



## Dermatoglyphics: A Study on Fingerprint of the Garos from the Two Localities of Tura, West Garo Hill, Meghalaya

**Ricky Mirth R. Marak**

Indira Gandhi National Open University, New Delhi

### ABSTRACT:

Dermatoglyphics is an imperative facet or clamant in the field of biological anthropology as well as in forensic sciences. The identification of fingerprint which helps to understand the biological variation of populations; investigation and examination are a very important role which subsumed in this field of study. The two localities of Tura brought to light through Garo tribes. The *Sample Random Sampling* (SRS) has picked from sample techniques which have selected 32 numbers of people and found aberrant multifaceted from the friction ridge patterns within these two localities between the age of 20 to 40 and those especially from the youths, men and women. The basic friction ridge patterns as exhibited the *Arch* (9), the *Loop* (202) and the *Whorl* (100) from both sexes. The *Arch* is the least one among the three fingerprint patterns and *Loop* occupied the highest in number. *Plain Arch* (37), *Tented Arch* (13), *Radial Loop* (24), *Ulnar Loop* (171), *Double Loop Whorl* (9), *Accidental Whorl* (2), *Plain Whorl* (48) are the other unwonted manifold types of friction ridges. Apart from these, another power of friction ridges brought to light through these wonderful patterns as *Fork Shape* (105), *Bridge* (91), *Core* (30), *Crossover* (11), *Delta* (14), *Fragment* (53), *Double Bifurcation* (16), *Eye* (54), *Island* (23), *Pore* (51), *Hook* (29), *Ridge Ending* (63), and *Tribifurcation* (11). Nine *fingerprint minutiae* are not regular present on the *distal phalanges* and the *Ulnar Loop* dominated the topmost highest ranking and the two least numbers are the *Accidental Whorl* and the *Double Loop Whorl*. Most commonly seen are *Bifurcation* and found 105, *Bridge* is 91 and *Ridge Ending* occupied the third place and *Tented Arch* is the least one which present on their *distal phalanges* on both male and female's hands. In *Bifurcation*, females' fingerprint occupied the highest in number whereas males' *distal phalanges* added to be mark the highest in *Ridge Ending*. *Core*, *Delta*, *Dot (Fragment)*, *Hook (Spur)* are more commonly seen which present on the fingertips of male than female. If *Desquamation* and *Scars* are present on the outermost layer of *stratum corneum* then makes daedal to scrutinise from the *friction ridges*.

**Keywords:** Dermatoglyphics, distal phalanges, forensic anthropology, fingerprint, Garo tribe, forensic science, fingerprint patterns, minutiae, desquamation, scar, friction ridges

### Introduction

The term "Dermatoglyphics" is etymologically derived from two Greek roots *derma* means "skin" and *glyphe* meaning "curving", and has been first used by two celebrated persons Dr. Herold Cummins, an anatomist and dermatoglyphics specialist and Dr. Charles Midlo, both have coined this term in 1926, though it might be immemorial in the area of forensic anthropology or forensic science but it is very fascinated to study about the palmars and plantars which the distinct friction ridges found on the outermost layer of *stratum corneum* and provides huge information through assimilation and helps us to garner knowledge regarding this field of dermatoglyphics. Dermatoglyphics is the scientific study of complicated ridge patterns which presents on the palmars and plantars, it comprehensively subsumes the palm, finger, toe and sole of the humans and animals mostly from apes. Cummins, regarded as the "father of dermatoglyphics" because he is the founder of dermatoglyphics (Jain, 2016; Mohil *et al.*, 2018; Prabha and Thenmozhi, 2014). One of the major attainment and the objectives in the area of dermatoglyphics is a very crucial requisite component in the identification of fingerprints which it help through multifarious tools by taking of fingers impression for particular purposes from the people and also helps to understand the biological variation of populations; investigation and examination are also prerequisite for who have involved in the culprits and a very important role which subsumed in this field of study. Dermatoglyphics is a very indispensable element which it is an integral part of forensic anthropology in physical anthropology. Not only employed for these field but it also has been associated in various aspects of field in this modern world and exhibits the knit relationship of study about the palmars and plantars of humans and animals; both men and monkeys have minute ridges on the palms, fingers, soles and toes are apparently similar (Galton, 1892; Prabha and Thenmozhi, 2014). Nowadays many of us uses touch identification (Touch ID) which has widely been used in smart phones such as Apple iPhone or Apple Tablet or expensive mobile phones to unlock through fingerprint identification, it facilely helps to generate through the finger's patterns with the other sensors if it would matched to the biometric. Not only uses in mobile phones but has been used in various purposes like Unique Identification (UIDI) or ADHAAR, in bank counters to operate their own computers etc. Skin is one the part of our organ and it is an essential component of our body. Mostly skin consisted of three layers and out of these, epidermis, the outermost layer part of the skin where dermal ridges present on the fingers, palms, soles and toes. Many of us could not understand the importance of fingerprint and do not know the various fingerprint patterns' names which was given the names for each 10 by the experts. Most of the common seen ridge patterns of fingerprint are arch, loop and whorl but according to the researchers survey brought to light that arch is the least common type of pattern in fingerprints among the people. Whorl pattern is

