Interracial Comparison of Ten-Digit Fingerprints of Different Regions of India and Africa

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ABSTRACT
Dermatoglyphics can be stated as the science which usually studies related to the epidermal pattern of a ridge on the soles, palms, and fingers. Fingerprints can be stated as the impression of the ridge crests through the skin friction within the ventral surface of digits. Fingerprints play a crucial role in the science of conducting a criminal investigation related to the identification of a person because of their uniqueness as well as they can be considered as conclusive evidence in front of the court. The Dermatoglyphic study of fingerprints is also taken at the duration of the study while utilizing the method of standard ink. Around 200 samples of fingerprints were analyzed, compared, collected, evaluated as well as verified by the students of Indian and African regions studying in the common university altogether in India. The fingerprints are also collected then classified and distributed among the three patterns of whorls, arches, and loops within the Indian and African regions. Samples of the 10-digit fingerprints are taken so that the differences among the fingerprints within the Indian region as well as African region needs to be identified on the basis of analyzing the 10-digit fingerprints on behalf of evaluating the interracial comparison on behalf of the sexual dimorphism.

KEYWORDS – Dermatoglyphics, Fingerprints patterns, India, Africa, Forensic

1. INTRODUCTION

The fingerprints can be stated as the impression of the ridge crests through the friction skin within the ventral surface of digits. A terminal's phalanges are only one of the constantly exhibiting pattern configurations, it can be utilized for creating the identification records, through the complete identification can also be accurate within the impression of either the remaining phalanges or palms of hands. The fingerprints are also having commercial and forensic applications. The recent research within the automated identification of fingerprint technology gets coupled with the growing requirements for reliable personal identification also resulted from the increment in the utilization of fingerprints in both civilian as well as government applications like employment background checks, border controls as well as secured facility access. The fingerprints can be presented as the mature technology of biometrics that can be calculated as legitimate proof of evidence and which is having the capability to get represented in court in the entire world. Relating to the availability of variations in the data from a fingerprint, forensic scientists are also capable of processing and identifying which includes the identification of the gender, ethnicity as well as age. The fingerprints which comprise some of the important characteristics can also create valuable evidence to conduct the investigation at a crime scene. The fingerprints can be stated as the impression of the ridge crests through the friction skin within the ventral surface of digits. A terminals phalanges are only one of the constantly exhibiting pattern configuration, it can be utilized for creating the identification records, all through the complete identification can also be accurate within the impression of either the remaining phalanges or palms of hands. This complete research is going to be based on the collection of the samples of the 10-digit fingerprints so that the differences among the fingerprints within the Indian region as well as the African region needs to be identified on the basis of analysing the 10-digit fingerprints on behalf of evaluating the interracial comparison on behalf of the sexual dimorphism. These 10-digit fingerprint samples of the Indian region and African region are also going to be evaluated and analysed on behalf of conducting the complete identification of the fingerprint patterns on behalf of international comparison among the citizens of the Indian region as well as African region by utilizing the properties among the patterns of the 10-digit fingerprints.

2. MATERIAL AND METHODS

The Materials, as well as methodology utilized while conducting the research, depend on receiving permission from an institute committee that functions on the ethical consideration. The complete quantitative methodology is also utilized while framing this research. The samples of the 10-digit fingerprints are collected and analysed in this research. This complete perspective of this research represents a cross-sectional view that is carried out for the month among the 200 people or students studying in the medical field of the university (Abdullah et. al., 2016) [1].

Students who are having marks on their fingers or thumb or they are having some the deformative like any kind of disease or injury or maybe a birthmark, bandage fingers, burnout fingers, as well as webbed fingers, are excluded from this research while collecting the samples from the students (Chaudhary et. al., 2017) [11].

