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THUMBPRINTS: A CROSS-SECTIONAL STUDY AMONG THE KUKI AND PAITE COMMUNITIES OF MANIPUR, NORTHEAST INDIA

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ABSTRACT

Every individual has unique fingerprints which remain unaltered during one's lifetime. This trait makes it significant in different fields; hence, such pattern study is essential to identify a person (or criminals), gender differences, or population variation. The main aim of the study is to determine the dominant thumbprint patterns and assess whether sexual dimorphism exists among the Kuki and Paite tribal communities of Northeast India. A total of 1391 out of 1460 participants in the age group of 30-65 had thumbprints that were clear and identifiable, hence only their thumbprints were analyzed for this study and classified as whorls, loops, and arches based on the ridge patterns. The whorls pattern was the dominant type of fingerprint, followed by loops and arches. Sexual dimorphism was not apparent.

Keywords: *Fingerprint, Kuki, Paite, Manipur, sexual dimorphism, Northeast India*

INTRODUCTION

Dermatoglyphics or skin carving studies the formation of epidermal ridge patterns. These ridges are friction ridges having unique arrangements (Kumar, 2011). Fingerprints are formed during the early uterine life between the 7th and 21st week of gestation and completed during the 7th month of fetal development (Namouchi, 2011). After the complete formation of fingerprints, it cannot be altered by age or any other factor unless it involves deep wounds that penetrate the epidermis or a disease known as leprosy. It was initially thought that monozygotic twins would share similar fingerprints as they shared the same DNA profile, yet their fingerprints differ like any other individual (Mozayani and Noziglia, 2006).

Identifying a person's individuality based on unique traits is crucial in

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forensic, medico-legal cases, and anthropology. Many traits are considered for this purpose, such as skin texture, speech, voice, gait pattern, handwriting, hair, footprints, fingerprints, DNA profile, etc. Among these, fingerprints are commonly used to identify a person due to their permanence, individuality, and uniqueness (Kanchan and Chattopadhyay, 2006). For crime scene investigation, fingerprints, mainly chance prints, are found at crime scenes. The fingerprint examiner will compare the fingerprint of the suspect, and that found at the crime scene through pattern type, ridge counting, and by comparing minute ridge characteristics and give his/her opinion. This opinion significantly impacts judgment (Koehler *et al.,* 2016), though sometimes an error can be made due to poor quality of fingerprints (Busey and Dror, 2011), which may burden the innocent (Garrett and Neufeld, 2009).

Thumb impressions are crucial as they are used in essential documents related to banks, legal documents, biometrics, etc., and in civil and criminal cases (Kapoor and Badiye, 2015). The thumb plays a vital role whenever work is done, like holding or lifting objects. This makes it evident that thumb impressions will be mostly present on the objects. Also, illiterate individuals use it as an alternative to signing the necessary documents. Studies have also found that a specific fingerprint pattern dominance differs according to a particular population (Shashikala and Ashwini, 2011), and gender differences could also be studied (Kapoor and Badiye, 2015). Hence, the present study attempts to find the dominant thumb patterns among the two Manipur tribal populations and assess whether sexual dimorphism in their distribution exists among the studied population.

MATERIALS AND METHODS

The present study is a cross-sectional study conducted on 1460 participants (Kuki=730 and Paite=730) in the Churachandpur District of Manipur, North East India. The Institutional Ethics Committee, Department of Anthropology, University of Delhi approved the study, and ethical clearance was obtained. Participants' Information Sheets were prepared and translated into local languages describing the study's rationale, benefits, and risks. The inclusion criteria were based on age between 30-65 years, voluntary participation. Participants with major deformities or leprosy were excluded from the study. The participants were asked to wash and dry their hands. An inkpad was used for collecting the thumb impressions. The inked thumb was then rolled toward the subject's body and an impression was obtained on the allotted space in the interview schedule. This schedule had the name, sex, age, and various other socio-demographic details of the participant. The thumbprint was analyzed with the help of the magnifying glass and classified based on their ridge patterns as loops, whorls, and arches, as proposed by Francis Galton in 1892. Even though the sample size was 1460, the total number of thumb impressions analyzed was 1391 (Kuki, N=710 and Paite, N=681). The reason is that the study participants were mostly agriculturists or daily laborers with prominent occupational marks

on their fingers, making some of their prints unidentifiable and hence were excluded. The collected data were entered into excel sheets and analyzed accordingly. P<0.05 was considered statistically significant.

