55	L	A	L	L	A	46	46
26.	69	M	14	10	10	18	6	29	75	46	58	L	L	W	DL	L		10	22	20	30	0	26	75	40	62	L	W	W	W	A	142	102
27.	69	M	10	30	0	30	20	24	74	44	62	W	W	A	W	W		16	22	12	16	22	24	80	40	65	DL	W	L	W	W	208	120
28.	56	M	18	8	8	22	0	34	80	40	55	L	L	L	W	A		0	12	0	10	8	32	80	40	58	A	L	A	W	L	86	70
29.	50	F	0	12	14	0	0	36	82	38	62	W	L	L	A	A		12	0	0	14	8	37	82	40	68	L	A	A	L	L	74	66
30.	55	M	22	0	0	0	10	27	90	34	45	A	A	A	A	L		10	8	12	12	12	30	76	38	55	L	L	L	L	L	66	66
31.	49	F	0	14	0	14	12	22	85	50	48	W	DL	A	DL	DL		10	8	6	6	10	29	78	50	55	L	L	L	L	L	102	86
32.	56	F	10	0	0	0	20	27	80	45	58	A	A	A	A	W		20	0	6	0	8	34	70	58	65	W	A	L	L	L	52	34
33.	56	M	8	8	8	10	10	32	80	46	58	L	L	L	L	L		14	0	0	26	0	28	70	50	65	L	A	A	A	A	60	60
34.	60	M	6	6	8	22	10	30	78	40	64	L	L	L	W	L		8	6	0	12	10	32	80	34	62	L	L	A	W	L	76	74
35.	56	M	8	12	6	6	8	36	86	40	55	L	W	L	L	L		6	8	10	18	12	36	78	40	58	L	L	L	L	L	86	8O
36.	42	M	18	10	10	14	12	34	82	38	62	L	L	L	L	L		26	10	12	8	8	32	90	34	72	W	L	L	W	L	128	98
37.	63	M	10	20	24	0	0	27	78	40	60	W	W	W	A	A		0	24	20	18	0	29	75	36	70	A	W	W	L	A	114	66
38.	68	F	14	24	10	26	20	39	70	40	70	L	W	L	W	W		18	12	10	0	10	36	70	38	62	W	L	L	W	L	158	112
39.	67	M	12	20	22	14	0	32	83	40	60	L	W	W	L	A		12	8	10	26	0	32	75	40	50	L	L	L	A	A	100	82
40.	42	M	12	8	0	6	0	27	74	44	65	L	L	A	L	A		14	30	14	24	12	30	85	42	56	L	W	L	W	L	126	102