more common than on the left hand and arches are very few which mostly seen in male but have more whorls pattern in male than female ( Archana *et al.*, 2016 ). None of the other person could not able to calculate the exact number of uniqueness of fingerprints from around the world and even though scientifically also very arduous to proven and never procured the accurate answer from different people. Fingerprints are used in forensic science to carry out the investigation, and also minutiae is employed to find out the uniqueness of fingerprints and brought to light the enormous information about 40 to 100 has been found from the good quality images ( Bansal, 2011 ).

“Fingerprint” refers to the traces of impression left by the friction ridge patterns which presents on the outermost layer of the skin of the human’s finger.

Ridge pattern from the each fingers are not exactly alike to other fingers and it is a very intricate pattern of ridges which present on the palms and fingers, if we comparison with others then it never match with our own family members, relatives etc., and never get the identical fingerprints and never match with each others, even our own finger prints and palms also not alike with these two because on the surface of fingers, palms etc., are made of distinct pattern of ridges and it remains unchanged from birth and for throughout the life ( Trimpe, 2009 ). Some researchers revealed that dermal ridges form within the uterus before birth and it starts to develop from around 13th weeks ( 3 months and a week ) and fully develop by the end of 21st week ( 5 months and a week ), it never change for throughout the life and even monozygotic twins’ fingerprints are not identical and never match between these two persons ( Archana *et al.*, 2016; Singh and Majumdar, 2015 ). Perhaps in some cases if a person has scars due to severe traumatic injury or accident then the fingerprints might be slightly change for throughout the life, experts revealed. Each and every friction ridges or dermal ridges are not bear resemblance to others where it can be seen on the palmars and plantars. The present of friction ridges are very helpful to reveal for the investigators while inquiring after the cases relating to the official law and order, to acquire the evidence and detail study from the fingers impression who has involved in the crime scene or suspected under criminal cases in various aspects of culprits and using of multifarious methods and tools are very essential role to procure the detail reports of authentic cases. The researchers brought to light that the first fingerprint evidence of conviction has used in 1898 in Bengal ( now in India ) and helps to make facilitative in the criminal cases ( Sodhi and Kaur, 2003 ). In the ancient times of China, fingerprints is a very imperative and most common practices for sale of land holdings, and in addition to fingerprint impression requires as an acknowledgement in legal document for the land holders, and also revealed that the used of friction ridge impressions is thought to be the oldest method to proof a person’s identification which has found in the archaeological site in China and it clearly brought to light through the excavators ( Sen *et al.*, 2014 ). If any person touches the object with the hands, the residue of pattern printed of fingers is always left behind on it, the most common method and oldest practices is employing of commercial powders, ink pad or other substances etc., because it is facilely available in the local markets, it helps to obtain the fingerprint from the culprits and this method makes certain to attain this goal. Nowadays, application of multifarious tools and techniques like fingerprint biometrics etc., through examination and detail investigation makes facilitate to acquire the enormous information ( Champod and Chamberlain, 2009 ). Employing of fingerprints have been popularly used since the early 19th century and till today, mainly in Investigation Department for personal identification who are involved in criminal cases, forensic science, and the examination of the mass disaster victims, fugitives, forgery signature in the banks who involved in illegally works, unknown deceased person etc., these are the very common fields in the identification of fingerprint. Most of the fingerprints which found at the crime scene may be of three types: latent, plastic and visible fingerprints. In the early 20th century Dr. Cummins and Dr. Midlo employed the dermatoglyphics and researchers brought to light that both has done link between congenital diseases and dermatoglyphics in medical research ( Mollik and Habib, 2011 ). It has not only been used in this fields but also use in the offices like in Banks, Post Offices etc., which is provided and given permission by the Government. In the offices, government has permitted to do the thumb impression for those who are not read and write in lieu of signing in the legal document and it makes easier to recognition and it makes a very facilitative to access to do their official work for the illiterate person by using their fingerprint impression.