It is also suggested to every subject that they need to wash their hands while providing the samples of the fingerprints with water as well as soap and also let them get dry while getting wiped from the napkins. After all this, every student is asked for providing their 10-digit fingerprints on the stamp pad for providing the fingerprints on the blank paper so that the Impressions of the fingerprints get transferred to the blank paper (Chuen Lee et. al., 2021) [18]. This same technique is applied to every subject of the Indian region students as well as the African region students both are also studying in the same University while utilizing the technique. Fingerprints comprised of the 10 digits were taken separately within their respective blocks provided on the blank sheet itself (Kumar et. al., 2017) [22]. The precautions are entertained of avoiding the fingers sliding so that preventing smudging of an impression of the fingerprints (CEYHAN & SAĞIROĞLU, 2017) [3].

After the successful conducting of the collection of samples of 10-digit fingerprints. The sex and age of the subjects are also noted down on the blank sheet (Joshi et. al., 2016) [21]. The subjects are given the particular serial number fingerprint patterns are also studied while utilizing the magnifying glasses support and conducting the identification of the arches, loops, and whorls which usually depend on the appearance of ridge lines as well as it is also based on a classification of the Henry system (Krishnan et. al., 2016) [12]. This type of Henry system is assigned a particular type of sequence for every fingerprint that usually depends on its order as well as is located on a hand that gets initiated from the right side providing the sequence of one and ending on the left side providing it the sequence number ten, the entire distribution of dermatoglyphics effect patterns of the 10 digit fingerprints of left and right hands as well as the connection among the gender also related to the statistics (Binorkar & Kulkarni, 2017) [2].

3. RESULTS

The samples collected from the total subjects are around 200 who participated in the survey of which 100 are from the Indian region and 100 belong to the African region (Ghosh & Pahari, 2021) [23]. This data usually follows the age limit of 18 to 24 years and the image which is presented below represents the various types of 10-digit fingerprints. Represents the various types of 10-digit fingerprints pattern (Brunelle et. al., 2016) [10].

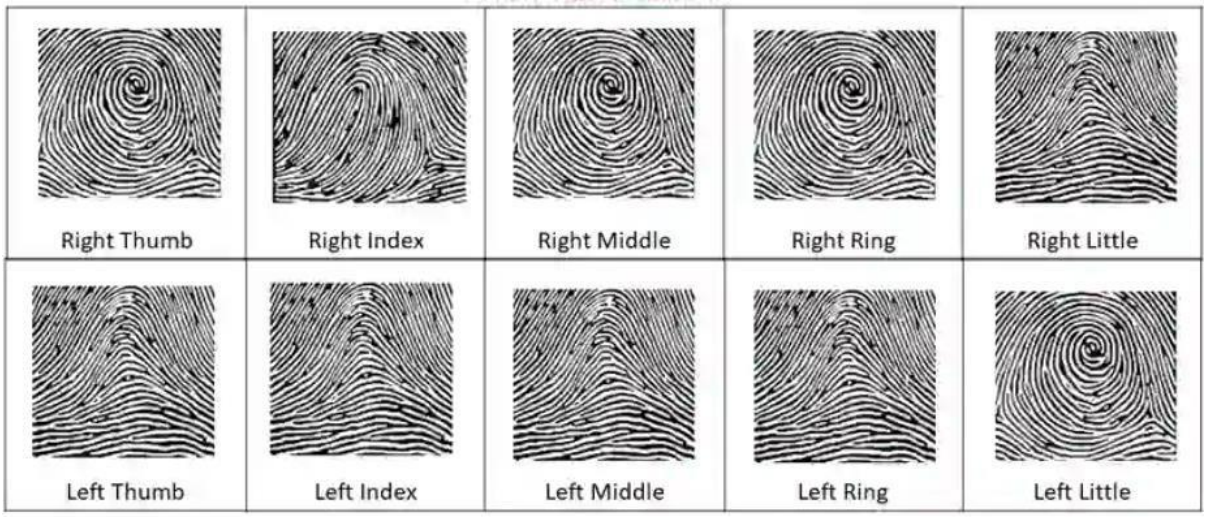


Figure 1. 10-digit fingerprints are presented in the above image

(Source: www.forensicreader.com, 2023) [14]

An analysis of the 10-digit fingerprint patterns of around 2000 fingers which are present in the both right- and left-hand fingers of 200 subjects represents the patterns of loops, arches, and whorls. The image which is presented below represents the various types of fingerprint patterns (Alam et. al., 2019) [9].

