Finger Print Patterns amongst Federal Polytechnic Ede Students, in Osun State, Nigeria.

ABSTRACT

This study determined the fingerprint patterns of 1000 students in Federal Polytechnic Ede, Osun State, Nigeria. A fingerprint is the reproduction of the friction ridges present on the inner surface of a fingertip. The fingerprint patterns were recognized based on the appearance of ridges lines to determine loops, whorls, and arches. The samples were collected based on the random sampling method. Materials used for this study; stamp pad, white paper, methylated spirit, and cotton wool. The smeared thumbs of both hands of the respondents were printed on plain white paper. For demographics, name, age, sex, department, and state of origin were collected. Of the 1000 students used for this study, 571 were females and 429 were males. This study lasted 5 months, from December 2021 to May 2022. The fingerprint pattern Loop was the highest, while the Arch was the least. From this study, it was discovered that the distribution of dermatoglyphic patterns was almost similar on both hands as regards handedness, while bilateral variations could not be established, but there was an association between the distribution of fingerprint patterns, gender and handedness.

Keywords: *Fingerprint patterns, fingertip, gender, students*

INTRODUCTION

Fingerprint is one of the most interesting, reliable and unique features of human body. No two fingerprints are exactly alike. Fingerprints follow the Locard's principle of exchange. The secretions in the fingerprints contain residues of various chemicals and their metabolites, which can be detected and used for forensic purposes[1].

Fingerprint identification, also referred to as dactyloscopy is the process of comparing questioned and known friction skin ridge impressions from fingers, palms, and toes to determine if the impressions are from the same finger or palm and toe. Medicolegal importance of fingerprinting includes identifying the criminal, in cheques, in bank notes or passports as a means of identification, in case of mass disasters, to prevent impersonation, in case of accidental exchange of new born

infants and to identify unknown corpses [2-6]. Due to the immense potential of fingerprints as an effective method of identification an attempt has been made in this study to analyze fingerprint patterns, their correlation with gender and also to determine the distribution of different fingerprint patterns among population of South-West region.

The proper usage of a technology implies precise knowledge of its limits and constraints [7-9]. With regard to automated fingerprint recognition technology, there exist well-known limits related to processing performance (i.e. how fast it can be done), to accuracy (i.e. how reliable the result of a comparison is) and to handling (i.e. the level of expertise necessary for its use). However, there is also a limit with respect to ageing [9]. Biometric identifiers (including fingerprints) have in common that they are based on physiological properties which may change over time. For the particular case of fingerprints, it is assumed that the characteristic pattern obtained from each finger is absolutely unique and unchanged for lifetime but at least the size of the pattern grows from childhood to adulthood [10].

Though fingerprint experts would be able, in principle, to compare the fingerprints obtained at different ages of a person, automated tools still need to be thoroughly tested under this scenario, especially when children´s fingerprints are taken into account.

Identification of humans is a necessity for personal, social and legal reasons and involves functional or psychic, normal or pathological characteristics that may define the individual [11-12]. The methods of identification according to Vahanwala et al.,[13] and Bansal et al.,[14] include anthropometry, dactyloscopy, fingerprinting, sex determination, estimation of age, measurement of height, postmortem reports, differentiation by blood groups as well as race, handwriting, skin texture and garments. The most important of these parameters is the fingerprints which often provide the positive identification of an individual or suspect because it is unique, durable and permanent [15]. Fingerprints are impressions of the unique characteristic mark or pattern curved lines of skin at the end of a finger that is left on a surface or made by pressing an inked finger onto paper. Some of the

earliest works on the use of fingerprints for personal identification were carried out in India so many years ago by Herschel (1859-1860)[16-17].

Human fingerprint is characterized by various types of ridge patterns classified as “Loop”, “Whorl” or “Arche”, with each having unique characteristics with respect to a reference point called a Triradius[18] and constitute 60-65, 30-35 and 5 % of all fingerprints, respectively [19]. The factors affecting the development of fingerprints towards a regular shape (such as size, degree of stoutness, growth rate of bone and thickness of subcutaneous fat) eventually result in the diversity of fingerprints [20].