The Garo or A-chik which belongs to the Tibeto - Burman ethnic group, a Sino-Tibetan language speakers and a matrilineal community just like the Khasi and Jaintia of Meghalaya, and comprises the second largest population after the Khasi tribe ( Sangma, 1984; Ali and Das, 2014 ). The main occupation for subsistence among the Garo tribe is agriculture, predominantly shifting cultivation. Most of the Garos gleefully accepted Christianity through the coming of the first American Baptist Missionaries but in some remote villages still follows animism, locally called Songsarek ( Maaker, 2007 and Playfair, 1909 ). The total number of households in Tura is 13,743 and the total population is 74,858 ( DCH West Garo Hills, 2011 ). Tura is a headquarter and principal town of West Garo Hills district and from these two localities i.e. Niram A’ding and Rengmal Gittim that the fingerprints have taken from the age of 20 to 40 of male and female which are done through Simple Random Sampling ( SRS ) method and found the fingerprint patterns as the Arch, the Loop and the Whorl. The Arch is the least one among the three fingerprint patterns and Loop occupied the highest number in their fingers which encompassed of both male and female’s distal phalanges in dermatoglyphics. The another type of fingerprint patterns also exhibits which the Ulnar Loop occupied the highest numbers and the two least numbers are the Accidental Whorl and the Double Loop Whorl. Employed of fingerprints through minutiae which helps to delineate and provide enormous information with details from these two localities of local people of Garos or A-chiks. In ridge characteristics or 9 minutiae, some distinct ridges like the Crossover, the Double Bifurcation, the Tribifurcation, these are not regular present on the distal phalanges. It provides detail huge information through unique fingerprint patterns which subsumed in minutiae or ridge characteristics in the dermatoglyphics and also to study and discover about the fingerprint patterns from the different people is very essential to garner the distinct fingerprint patterns and rather it helps to sensitise about their own fingerprints. Through minutiae brought to light that within these two localities which found most commonly seen Bifurcation ( Fork shape ), Bridge and Ridge Ending which present on their distal phalanges (included both male and female). In the advancement of technology and the world has been changing year after year. It is a very indispensable to understand and to garner regarding the lore of fingerprints along with the imbibing of other knowledge and a very important to assimilate in the field sciences which associated with the other institutions or academia in the area of Garo Hills or Meghalaya state of India. Seeking of wisdom, knowledge are the crucial aspect in this area of study and those related to biological aspect all have subsumed in anthropology which it is a broad-ranging and regarded as a holistic discipline in the area of field sciences and not only this it always have pragmatic field in this area of physical anthropology. Fingerprint is a very element in the discipline of anthropology

which it also subsumed in the dermatoglyphics and always knit relationship in the human body parts which mostly this field of study is a part in the biological or physical anthropology.

## Materials and Methods

The research was carried out through Simple Random Sampling ( SRS ) method and also employed some other significant multifarious tools and techniques. In this study, the main aspiration is to procure and imbibe knowledge about the different aberrant of friction ridges from the locality of Niram A-ding and Rengaml Gittim of Tura, West Garo Hills, Meghalaya. The Simple Random Sampling ( SRS ) has picked from the sample techniques which have selected 32 numbers of people within these two localities between the age of 20 to 40 and those especially from the youths, men and women which have selected to obtain the fingerprint by employing the ink pad to procure their ridge patterns, minutiae. White papers are also used for fingers impression, exploration and examining to acquire the minutiae which has also done by using of common magnifier glass. Qualitative and quantitative data also collected along with the procedures of fingerprint identification.

## Results and Discussion

The distinct unique of friction ridges pattern exhibited through delineates regarding the important of dermatoglyphics in the sphere of biological anthropology as well as forensic sciences. It revealed the biological variation of populations through fingerprints among the Garos of the two localities of Tura. In this study, the illuminate description has been listed in Table - 1 which encompassing the list of basic fingerprint patterns, male and female's age, and total; in Table - 2 includes the different types of friction ridges, male and female's age, total and in Table - 3 encompassing the minutiae from the distal phalanges and the total.