RESULTS

The present study found that the whorl pattern was the most prevalent one in the studied communities constituting 61.7% and 66.8% among the Kuki and Paite, respectively. The Kuki females were found to have more numbers of whorls when compared with males, even though the difference was not statistically significant. On the other hand, among the Paites, males were found to have a higher whorl pattern than females, though this difference was not statistically significant. The Paite males were found to have a higher prevalence of whorls than Kuki males when a comparison was made between the two communities, which is significant (Table-1).

Table-1: Prevalence of types of thumbprint patterns among the two studied tribal communities of Manipur.

	Kuki				Paite				
Types of thumbprints	**Total, N (%)**	**Males, N (%)**	**Females, N (%)**	**χ^2 p-value**	**Total, N (%)**	**Males, N (%)**	**Females, N (%)**	**χ^2 p-value**	**χ^2 p-value**
Whorls	438 (61.7)	192 (60.2)	246 (62.9)	0.294	455 (66.8)	221 (70.2)	234 (63.9)	0.067	0.075$^{\Psi}$
Loops	248 (34.9)	119 (37.3)	129 (33.0)		212 (31.1)	91 (28.9)	121 (33.1)		0.018$^{*¥}$
Arches	24 (3.4)	8 (2.5)	16 (4.1)		14 (2.1)	3 (1.0)	11 (3.0)		0.828$^{€}$
Total	710 (100.0)	319 (100.0)	391 (100.0)		681 (100.0)	315 (100.0)	366 (100.0)		

* Significant at p<0.05; N: Count; p: Chi-square between overall participants of Kuki and Paite communities; ¥: Chi-square between males of both communities; €: Chi-square between females of both communities.

It was observed that, between the two studied communities, Paites (66.80%) were found to have higher frequencies of whorls than the Kukis (61.70%). In contrast, the loops (34.90%) and arches (3.40%) were slightly higher in the case of Kukis when compared with the Paites, which were 31.10% and 2.10%, respectively (Figure-1).

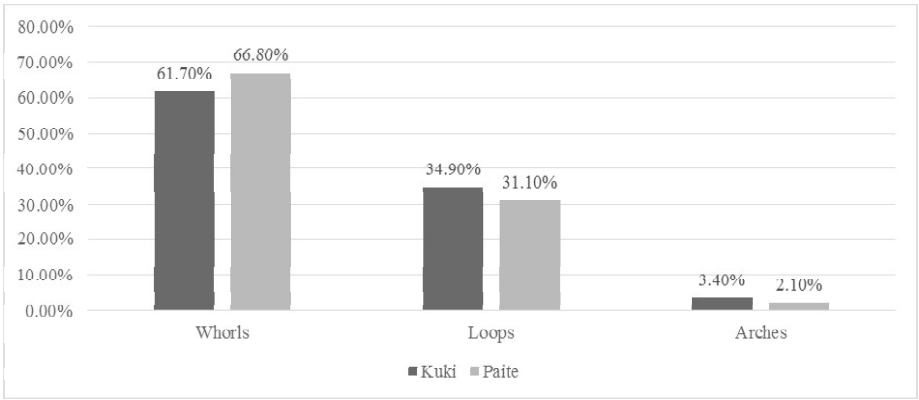

Figure-1: Distribution of thumbprint patterns among the studied tribal communities.