S.NO	AGE	SEX	RIGHT HAND															LEFT HAND														AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
41.	68	M	18	10	8	12	14	32	70	48	62	L	L	L	L	L		0	18	14	20	12	34	80	44	70	A	W	L	W	L	124	104
42.	58	F	22	24	22	20	22	30	85	40	58	W	W	W	W	W		18	22	20	26	12	30	65	45	56	W	W	W	W	L	198	112
43.	70	M	0	26	26	24	22	32	90	40	50	W	W	W	W	W		24	26	28	0	12	30	80	40	60	W	W	W	W	L	236	138
44.	70	M	10	18	10	10	0	36	80	38	62	A	W	L	L	A		12	0	10	22	0	34	78	42	60	L	A	L	A	A	60	52
45.	52	M	14	14	10	26	10	36	80	50	50	L	L	L	W	L		10	12	10	12	10	36	80	45	68	L	L	L	W	L	134	124
46.	55	M	26	10	8	12	0	32	82	38	62	L	L	L	L	A		12	0	8	28	8	32	76	38	52	L	A	L	L	L	84	84
47.	49	M	14	26	28	26	10	34	72	42	50	W	W	W	W	L		14	32	28	26	12	22	84	48	50	L	W	W	W	L	230	142
48.	48	M	16	20	10	26	18	37	78	60	55	L	W	L	W	W		16	24	14	28	0	36	80	40	62	L	W	L	W	A	168	116
49.	40	M	8	26	22	26	12	32	78	50	62	L	W	W	W	L		20	22	22	0	12	38	75	44	62	W	W	DL	W	L	206	130
50.	61	M	24	0	8	6	10	32	75	35	66	L	A	L	L	L		0	0	6	20	0	30	82	35	65	A	A	L	A	A	38	38
51.	43	F	12	22	10	10	14	38	88	32	60	L	W	L	L	L		14	26	12	22	12	32	80	34	64	L	W	L	W	L	152	120
52.	46	M	24	22	0	0	0	29	88	36	60	W	W	A	A	A		8	0	12	20	12	32	84	34	56	L	A	L	W	L	100	70
53.	55	F	10	20	12	22	18	30	78	44	52	L	W	L	W	W		12	22	10	22	18	27	80	32	58	L	W	L	W	W	154	100
54.	49	M	24	18	0	20	20	34	80	35	60	W	W	A	W	W		10	10	12	10	8	34	84	40	62	L	L	L	W	L	144	100
55.	59	F	10	0	12	10	10	29	78	42	62	L	A	L	L	L		10	8	10	28	10	29	84	36	65	L	L	L	RL	L	90	90
56.	62	M	26	22	12	28	26	32	75	34	56	W	W	L	W	W		10	12	0	10	0	29	80	38	56	L	L	A	W	A	170	112
57.	50	M	20	0	0	24	0	36	82	42	56	W	A	A	W	A		14	8	10	0	20	34	82	42	62	L	L	L	L	W	106	76
58.	52	F	10	0	0	0	0	32	80	40	58	L	A	A	A	A		12	10	0	28	0	30	76	40	60	L	L	A	A	A	32	32
59.	50	F	12	30	14	28	16	38	88	40	62	L	W	L	W	L		14	18	10	12	10	34	80	42	60	L	DL	L	W	L	180	142
60.	58	M	0	22	14	0	0	32	80	40	60	A	W	L	A	A		16	0	8	16	26	36	76	42	62	L	A	L	L	W	98	76