Figure 2. Types of Fingerprints pattern

(Source: link.springer.com, 2023) [7]

The table which is presented below shows the data of the samples collected from Indian region students: -

INDIAN-	FEMALES-50	MALES-50	TOTAL-100
Haryana	11	13	24
Himachal Pradesh	14	7	21
Uttar Pradesh	6	13	19
Kerela	11	11	22
Andhra Pradesh	8	6	14

Table 1. Samples collected from Indian region students

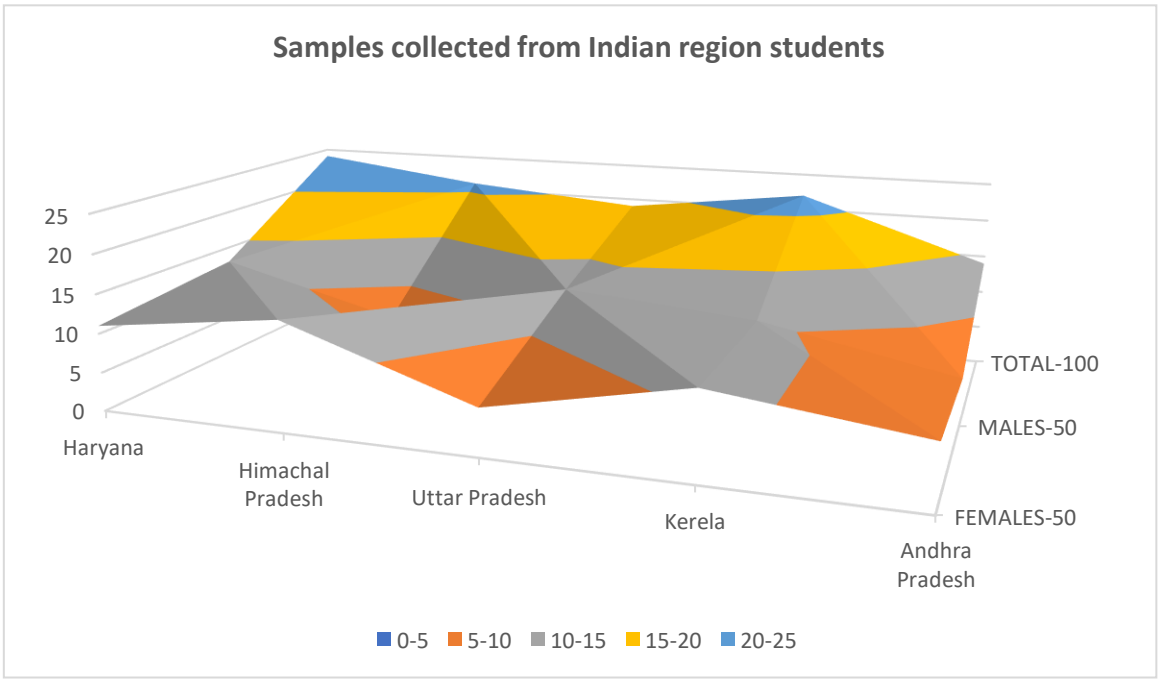


Figure 3. Samples collected from Indian region students

The table which is presented below shows the data of the samples collected from the African region: -

AFRICAN-	FEMALES-50	MALES-50	TOTAL-100
Malawi	10	15	25
Zimbabwe	15	10	25
Nigeria	10	15	25
Ghana	15	10	25