The sex-wise distribution of thumbprint patterns was plotted in a graph (Figure-2). Among the Kuki, the frequency distribution of thumbprint patterns was whorl (males-60.20%; females- 62.90%), loops (males-37.30%; females-33.0%), and arches (males- 2.50%; females- 4.10%). Meanwhile, among the Paite, the frequency distribution of thumbprint patterns was whorl (males-70.20% and females- 63.90%), loops (males-28.90% and females-33.10%), and arches (males- 1.00% and females- 3.00%)

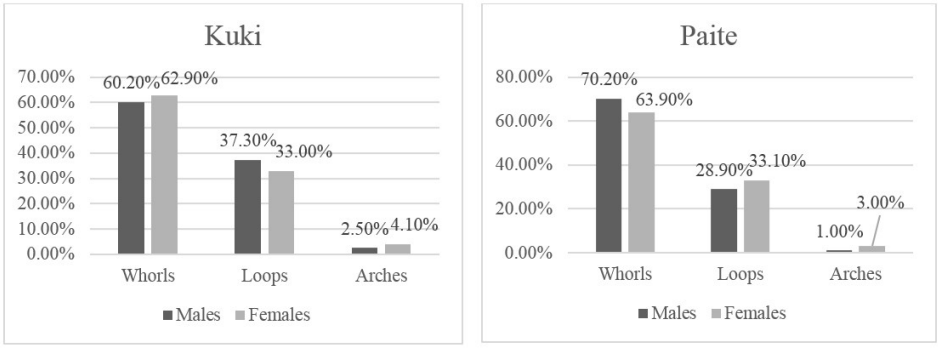

Figure-2: Sex-wise distribution of thumbprint patterns among the studied tribal communities.

DISCUSSION

Thumbprints play a significant role in identifying a person due to their uniqueness, which is helpful in various fields of genetics, anthropology, and forensic science. This has been known since prehistoric times and was used to solve cases (Ball, 2002). The reason for considering fingerprints instead of various other traits was due to their permanence which does not alter with age or environment. Studies state that an individual, sex, and population can be determined by studying the prevalence of fingerprint types (Namouchi, 2011; Herdegen and Loew, 2012; Koneru *et al.,* 2014). This study was done to determine the dominant thumbprint pattern and assess whether sex differences exist in the frequency distribution of various ridge patterns among Manipur's Kuki and Paite communities.

It was observed that whorls show the highest frequency among the Kuki and Paite communities. In a study by Banik *et al.* (2019) among the Rengma Nagas of Nagaland, they found similar results: whorls were the highest, followed by those of loops and then arches. While in other regions, studies reported higher loops frequencies followed by those of whorls and arches (Karki and Singh, 2014; Sam et al., 2015; Shukla *et al.,* 2016; Afza and Khurshid, 2019; Shrestha and Malla, 2019). Arches were found to be the least occurring thumbprint pattern in the present study and are in agreement with the studies of *Qayyum et al.* (2013) and *Nithin et al.* (2015).

The present study shows that in both the studied communities, whorls were dominant among males and females, followed by loops and then arches. This

study is in line with Banik *et al*. (2019) study where whorls were the most frequent among males and females, then loops and arches. A study done by *Patel et al*. (2011) found that whorls were dominant among females, and Afza and Khurshid (2019) found that whorls were higher in males, but loops were higher in females. This finding is in contrast with *Koneru et al*. (2014) who studied the Manipuris of Manipur, and it was reported that loops show the highest prevalence, followed by whorls and arches in both males and females. Hence, sexual dimorphism was not apparent as the frequencies of fingerprint patterns were similar, and the difference was not statistically significant.

The study's strength is the large sample size. It may also be the first documentation of thumb impressions among the Paites and Kukis of Manipur. The limitation of the study is that only thumb impressions were considered, which in the future, research can be carried out on all ten digits along with ridge counting and ridge characteristics.

CONCLUSIONS

Since ancient times, fingerprints have been considered a tool for identifying an individual for multiple purposes, which is still relevant today. The present study focuses on thumb impressions, the most motile digit whose impressions are commonly found in crime scenes and at essential documents. This study aims to find the dominant left thumb pattern types and observe that whorls have the highest occurrence, followed by loops and arches in the studied tribal communities. Sexual dimorphism could not be observed as the frequency distribution shows no statistical difference. The finding of this study is that specific thumb patterns differ according to the population studied and can be beneficial as it describes a population-wise preponderance which can also aid in forensic investigations. Also, there is a need for a fingerprint database in India which is still nascent even though the Police department already has a few records in its database. This study might also contribute to the existing database and aid in fields relating to anthropology, forensic science, and medico-legal cases.

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