S.NO	AGE	SEX	RIGHT HAND															LEFT HAND														AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
61.	58	M	26	24	30	12	16	30	76	45	68	W	W	W	L	L		12	14	28	14	14	30	80	42	58	L	L	W	L	L	192	148
62.	52	M	20	24	6	28	18	27	78	36	64	W	W	L	W	W		12	16	6	18	12	27	90	40	66	L	DL	L	L	L	146	106
63.	56	M	12	14	18	18	10	25	82	40	65	L	W	W	W	L		8	6	20	22	14	27	80	34	50	L	L	W	W	W	138	94
64.	70	M	14	26	10	22	26	36	76	36	64	L	W	L	W	W		14	26	28	20	24	34	88	44	58	L	W	W	W	W	204	132
65.	57	M	10	8	20	22	8	26	82	48	58	L	L	W	W	L		8	8	16	10	8	24	82	40	65	L	L	W	W	L	128	92
66.	70	M	0	0	0	10	0	25	80	45	60	A	A	A	L	A		0	8	10	8	0	25	65	48	56	A	L	L	L	A	38	38
67.	66	F	10	0	0	20	10	29	85	45	60	L	A	A	W	L		0	0	10	24	0	24	80	44	68	A	A	L	L	A	58	48
68.	60	M	22	10	12	28	10	32	76	42	56	W	L	L	W	L		24	32	22	20	20	34	80	42	60	W	W	W	W	W	198	128
69.	60	M	22	10	11	18	10	30	84	68	40	W	L	L	W	L		24	8	18	12	10	36	75	48	40	W	L	W	W	L	140	92
70.	60	M	10	12	10	26	10	27	80	42	66	L	RL	L	W	L		8	8	10	24	8	22	80	60	68	L	L	L	L	L	128	90
71.	41	F	26	10	26	14	26	30	80	38	65	W	L	W	L	W		18	26	26	26	12	34	70	40	65	L	W	W	W	L	114	102
72.	65	M	18	22	22	30	26	32	85	42	62	W	W	W	W	W		12	28	30	22	12	34	75	36	56	L	W	W	W	L	208	142
73.	51	M	12	20	10	18	10	36	80	42	50	L	W	L	W	L		10	24	12	24	12	32	80	42	58	L	A	L	W	L	226	134
74.	48	M	18	10	12	26	12	34	70	40	55	W	L	L	W	L		19	0	16	0	14	29	76	44	58	W	W	L	W	L	124	96
75.	49	M	10	0	0	0	0	27	80	38	65	L	A	A	A	A		10	0	0	0	0	29	88	38	60	L	A	A	A	A	168	126
76.	41	F	26	0	0	0	12	24	72	40	60	W	A	A	A	L		10	0	0	14	0	24	80	43	65	L	A	A	A	A	20	20
77.	50	F	10	14	8	10	12	29	78	42	62	L	W	L	L	L		12	12	14	0	10	30	70	45	60	L	A	L	L	L	54	44
78.	61	F	10	18	10	30	30	36	80	50	55	L	W	L	W	W		10	6	18	16	10	22	80	44	58	L	L	W	A	L	68	42
79.	49	F	10	18	18	8	10	34	80	44	54	L	W	W	L	L		8	30	20	28	14	36	75	50	40	L	L	W	W	W	104	98
80.	50	M	12	28	32	28	10	22	76	40	65	L	W	W	W	L		10	12	24	26	28	24	82	58	62	L	W	W	W	W	160	114

S.NO	AGE	SEX	RIGHT HAND															LEFT HAND														AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
81.	65	F	24	10	12	30	22	22	86	36	55	DL	L	L	W	W		14	8	24	20	24	26	80	36	62	L	L	W	W	W	228	132
82.	43	M	20	12	10	8	22	36	86	46	58	W	L	L	L	W		24	0	0	0	18	36	82	38	62	W	L	A	W	A	198	144
83.	70	M	0	0	0	0	20	34	70	42	62	A	A	A	A	W		0	0	0	20	0	34	70	48	66	A	A	A	A	A	142	94
84.	70	M	8	0	0	22	10	27	80	42	65	L	A	A	W	L		10	18	0	22	0	29	70	46	62	L	A	A	W	L	20	10
85.	55	F	12	18	0	18	12	24	90	44	56	L	W	A	W	L		20	0	12	12	10	32	80	38	56	W	W	L	W	L	78	60
86.	50	M	0	8	10	12	14	30	88	42	65	A	L	L	L	L		18	26	8	26	10	27	82	42	70	W	A	L	L	L	140	100
87.	40	F	14	28	24	28	26	36	84	34	62	L	W	W	W	W		12	18	30	10	12	34	70	40	60	L	W	W	W	L	90	84
88.	57	M	12	20	8	18	10	27	90	42	55	L	W	L	W	L		26	10	0	12	10	25	75	40	55	W	W	A	L	L	226	136
89.	46	M	8	24	10	22	10	24	78	36	60	L	W	L	W	L		18	18	14	24	12	26	84	46	60	W	RL	L	L	L	132	94
90.	50	M	10	22	8	10	8	38	90	46	58	L	W	L	L	L		26	8	18	12	10	34	80	42	56	W	W	W	W	L	140	112
91.	60	M	10	0	10	12	0	24	80	45	62	L	A	L	L	A		10	22	12	20	0	27	78	45	70	L	L	L	L	A	166	106
92.	62	M	0	22	20	18	22	38	82	42	60	A	W	W	W	W		18	0	0	0	22	36	68	45	55	W	W	A	W	W	74	74
93.	60	M	0	0	0	0	10	28	80	48	55	A	A	A	A	L		10	26	0	0	0	28	80	48	58	L	A	A	A	A	174	100
94.	60	F	10	28	16	18	14	22	85	40	60	L	W	L	L	L		10	28	16	28	14	22	80	44	60	L	W	L	A	L	20	20
95.	55	F	22	24	26	28	28	36	70	40	60	W	W	W	W	W		22	26	28	24	26	32	85	40	64	W	W	W	W	W	168	142
96.	46	F	12	22	14	28	26	30	84	50	65	L	W	L	W	W		0	22	28	18	0	29	70	52	80	A	W	W	W	A	260	138
97.	45	M	22	10	20	10	10	24	78	38	55	W	L	W	L	L		20	26	22	20	0	24	60	45	55	W	W	W	W	A	188	114
98.	48	F	16	22	12	12	22	27	88	40	70	L	W	L	L	W		16	10	14	22	12	32	82	46	68	L	W	L	W	L	154	96
99.	65	M	22	8	10	18	20	30	80	48	55	W	L	L	W	W		22	10	20	0	10	30	78	35	55	W	L	W	W	L	182	130
100.	55	M	10	8	0	20	0	32	78	40	50	L	L	A	W	A		26	10	0	8	0	38	75	48	60	W	L	A	A	A	162	106