Table 2. Samples collected from African region students who live in India

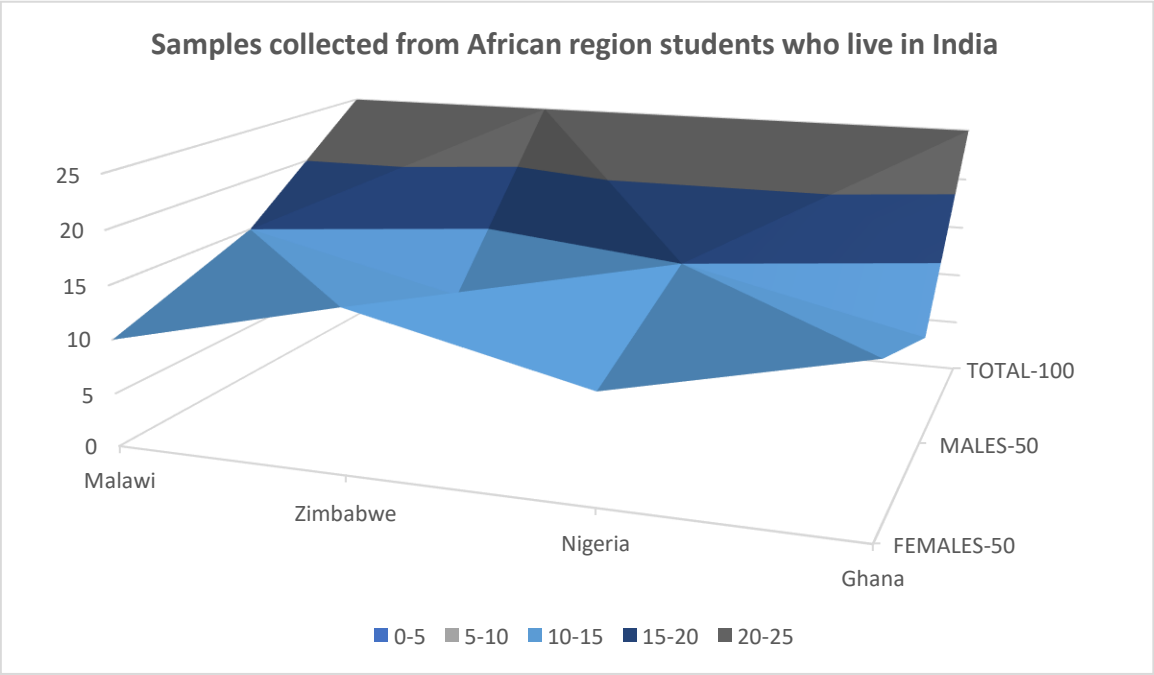


Figure 4. Samples collected from African region students who live in India

Indian

Females with similar kinds of patterns in thumbprints on both Hands- 35. Females with opposite/different kinds of patterns in thumbprints of both Hands- 15. Males with similar kinds of patterns in thumbprints on both Hands- 40. Males with opposite/different kinds of patterns in thumbprints of both Hands- 10.

African

Females with similar kinds of patterns in thumbprints on both Hands- 25. Females with opposite/different kinds of patterns in thumbprints of both Hands- 25. Males with similar kinds of patterns in thumbprints on both Hands- 30. Males with opposite/different kinds of patterns in thumbprints of both Hands- 20

Total prints of Indian region and African region: -

= (100+100/M+F) = 200 = Total Prints =200 = Total number of impressions = 200 x 10= 2000.

In the Indian region males and females having the same kind of patterns in the thumbprints on both hands are presented below: -

= Females with similar kinds of patterns in thumbprints on both Hands + Males with similar kinds of patterns in thumbprints on Both Hands= 35 + 40 = 75 Same kinds of patterns in the thumbprints on both the hands in Indian region among males and females.