Fingerprint is genotypically determined and it is affected by intrauterine environment in the first trimester of pregnancy though they are characterized by alternating strips of raised frictional ridge and depressed grooves on the fingertips Wijerathne[19]. The characteristic patterns of epidermal ridges are differentiated in their definitive forms during the third and fourth months of fetal life [21] and they remain unchanged from birth till death [6]Vij. Dermatoglyphics; the scientific study of epidermal ridge patterns of the skin of the fingers, palms, toes, and soles have been widely employed in areas as anthropology, genetics and evolutionary studies in characterizing populations, analyzing the nature and origin of human variability, population structure assessment, and the micro differentiation among populations. Although many studies on dermatoglyphics patterns have been conducted in different parts of the world, there are only limited studies carried out so far in Africa [22]. Study of finger prints patterns amongst students in Nigeria is quite impressive as a number of works have been done [23-24], but studies involving students in the polytechnic sector are not many and hence the focus of this study. Some of these studies involving finger print patterns amongst Nigerian populace include the brilliant work of Abimbola et al.[25], who looked at finger print and ear print patterns involving 2 distinct tribes in Nigeria namely; the Urhobos and Ibos residing in Warri, Southwest Nigeria, their instrument of analysis was a Hewlert-Packard G4010 photoscanner, although the number in their survey was low, the ulnar loop was found to be predominant, a similar study was also done by Jaiyeoba-Ojigho et al., [26], who also looked at 2 ethnic groups in Nigeria

namely the Itsekiris and the Urhobos, another study also looked at the fingerprint distribution amongst the 3 distinct ethnic groups in Nigeria namely; the ibos, yorubas and the ibibios (Akpan et al.,[27], the work of Eboh, [23]) is also worth mentioning as it involved fingerprint patterns in relation to gender and blood group amongst students in Delta state University Abraka.

Many studies on dermatoglyphics patterns have proven useful for identification and disease prognosis[12,27] but there are representative studies among Africans and the Nigerian population in particular. Some of these studies include; fingerprint patterns and its correlations to for example blood group type [29-30].Chima et al., [31] looked at finger print patterns in association with the ABO blood group system in the Nkalaha tribe of South eastern Nigeria and found the radial loop pattern to be the most common amongst genders. Aigbogun et al.,[32] on the other hand focused on familial pattern distributions to see the inheritance traits of finger print pattern acquisition amongst families. Onwuruka et al., [33] looked at fingerprint patterns in relation to gender amongst residents of Port Harcourt, Rivers State Nigeria. These researches done in Nigeria are noteworthy but a feature prevalent amongst them is the subject selection. For example, Obi et al., [34] looked at finger print patterns amongst students with learning disabilities. This study actually looked at a larger and broader respondent selection, even though Osun State is in South West Nigeria, Federal Polytechnic Ede is quite cosmopolitan in its Student population. Toward this purpose, this study is aimed to investigate the prevalent fingerprint patterns of among Students in Federal Polytechnic Ede, Osun State.Isah et al.,[24], did a similar study making his subject base to be students of Ibrahim Badamasi University, Lapai, Niger State Nigeria, his study included finger print pattern distribution amongst ethnic groups predominant in that area, their study found again the Ulnar loop to be the most predominant finger print pattern.

Empirical evidence has supported the prevalent of fingerprint patterns amongststudents in tertiary institutions where many authors identified the fact that fingerprint evidence rests on two basic principles which states that; a person's "fiction ridge patterns" (the swirled skin on their fingertips) don't change over their lifetimes, and that no two people have the same pattern of friction ridges.

Even identical twins have different fingerprints. The accuracy of the fingerprinting technique can be greatly affected by either appropriateness of the chose statistical channel model or alternatively by how fast and how much the signal signature change with time. This study however comes through to investigate the fingerprint patterns amongst polytechnic students.

MATERIALS AND METHODS

Sample Collection

The cross sectional study was conducted over a period of 5 months December 2021 to May 2022.The study was approved by the Department of Science and Laboratory Technology, Federal Polytechnic Ede, Osun State. The material consisted of 1000 fingerprints taken from 1000 students among which 429 were males and 571 were females.

Written informed consent was taken from the study subjects before taking the fingerprints. Healthy subjects who participated voluntarily were included in the study and their age ranged from 18-25 years. Subjects with permanent scars on their fingers and with hand deformities were excluded from the study. The fingerprints were taken by using Ink method as described by Cummins and Midlo[35].

The Kores duplicating ink, ink pad, white paper, methylated spirit, and cotton wool were used for obtaining fingerprints. Subjects were advised to wash their hands and made to dry. Ink was applied on the ink pad and uniformly smeared. The fingers were rolled on the ink slab and then placed on a white paper with one lateral edge and rolled over in opposite direction. Thus, an imprint of ten fingertips of both hands were recorded on the white paper. After the prints were dried sheets were marked with name, age, state of origin, department and sex. After taking the imprints of all fingers, the ink was removed by using cotton wool and methylated spirit. The qualitative analysis of fingertip patterns were studied with help of a magnifying lens. In this study, the classification of fingerprints into Loops, Arches and Whorls was considered. The qualitative data obtained from the fingerprints were tabulated, compared and analyzed.