S.NO	AGE	SEX	RIGHT HAND															LEFT HAND														AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN							
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
1.	50	F	9	0	14	29	16	40	82	44	60	L	A	L	W	L		12	0	26	25	12	30	80	40	58	L	A	W	W	L	206	138
2.	60	M	28	13	22	24	0	34	65	36	62	W	L	W	W	A		0	23	10	15	12	34	74	46	62	A	W	L	L	L	132	110
3.	51	M	20	25	15	26	14	37	78	40	62	L	W	L	W	L		18	20	15	34	10	35	78	40	62	L	L	L	W	L	144	110
4.	61	F	26	22	12	30	12	27	78	50	54	W	W	L	W	L		26	14	10	12	12	34	82	46	50	W	L	L	L	L	88	66
5.	46	F	26	14	12	29	12	38	65	52	55	W	L	L	W	L		26	14	15	5	12	30	80	55	48	W	L	L	L	L	110	94
6.	42	M	0	8	0	10	14	27	82	32	68	A	L	A	L	L		22	0	0	0	12	27	80	36	65	DL	A	A	A	L	195	193
7.	45	F	10	6	8	10	14	36	80	35	66	L	L	L	L	L		8	0	10	26	12	35	80	38	64	L	A	L	W	L	164	128
8.	50	M	15	26	14	14	14	32	82	34	68	L	W	L	L	L		15	14	12	14	12	30	76	32	70	L	L	L	L	L	110	98
9.	41	F	15	10	24	15	8	35	78	38	68	L	L	L	L	L		12	10	8	14	10	26	78	32	76	L	L	L	RL	L	150	126
10.	60	M	22	26	12	24	10	27	74	48	60	W	W	W	W	L		22	22	26	14	12	35	80	43	60	W	W	W	L	L	168	130
11.	42	F	22	8	10	30	0	36	76	36	70	W	L	L	W	A		24	0	10	8	0	26	82	28	72	W	A	L	L	A	182	118
12.	67	M	15	0	24	15	14	29	80	34	66	L	A	L	L	L		14	12	12	12	10	27	80	38	66	L	L	L	L	L	90	90
13.	62	M	0	28	10	30	26	27	80	42	70	A	W	W	W	W		26	30	24	29	0	27	78	46	56	W	W	W	W	A	164	130
14.	62	M	20	28	0	10	13	30	82	40	55	L	W	L	L	W		24	21	15	18	10	30	84	40	55	W	L	L	L	L	136	124
15.	52	F	12	0	26	14	14	29	86	38	58	L	A	A	L	L		18	0	0	0	10	32	80	46	55	L	A	A	A	L	178	132
16.	50	M	33	29	12	34	0	30	72	44	66	W	W	W	W	A		0	30	30	26	0	27	74	44	62	A	W	W	W	A	52	52
17.	50	F	14	24	16	24	14	27	75	44	70	L	W	L	W	L		10	24	10	14	10	30	72	44	70	L	W	L	L	L	124	114
18.	61	M	14	27	8	31	14	35	78	40	68	L	W	L	W	L		15	29	31	26	12	27	70	40	65	L	W	W	W	L	68	68
19.	60	M	0	0	10	10	4	42	75	38	65	A	A	L	L	L		0	6	9	13	0	34	82	35	60	A	L	L	L	A	22	12
20.	60	M	12	14	12	26	10	33	65	50	70	L	L	L	W	L		10	10	14	12	16	32	70	50	75	L	L	L	L	L	62	62