In African regions males and females having the same kind of patterns in the thumbprints on both hands are presented below: -

= Females with similar kinds of patterns in thumbprints on both Hands + Males with similar kinds of patterns in thumbprints on Both Hands = 25 + 30 = 55 Same kinds of patterns in the thumbprints on both the hands in Indian region among males and females.

In the Indian region males and females have different kinds of patterns in the thumbprints on both hands are presented below: -

= Females with different kinds of patterns in thumbprints on both Hands + Males with different kinds of patterns in thumbprints on Both Hands = 15 + 10 = 25 Different kinds of patterns in the thumbprints on both the hands in Indian region among males and females.

In African regions males and females have different kinds of patterns in the thumbprints on both hands are presented below: -

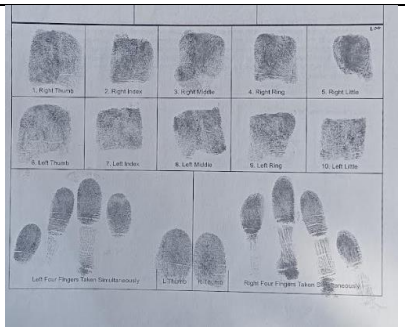
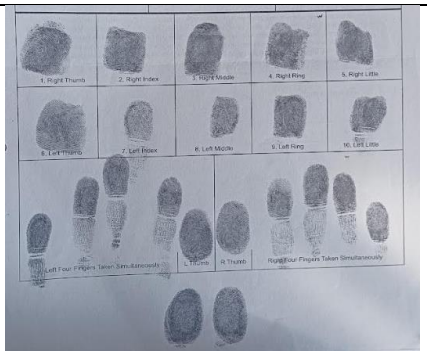
= Females with different kinds of patterns in thumbprints on both Hands + Males with different kinds of patterns in thumbprints on Both Hands = 25 + 20 = 45 Different kinds of patterns in the thumbprints on both the hands in Indian region among males and females.

Interracial comparisons between the Indian region and the African region are presented below:

S. No	Indian Region	African region
1	Females with similar kinds of patterns in thumbprints on both Hands- 35	Females with similar kinds of patterns in thumbprints on both Hands- 25
2	Females with opposite/different kinds of patterns in thumbprints of both Hands- 15	Females with opposite/different kinds of patterns in thumbprints of both Hands- 25
3	Males with similar kinds of patterns in thumbprints on both Hands- 40	Males with similar kinds of patterns in thumbprints on both Hands- 30
4	Males with opposite/different kinds of patterns in thumbprints of both Hands- 10	Males with opposite/different kinds of patterns in thumbprints of both Hands- 20

Table 3. Interracial comparison between the Indian region and African region

Fingerprint sample of Indian region

S. No	Name	Age	Sex	Place	10 Digit Fingerprints
1.	Vaid	21	Male	Kerala	
2.	Prakash	22	Male	Haryana	

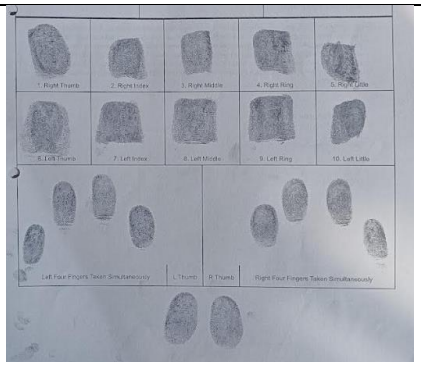
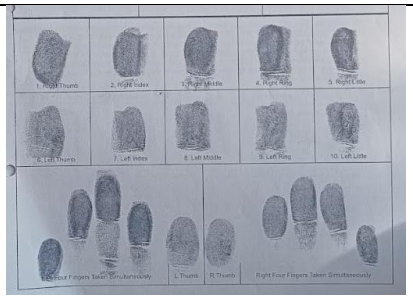
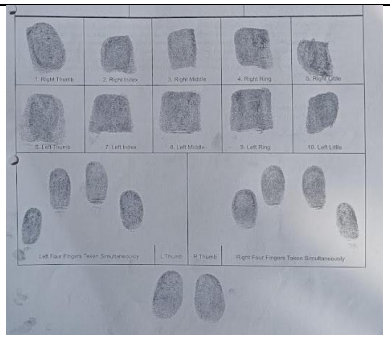
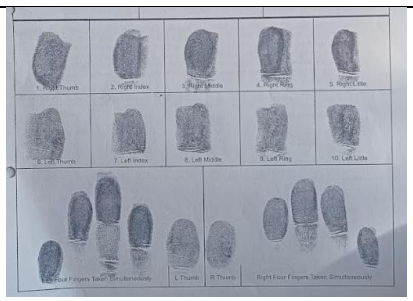
3.	Indu	19	Female	Himachal Pradesh	
4.	Juhi	23	Female	Uttar Pradesh	