In this study, the basic friction ridge patterns as exhibited the *Arch* (9), the *Loop* (202) and the *Whorl* (100) from both sexes. The *Arch* is the least one among the three fingerprint patterns and *Loop* occupied the highest in number. *Plain Arch* (37), *Tented Arch* (13), *Radial Loop* (24), *Ulnar Loop* (171), *Double Loop Whorl* (9), *Accidental Whorl* (2), *Plain Whorl* (48) are the other unwonted manifold types of friction ridges. Apart from these, another power of friction ridges brought to light through these wonderful patterns as *Fork Shape* (105), *Bridge* (91), *Core* (30), *Crossover* (11), *Delta* (14), *Fragment* (53), *Double Bifurcation* (16), *Eye* (54), *Island* (23), *Pore* (51), *Hook* (29), *Ridge Ending* (63), and *Tribifurcation* (11). Nine fingerprint minutiae are not regular present on the distal phalanges and the *Ulnar Loop* dominated the topmost highest ranking and the two least numbers are the *Accidental Whorl* and the *Double Loop Whorl*. Most commonly seen are *Bifurcation* and found 105, *Bridge* is 91 and *Ridge Ending* occupied the third place and *Tented Arch* is the least one which present on their distal phalanges on both male and female's hands. In *Bifurcation*, females' fingerprint occupied the highest in number whereas males' distal phalanges added to be mark the highest in *Ridge Ending*. *Core*, *Delta*, *Dot* ( *Fragment* ), *Hook* ( *Spur* ) are more commonly seen which present on the fingertips of male than female.

Each and every distal phalanges having with the special ridge patterns do not be the same as in one hand and never alike with the other fingerprint patterns. Under the area of study through analysis revealed that most of the fingerprint patterns are done through various employ of tools such as with the help of magnifier glass ( optical grade lenses with 5x & 10x magnifying capacity ) to extract multifarious ridge patterns, black moulded ink pad to smear on the distal phalanges in order to impression on the white papers and white papers used to record the various fingerprints and minutiae too from the selected persons within these two area of localities through Simple Random Sampling ( SRS ).

According to subtle analysed of fingerprint patterns, its types and minutiae exhibits that both male and females' fingerprints are not homogeneous and did not match with their own fingers which comparing with the each fingertips of their own. Even though the types of fingerprint and minutiae also never match with the other fingerprints because all the ridge patterns are formed naturally with the help of tissues and some factor of environmental influences which easily present on the every distal phalanges. Desquamation also present on the fingertips which is occurred in one person that it also made difficulty to investigate regarding the fingerprint patterns and while extracting it can renders the good quality of this to imbibe knowledge to the researchers; and even the scar which it is either by wounded or by others circumstances, this occurred also not provide clear information about this study of minutiae.

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Especially thanks who have voluntarily participated while conducting for dermatoglyphics (especially studied the friction ridge patterns of distal phalanges from both sexes) from these two localities i.e. Niram A-ding and Rengaml Gittim of Tura, West Garo Hills, Meghalaya. Without your kind cooperation never provides information on study of fingerprints which very helpful to garner pragmatically, also really informative and absorb enormous lore of knowledge.

**Table 1: Basic fingerprint patterns from the two localities of Tura, West Garo Hills, Meghalaya**

List of Fingerprint Patterns	Male (Age: 20 to 40)	Female (Age: 20 to 40)	Total
1. Arch	8	1	9
2. Loop	94	108	202
3. Whorl	41	59	100

**Table 2: Types of fingerprint patterns from the two localities of Tura, West Garo Hills, Meghalaya**

Types of Fingerprint Patterns	Male ( Age: 20 to 40 )	Female ( Age: 20 to 40 )	Total
1. Plain Arch	25	12	37
2. Tented Arch	10	3	13
3. Radial Loop	13	11	24
4. Ulnar Loop	78	93	171
5. Double Loop Whorl	5	4	9
6. Accidental Whorl	1	1	2
7. Plain Whorl	18	30	48