S.NO	AGE	SEX	RIGHT HAND															LEFT HAND													AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
21.	46	F	10	12	0	30	12	27	72	38	65	L	L	L	W	L		15	31	14	27	9	38	75	34	55	L	W	L	W	L	84	54
22.	57	F	10	0	13	0	12	30	70	42	55	L	W	A	A	L		10	0	10	10	0	27	80	40	58	L	A	L	L	A	154	126
23.	60	M	27	23	12	28	15	29	80	45	55	W	W	L	W	L		33	11	11	30	12	32	82	40	65	W	L	L	W	L	186	132
24.	60	F	30	26	15	12	29	34	80	38	65	W	W	L	L	W		18	22	14	18	15	30	85	36	72	L	W	L	L	L	110	104
25.	61	M	18	29	12	27	14	33	76	34	70	W	W	L	W	L		30	30	12	32	0	24	76	32	74	W	W	L	W	A	46	46
26.	40	F	32	35	36	32	31	34	80	32	65	W	W	W	W	W		30	26	31	23	12	32	80	34	48	W	W	W	W	L	142	102
27.	62	F	18	31	13	36	20	35	75	60	48	L	W	L	W	L		32	26	28	33	0	30	65	55	57	W	W	W	W	A	208	120
28.	50	F	24	24	16	18	14	30	84	42	54	DL	DL	L	L	L		24	28	28	12	16	27	80	44	70	W	W	W	L	L	86	70
29.	55	M	10	8	10	18	10	26	75	38	70	L	L	L	W	L		0	10	10	14	8	32	72	38	56	A	L	L	W	L	74	66
30.	62	M	10	10	12	0	10	34	70	42	65	L	L	L	A	L		12	8	12	10	12	32	84	44	60	L	L	L	L	L	66	66
31.	56	F	0	10	28	12	14	32	84	44	68	A	L	W	L	L		12	0	0	12	10	34	72	44	60	L	A	A	L	L	102	86
32.	42	F	30	26	32	31	26	29	76	42	54	W	W	W	W	W		26	26	28	26	26	37	80	38	60	W	W	W	W	W	52	34
33.	40	F	15	26	32	33	14	28	78	42	60	L	W	W	W	L		14	22	31	28	10	34	70	46	64	L	W	W	W	L	60	60
34.	59	M	41	0	0	17	10	30	76	42	60	W	A	A	L	L		23	0	8	14	10	45	73	43	62	W	A	L	L	L	76	74
35.	58	M	30	25	16	10	0	28	72	36	70	W	DL	L	L	A		19	24	26	0	10	34	80	35	55	L	W	W	A	L	86	8O
36.	61	M	24	20	24	28	32	29	76	48	65	W	DL	W	W	W		24	26	28	30	30	28	80	46	60	W	W	W	W	W	128	98
37.	58	F	15	14	12	15	14	30	78	40	60	L	L	L	L	L		14	12	10	12	10	30	82	40	62	L	L	L	L	L	114	66
38.	45	M	14	14	14	14	12	29	76	45	60	L	L	L	L	L		15	0	12	24	22	36	78	45	70	L	A	L	W	W	158	112
39.	60	F	22	8	10	26	16	27	80	38	64	DL	L	L	W	L		20	0	10	26	14	32	74	32	58	DL	A	L	W	L	100	82
40.	45	M	0	0	12	14	0	32	86	42	58	A	A	L	L	A		12	0	12	14	0	29	80	44	60	L	A	L	L	A	126	102