Table 4. A fingerprint sample of the Indian region is presented in the above table.

Fingerprint sample of the African region

S. No	Name	Age	Sex	Place	10 Digit Fingerprints
1.	Amari	23	Male	Malawi	
2.	Chima	20	Male	Zimbabwe	

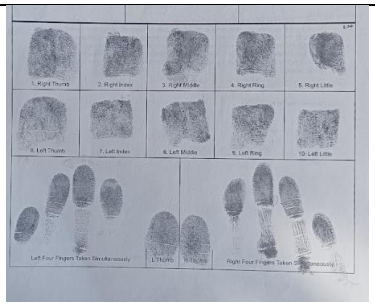
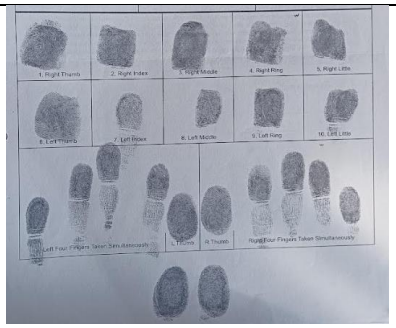
3.	Diallo	20	Female	Nigeria	
4.	Faraji	19	Female	Ghana	

Table 5. A fingerprint sample of the African region is presented in the above table.

Percentage Distribution of Indian Region male and female fingerprints among the 100 collected samples.