Sample Technique

The samples were collected by simple random sampling method.

Inclusion criteria

Only healthy Federal Polytechnic Ede students, free from deformities of fingers or hand or disease or birth defects were included in the study.

Exclusion criteria

Any Federal Polytechnic Ede student having deformity like permanent scars on their finger or thumb, or hand deformities following injuries or birth defects or any kind of disease, those with worn fingers, extra webbed or bandage fingers were not included as part of the study.

Materials

Pre - structured Performa, Stamp pad (Camlin, size: 157×96 mm.), Unglazed paper, Hand magnifying lens and Pencil.

Methods

Each student was asked to clean their thumbs thoroughly with methylated spirit and cotton wool. The student were then instructed to press the thumb of right and left of their fingers on the stamp pad. The smeared fingers of both hands were printed on an unglazed plain paper which consisted of different blocks for fingers of right hand and left hand respectively. Both rolled and plane prints of right and left hand were taken. After obtaining the finger prints the basic details such as name, age, state of origin, department and sex was also collected. Primary patterns loops, whorl, arches and composite based on the appearance of ridge lines were observed with the help of a powerful hand lens. Precaution was taken to avoid sliding of fingers to prevent smudging of the print.

Classification Used

Henry system of classification was used for this study. This system assigns each finger number according to the order in which it is located in hand, beginning with the right thumb as number one and ending with the left thumb as number two.

RESULTS

A total of 1000 fingerprints were analyzed, from 1000 human subjects comprising of 429 males and 571 females. They all fingerprinted on the columns provided in the questionnaires, and then filled in where necessary.

Table 1. Percentage of fingerprint patterns in male and female subjects in the totalpopulation sample.

Sex	Arch	Loop	Whorl
Males	8.85%	57.8%	33.56%
Females	9.6%	53.59%	39.93%

Males have fewer arches, more loops; and fewer whorls. Females also have fewer arches, more loops and fewer whorls, although the percentage distribution was quite similar in both sexes.

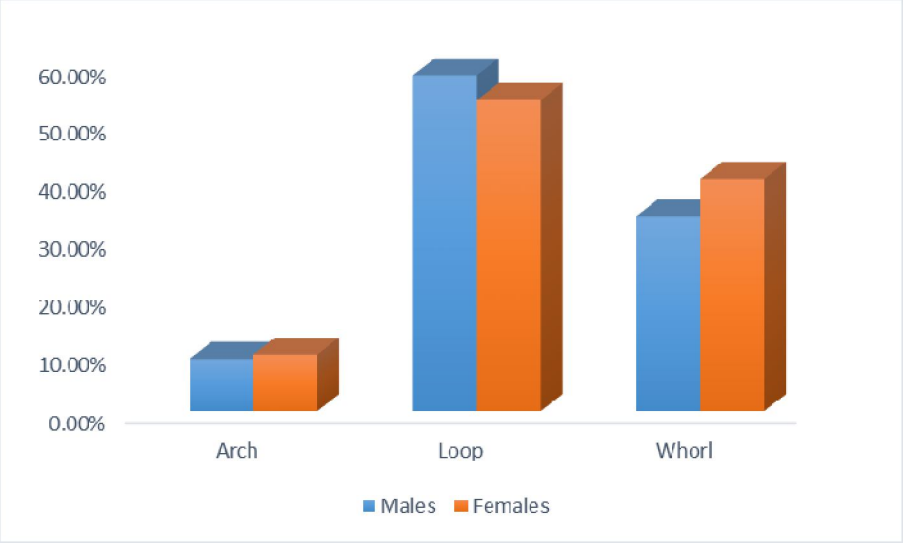

Fig 1: Fingerprint patterns of respondents in Federal Polytechnic Ede

Table 2. Percentage of Fingerprint Patterns in Relation to Handedness in Total Population Sample.