S.NO	AGE	SEX	RIGHT HAND															LEFT HAND													AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
41.	58	F	10	10	12	18	8	27	76	42	50	L	L	L	W	L		18	0	20	20	10	27	80	42	60	W	A	W	W	L	124	104
42.	49	M	17	0	12	25	10	29	82	40	60	L	A	L	W	L		12	17	14	14	12	29	85	38	58	L	L	L	L	L	198	112
43.	56	M	20	24	0	26	24	30	72	42	58	W	W	A	W	W		26	12	22	24	20	26	80	42	65	W	L	W	W	W	236	138
44.	50	M	26	20	30	30	14	34	80	42	68	W	W	W	W	L		15	29	17	14	0	37	75	48	68	L	W	L	L	A	60	52
45.	53	F	14	10	12	12	10	24	78	40	55	L	L	L	L	L		17	14	12	14	12	40	72	36	58	L	L	L	L	L	134	124
46.	60	M	10	10	12	12	10	32	70	40	65	L	L	L	L	L		14	8	0	12	0	32	82	44	45	L	L	A	L	A	84	84
47.	60	M	14	0	0	12	10	32	76	36	72	L	A	A	L	L		0	0	12	12	10	34	82	55	65	A	A	L	L	L	230	142
48.	66	M	8	0	0	0	0	29	70	42	65	L	A	A	A	A		8	0	0	0	0	26	76	38	54	L	A	A	A	A	168	116
49.	50	M	12	8	10	0	12	32	82	48	62	L	L	L	A	L		26	22	10	25	24	32	78	45	60	DL	DL	L	W	W	206	130
50.	41	F	26	30	16	26	26	36	92	38	60	W	W	L	W	W		22	10	32	26	12	30	80	40	65	DL	L	W	W	L	38	38
51.	49	F	12	22	12	14	12	26	76	35	55	L	W	L	L	L		12	20	20	12	12	30	82	35	72	L	W	W	L	L	152	120
52.	40	F	14	0	0	0	0	34	84	46	65	L	A	A	A	A		0	0	0	0	0	30	75	30	58	A	A	A	A	A	100	70
53.	50	F	10	10	10	14	15	32	70	35	60	L	L	L	L	L		14	10	12	12	10	30	75	50	60	L	L	L	L	L	154	100
54.	49	M	14	8	10	20	8	34	80	50	60	L	RL	L	W	L		10	12	10	12	8	30	70	40	60	L	L	L	L	L	144	100
55.	55	F	16	0	0	18	10	35	74	40	60	L	A	A	L	L		10	8	14	0	0	38	80	40	60	L	RL	L	A	A	90	90
56.	61	F	32	10	10	0	12	33	76	30	54	W	L	L	A	L		24	21	9	12	10	29	76	36	58	DL	DL	L	L	L	170	112
57.	60	F	12	26	16	24	22	47	80	40	56	L	L	L	W	W		12	26	12	22	22	30	75	52	50	L	W	L	W	W	106	76
58.	56	M	0	0	0	14	8	36	85	52	62	A	W	A	L	L		0	15	5	5	5	32	88	46	60	A	L	L	L	L	32	32
59.	50	M	0	0	0	0	0	27	80	40	58	A	A	A	A	A		0	0	5	5	5	29	86	35	60	A	A	L	L	L	180	142
60.	56	F	14	8	10	10	8	30	78	50	50	L	A	L	L	L		10	0	10	10	0	30	80	52	66	L	A	L	L	A	98	76