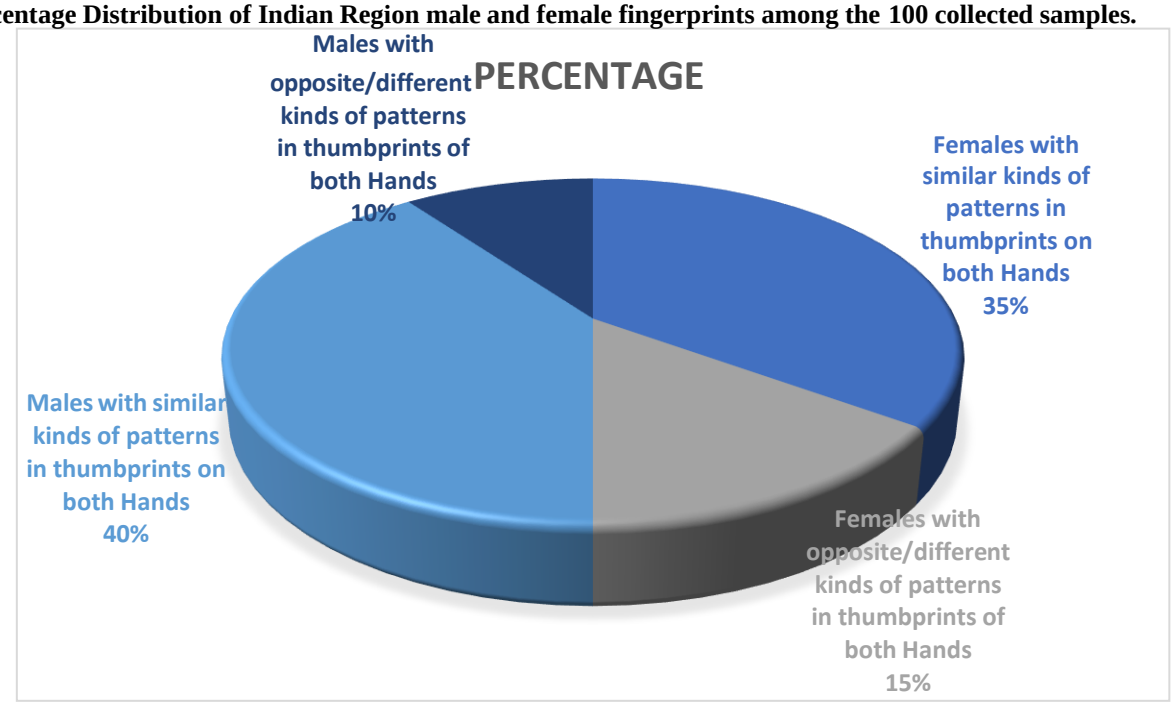


Figure 5. Percentage Distribution of Indian Region male and female fingerprints among the 100 collected samples.

Percentage Distribution of African Region male and female fingerprints among the 100 collected samples.

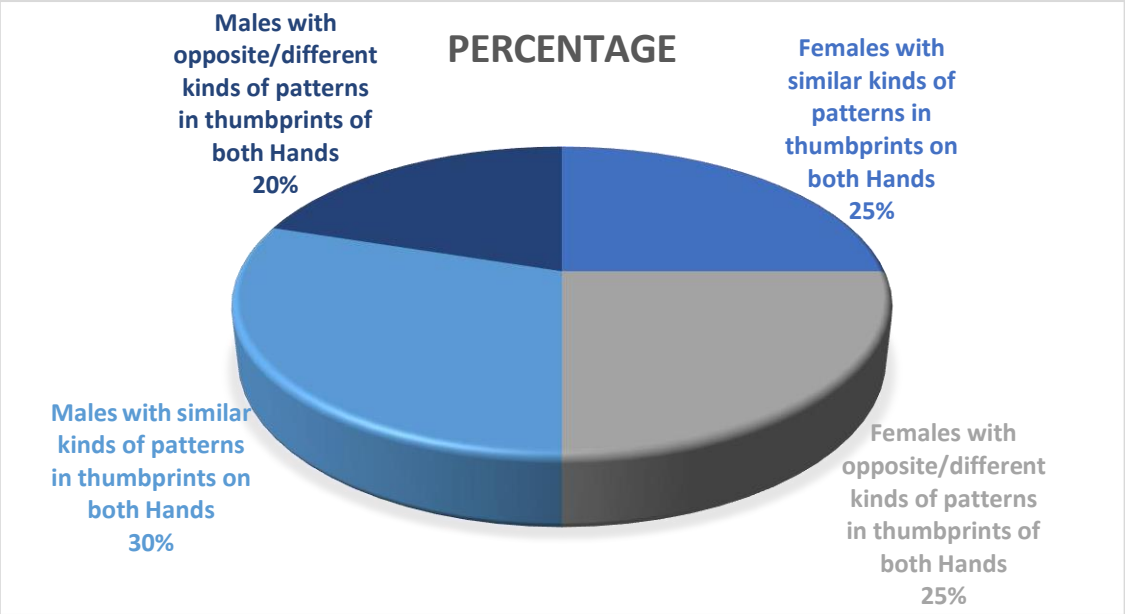


Figure 6. Percentage Distribution of African Region male and female fingerprints among the 100 collected samples.

An interracial comparison among the people of Indian and African regions on the basis of fingerprints represented that the Indian fingerprints and African fingerprints are quite similar to each other in every proportion and in every characteristic (Sandhu et. al., 2017) [6].