**Table 3: THE COMPARISON OF MALE AND FEMALE’S MINUTIAE IN THE TABULAR**

Sl. No.	DIFFERENT TYPES OF RIDGE CHARACTERISTICS / MINUTIAE	MALE	FEMALE	TOTAL	HIGHEST NO. OF MINITIAE
1.	Bifurcation ( Fork )	51	54	105	<i>Fork in female</i>
2.	Bridge	46	45	91	<i>Bridge in male</i>
3.	Core	18	12	30	<i>Core in male</i>
4.	Crossover	3	8	11	<i>Crossover in female</i>
5.	Delta	13	1	14	<i>Delta in male</i>
6.	Dot (Fragment)	28	25	53	<i>Fragment in male</i>
7.	Double Bifurcation	7	9	16	<i>Double Bifurcation in female</i>
8.	Eye ( Enclosure )	26	28	54	<i>Enclosure in female</i>
9.	Island ( Short Ridge )	9	14	23	<i>Island in female</i>
10.	Pore	25	26	51	<i>Pore in female</i>
11.	Hook ( Spur )	18	11	29	<i>Spur in male</i>
12.	Ridge Ending	28	35	63	<i>Ridge Ending in male</i>
13.	Tribifurcation	4	7	11	<i>Tribifurcation in female</i>
14.	Desquamation		1	1	<i>Desquamation found only in one female</i>
15.	Scar	1	1	2	<i>Scar, found from both sexes.</i>

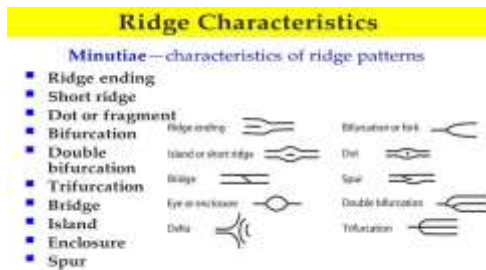


Figure 1



Figure 2

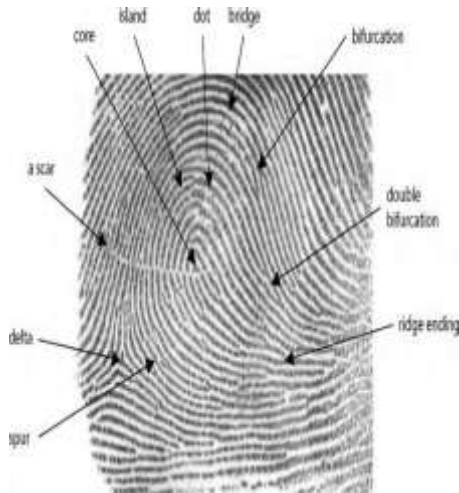


Figure 3

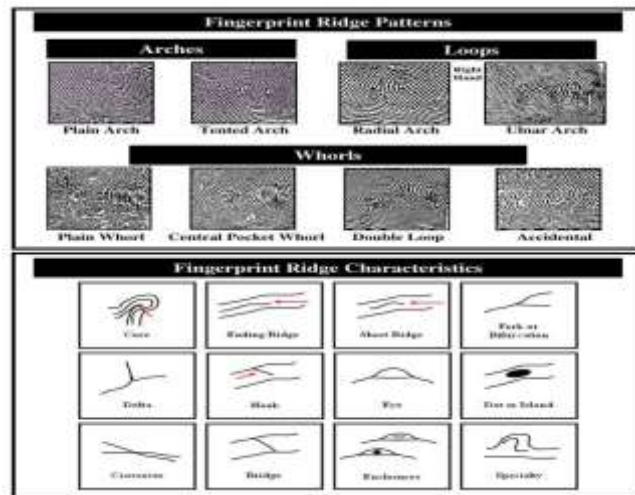


Figure 4

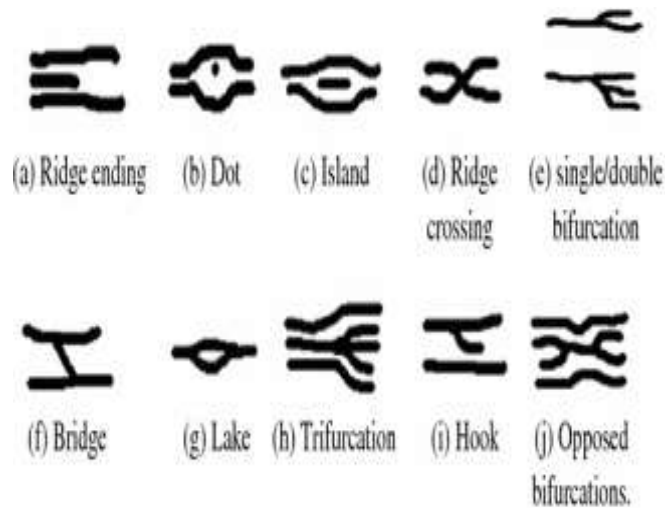


Figure 5

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