S.NO	AGE	SEX	RIGHT HAND														LEFT HAND													AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN					FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5	1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
61.	42	F	16	16	10	24	10	34	78	40	65	L	L	L	W	L	12	12	14	12	10	32	75	40	60	L	L	L	L	L	192	148
62.	62	M	24	10	12	30	26	34	85	38	66	W	L	L	W	W	22	10	10	26	24	36	80	44	50	W	L	L	W	W	146	106
63.	62	F	29	0	0	11	10	27	78	42	45	W	L	A	L	L	11	0	5	13	11	32	85	50	58	L	A	L	L	L	138	94
64.	62	M	12	12	14	14	12	29	80	45	64	L	A	A	L	L	12	12	33	31	14	36	80	40	65	L	L	W	W	L	204	132
65.	60	F	40	14	16	16	6	27	80	40	60	W	L	L	L	L	40	10	14	16	18	36	75	45	58	W	L	L	L	L	128	92
66.	49	F	26	26	15	27	10	33	82	40	60	W	L	L	W	L	27	18	15	32	18	32	85	38	60	W	L	L	L	L	38	38
67.	50	F	40	35	36	30	34	27	76	38	55	W	W	W	W	W	49	0	37	12	5	36	80	44	60	W	A	W	W	L	58	48
68.	55	F	0	0	0	0	0	36	82	32	64	A	W	A	A	A	0	0	5	19	10	38	80	40	60	A	A	L	L	L	198	128
69.	45	F	0	0	0	15	0	30	80	45	62	A	A	A	L	A	0	0	12	14	22	30	80	40	65	A	A	L	W	W	140	92
70.	49	F	10	28	0	10	14	30	80	40	55	L	A	A	L	L	12	10	10	33	12	32	74	42	64	L	L	L	L	L	128	90
71.	42	M	31	35	17	31	29	29	75	48	60	DL	W	L	W	W	13	23	16	10	29	27	82	35	60	L	W	L	W	W	114	102
72.	40	F	10	12	0	10	0	32	78	38	64	L	W	A	L	A	10	0	8	26	10	36	82	40	60	L	A	L	L	L	208	142
73.	62	F	12	0	24	22	10	32	75	40	70	L	L	W	W	L	12	22	12	5	22	30	86	38	74	L	W	L	W	W	226	134
74.	45	F	18	0	8	24	18	27	82	38	65	W	A	L	W	W	20	0	5	10	5	32	70	38	60	W	A	L	L	L	124	96
75.	44	M	12	8	10	12	8	32	86	44	62	L	A	L	L	L	12	10	10	0	0	34	88	34	65	L	L	L	L	A	168	126
76.	59	F	10	8	0	10	8	30	76	38	55	L	L	A	L	L	12	0	10	10	8	33	80	40	70	L	A	L	A	L	20	20
77.	52	M	0	0	0	0	0	32	75	40	65	A	L	A	A	A	0	0	5	5	5	37	70	42	60	A	A	L	L	L	54	44
78.	60	M	20	10	10	14	12	38	82	40	64	W	A	L	L	L	22	0	12	10	5	32	78	45	60	W	A	L	L	L	68	42
79.	50	F	0	0	0	0	0	30	70	38	60	A	L	A	A	A	20	0	5	5	8	35	84	38	64	W	A	L	L	L	104	98
80.	45	M	0	10	20	22	0	32	82	38	75	A	A	W	W	A	0	16	18	16	0	35	80	38	60	A	W	W	W	A	160	114