4. DISCUSSION

For several decades, fingerprints are used as identification as well as verification because they are different and unique in an individual way (Kumar et. al., 2019) [25]. These fingerprints provide the information in the three levels, the level First comprises the Macro details such as ridge flow, and pattern types like the arches, loops, whorls, etc (Ag & Suresh, 2020) [24]. The second level involves Galton characteristics or minutes like the termination of ridge or bifurcation ridge. For example, Bifurcation, eye, hook, etc., and the third level includes each and every dimension as well as the attributes of the ridge like the width, creases, pores, shape, edge contours, scars as well as other types of necessary, various and important details (Singh, 2021) [16].

An environment in the current situation also enhanced the importance of security and authentication methods, organizations as well as identification which usually gets developed within the main frame of Technology. All these types of necessities among the suitable identification personnel within controlled access which is computerized also resulted in the enhancement of interest in the utilization of biometrics (Pratap, 2021) [17].

Fingerprints can be presented as the mature technology of biometrics that can be calculated as legitimate proof of evidence and which is having the capability to get represented in court in the entire world (Tripathi et. al., 2020) [20]. Relating to the availability of variations in the data from a fingerprint, forensic scientists are also capable of processing and identifying which includes the identification of the gender, ethnicity as well as age. The fingerprints which comprise some of the important characteristics can also create valuable evidence to conduct the investigation at a crime scene (Patil et. al., 2019) [5].

The techniques of comparison also use by forensic scientist for the conducting of an investigation as well as the identification of both the factors which needs to be entertained which includes the characteristics of the Ridge as well as the position of complete characteristics in the process of Investigation (Govindarajulu et. al., 2020) [19]. Forensic experts of a fingerprint require to compare a systematic pattern of the fingerprint which includes the arches, loops, and whorls. The kind of fingerprint may be the left-hand print, right-hand print, thumbprint, etc, and a greater number of characteristics of the Ridge pattern (Bai et. al., 2018) [15].

The fingerprint ridge density can be used in the identification of the belongings of fingerprint patterns within the origin of females or males. Some of the characteristics of the type of ridge can also relate to gender. It can also provide support to the forensics experts in determining the particular type of gender as well as the investigating officer can also save good time in nabbing suspects. The fingerprints also create the impression of the friction ridges of every skin part of the finger (Qi et. al., 2021) [13]. It can also be represented as the raised or a proportion of an epidermis on the digits, the plantar skin as well as the palmer skin which comprises one or more than one connected unit of the rich pattern of a friction ridge skin. Fingerprints can be stated as the impression of the ridge crests through the

friction skin within the ventral surface of digits. A terminals phalanges are only one of the constantly exhibiting pattern configuration, it can be utilized for creating the identification records, all through the complete identification can also be accurate within the impression of either the remaining phalanges or palms of hands (Whitson, 2013) [8].

5. CONCLUSION

It is concluded that fingerprints are used as the identification as well as the verification because they are different and unique in an individual way. These fingerprints provide the information in the three levels, the level First comprises the Macro details such as ridge flow, and pattern types like the arches, loops, whorls, etc. The second level involves Galton characteristics or minutes like the termination of ridge or bifurcation ridge. For example, Bifurcation, eye, hook, etc., and the third level includes each and every dimension as well as the attributes of the ridge like the width, creases, pores, shape, edge contours, scars as well as other types of necessary, various and important details. The samples collected from the total subjects are around 200 who participated in the survey of which 100 are from the Indian region and 100 belong to the African region. This data usually follows the age limit of 18 to 24 years. An analysis of the 10-digit fingerprint patterns of around 2000 fingers which are present in the both right- and left-hand fingers of 200 subjects represents the patterns of loops, arches, and whorls. The image which is presented below represents the various types of fingerprint patterns. The interracial comparison among the people of Indian and African regions on the basis of fingerprints represented that the Indian fingerprints and African fingerprints are quite similar to each other in every proportion and in every characteristic.

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