Handedness	Arch	Loop	Whorl
Right-Handed	4.45%	26.7%	17.5%
Left-Handed	4.85%	28.7%	19.7%
TOTAL	9.3%	55.4%	37.2%

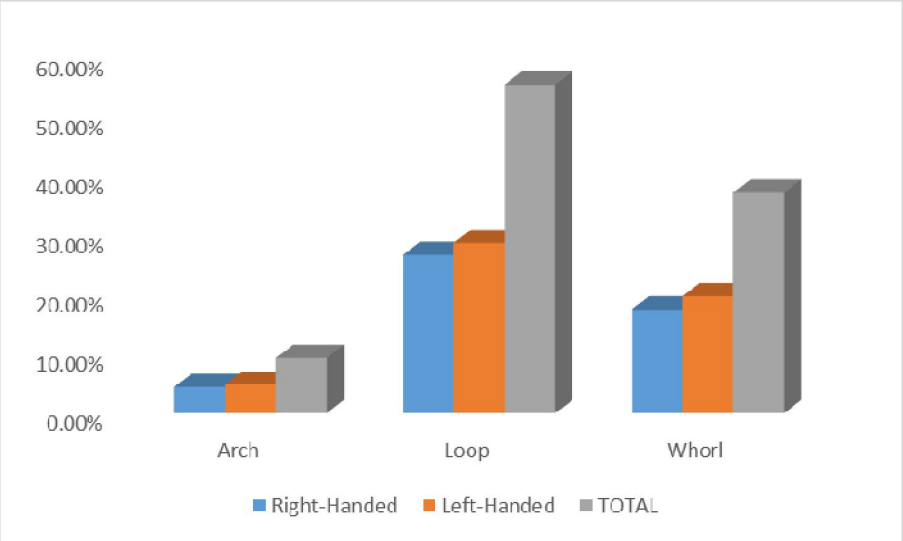

Fig 2: fingerprint patterns of respondents in relation to handedness in Federal Polytechnic Ede

Loops are the highest in all the left-handed subjects (28.7%) and then the right-handed subjects (26.7%)with the least number of loops. This same pattern applies in the other fingerprint types whorls and arches.

Percentage of fingerprint patterns in relation to handedness in total population sample.

The fingerprint pattern distribution in respect to handedness in this study was loop>whorl>arch. In terms of left handedness as against right handedness, the left handedness was relatively slightly more than the right handedness, with the same distribution pattern stated above. The arch fingerprint pattern was the lowest in this study.

DISCUSSION

It has been established over the decades that fingerprints are more than just 'mere impressions' made by the 'fingers'. In fact, their studies over time have shown that they delve deep into a realm that unleashes vast benefits found to be relevant in fields concerned with crime, forensic science, medicine, and so on; and even quite a number of other yet-to-be-discovered applications. These fingerprints actually have more to say than they let on; a relatively meager number have noticed

enough to want to tap into any more available uses; in form of innovations. This is actually a key factor as to why this research work has been executed.

Judging based on the overall survey made, it has been observed that loops have the highest frequency this is as presented in Table 1 and graphically presented in Figure 1 loops with a frequency of (55.4%) followed by whorls (37.2%) and then arches (9.3%). Most preceding dermatoglyphic studies are similar to this [36]. Also, there were contrasting results where fingerprint patterns were in this manner: Whorls > Loops > Arches [37]. In the study of Eboh[23] who worked on fingerprint patterns in relation to gender and blood group, the females had higher percentages of loops and whorls, while the males had higher percentage of arches. Another study, Onmuruka et al., [33], looked at fingerprint patterns in relation to gender and found that loops as higher in females than males, while whorls as higher in males than females and arches as found to be the lowest amongst both sexes.

The results indicates that males have fewer arches, more loops; and fewer whorls this is similar to previous research of Ekanem et al. [36] and Ujaddughe et al. [29] this also is quite similar to Reddy's work on finger dermatoglyphics of the Bagathas of Araku Valley, India. However, the results of this research differs from the reports of Taye et al. [38] and Mohammed [39] where they reported that the males had more whorls, fewer loops and arches than the females.

The left-handed subjects have the highest number of arches, loops and whorls, and then the right-handed subjects, there were no earlier report on the relationship between fingerprint patterns and handedness. Some studies however have found associations between fingerprint patterns and certain parameters, e.g. Obi et al., [34], in his study found an association between fingerprint and learning disabilities in students.

CONCLUSION

In this study loops were the predominant pattern in both males and females. Although loops were the predominant patterns followed by whorls and arches similar to the worldwide average, the frequency of whorls were comparatively higher and that of loops lower when compared with

worldwide distribution percentage. However, distribution of dermatoglyphic patterns being almost similar on both hands bilateral variations could not be established but there was an association between distribution of fingerprint patterns and gender.

RECOMMENDATION

Frequency of distribution of dermatoglyphic patterns amongst Undergraduate Federal Polytechnic Ede students differs from other population groups. The present study confirms that loop was the most common fingerprint pattern while arches was least common. Distribution of dermatoglyphic patterns was almost similar on both hands and both sexes. Bilateral variations and gender based differences could not be established. The study therefore recommended that similar studies should be done in other population groups for better correlation.

Disclaimer (Artificial intelligence): The authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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