S.NO	AGE	SEX	RIGHT HAND															LEFT HAND														AFRC	TFRC
			FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN						FINGER RIDGE COUNT						ANGLES			FINGER TIP PATTERN							
			1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		1	2	3	4	5	A-B	ADT	ATD	DAT	1	2	3	4	5		
81.	50	F	0	10	10	18	0	32	75	38	55	A	L	L	W	A		12	0	8	5	18	32	70	40	60	L	A	L	L	W	228	132
82.	50	F	0	10	10	8	0	29	85	48	64	A	L	L	L	A		22	10	8	5	8	30	75	44	58	W	L	L	L	L	198	144
83.	43	F	10	8	12	22	12	30	82	44	56	L	L	L	W	L		14	0	30	24	22	34	81	41	58	L	A	W	W	W	142	94
84.	60	M	22	26	28	29	32	34	68	42	60	W	L	W	W	W		12	18	15	24	14	32	76	44	60	L	L	L	W	L	20	10
85.	56	M	16	18	16	26	22	34	80	44	64	L	DL	L	W	W		12	14	22	26	0	35	65	52	64	L	L	W	W	A	78	60
86.	50	M	12	20	12	12	10	34	78	50	60	L	L	L	L	L		16	14	14	10	14	30	75	44	68	L	L	L	L	L	140	100
87.	60	M	10	0	12	14	10	34	76	42	68	L	L	L	L	L		0	0	0	12	0	35	84	32	65	A	A	A	L	A	90	84
88.	49	M	10	20	12	10	10	32	78	32	75	L	A	L	L	L		12	0	15	24	12	29	80	40	60	L	A	L	W	L	226	136
89.	57	F	10	8	12	25	24	35	80	38	68	L	W	L	W	W		24	8	8	29	18	34	82	38	60	W	L	L	W	W	132	94
90.	63	M	14	22	28	28	10	34	78	38	51	L	L	W	W	L		10	22	28	24	22	30	78	32	60	L	DL	W	W	W	140	112
91.	50	M	24	22	28	30	28	36	72	44	68	W	W	W	W	W		22	26	12	26	14	30	84	38	66	W	W	L	W	L	166	106
92.	61	F	12	10	12	12	12	34	75	33	55	L	W	L	L	L		0	10	14	10	12	30	64	32	60	A	L	L	L	L	74	74
93.	62	M	0	14	13	10	10	30	72	48	58	A	L	L	L	L		24	0	0	30	0	29	75	64	60	W	A	A	W	A	174	100
94.	52	M	15	16	9	13	15	24	78	48	63	L	L	L	L	L		15	22	13	14	12	32	75	45	66	L	L	L	L	L	20	20
95.	60	M	16	16	25	29	27	34	78	42	70	L	L	W	W	W		17	17	14	27	27	29	70	46	58	L	L	L	W	W	168	142
96.	62	M	16	12	14	15	16	27	75	40	68	L	L	L	L	L		24	28	14	0	14	33	78	45	60	W	W	L	A	L	260	138
97.	61	M	17	29	14	31	14	30	80	36	65	L	L	L	W	L		16	14	12	32	12	30	70	50	58	L	L	L	W	L	188	114
98.	62	M	26	32	34	8	13	29	72	40	55	W	W	W	L	L		18	22	30	15	15	30	80	44	75	L	W	W	L	L	154	96
99.	64	M	10	10	10	12	14	30	83	46	70	L	W	L	L	L		10	12	14	10	10	27	75	42	60	L	L	L	L	L	182	130
100	62	M	0	0	30	26	10	37	74	40	58	A	L	W	W	L		0	0	12	12	22	30	80	40	60	A	A	L	L	W	162	106

ANNEXURE III

KEY TO MASTER CHART

A – B – ab ridge count

ADT – angle adt

DAT – angle dat

ATD - angle atd

1 – first digit (thumb)

2 – second digit (index finger)

3 – third digit (middle finger)

4 – fourth digit (ring finger)

5 – fifth digit (little finger)

W – whorl

L – ulnar loop

A – arch

DL – double loop

RL – radial loop

AFRC – absolute finger ridge count

TFRC – total finger ridge count.

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