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Analysis of fingerprint patterns and axial triradius digital angles in the Komering population

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ABSTRACT

Some dermatoglyphic components that can be used to analyze a population are fingerprint patterns and Axial Tri-Radius Digital (ATD) angles because they are unique to each ethnic group. This study aimed to determine variations in fingerprint patterns and ATD angles in the Komering population in Palembang. The study of fingerprint patterns and ATD angles was descriptive. The sample size was 43 respondents registered in the Gunung Batu Family Association (IKA GUBA) Komering Ulu Timur in Palembang City. The results showed that the ulnar loop pattern was the most common fingerprint pattern, with 90.4% on the right palmar hand and 85.9% on the left palmar hand. The most minor fingerprint pattern is accidental whorl, which is 0% on the right palmar hand and 1.8% on the left. The 30°-45° angle dominates the right and left palmar ATD angles (88.4% and 86.0% respectively).

Keywords: *Axial Tri-Radius Digital, Fingerprint patterns, Komering population*

ABSTRAK

Beberapa komponen dermatoglifi yang dapat digunakan untuk menganalisis suatu populasi adalah pola sidik jari dan sudut Axial Tri-Radius Digital (ATD) karena memiliki keunikan tersendiri pada setiap etnis. Penelitian ini bertujuan untuk mengetahui variasi pola sidik jari dan sudut ATD pada populasi suku Komering di Palembang. Penelitian tentang pola sidik jari dan sudut ATD ini bersifat deskriptif. Jumlah sampel sebanyak 43 responden yang terdaftar di Ikatan Keluarga Gunung Batu (IKA GUBA) Komering Ulu Timur di Kota Palembang. Hasil penelitian menunjukkan bahwa pola ulnar loop adalah pola sidik jari yang paling umum, dengan 90,4% di telapak tangan kanan dan 85,9% di telapak tangan kiri. Pola sidik jari yang paling sedikit adalah accidental whorl, yaitu 0% pada telapak tangan kanan dan 1,8% pada telapak tangan kiri. Sudut 30°-45° mendominasi sudut ATD telapak tangan kanan dan kiri (masing-masing 88,4% dan 86,0%).

Keyword: Populasi Komering, Pola sidik jari, Sudut axial triradius digital

1. Introduction

The characterization of an individual's ethnic diversity appears on physical characteristics such as skin color, hair shape, and language spoken. One of the biological characteristics that can signify a population is the fingerprint pattern. Volar pads and boundaries influence the formation of fingerprint patterns in humans, while genetic factors influence ridges on the fingers. Volar pads are temporary protrusions on the skin surface that form during the seventh week of fetal development. Boundaries are nail indentations, flexion creases, and fingertip margins (Adamu & Taura, 2017). Dermatoglyphics refers to the epidermal tendrils found on the palms of the hands, soles of the feet, fingers, and big toes (Singh & Parvathi, 2016). Fingerprint patterns and Axial Tri-Radius Digital (ATD) angles are usually used as markers for dermatoglyphics studies because those

two markers are unique for each individual and can be an alternative for identifying an individual (Farha, 2015).

Fingerprint pattern is one of the biological variations that differ from one racial group to another, between women and men, even in identical twins. This difference causes fingerprints to be used as material for investigating crimes, identifying a person, and diseases due to genetic disorders in a person. The distribution of dermatoglyphics differs across gender and race. Men have more whorl patterns than women, while women have simpler arch patterns than men (Kapoor & Badiye, 2015).

Hidayati found that most Javanese subjects had a loop fingerprint pattern (52.1%) compared to Papuan tribes (Hidayati, 2015). Previous research comparing fingerprint pattern variations of students of various ethnic groups in Madiun city from a sample of 11 ethnic groups, showed that there were ten ethnic groups, namely Javanese, Dayak, Flores, Batak, Lampung, Bali, Mentawai, Banjar, Madura, Betawi, and Minangkabau. Whorl fingerprint patterns dominate the Minangkabau tribe, while loop fingerprint patterns dominate other tribes (Purbasari, 2017).

Until now, there has been no scientific publication on fingerprint patterns in the Komering tribe from South Sumatra. Therefore, it is necessary to conduct a study that aims to identify fingerprint patterns and ATD angles in the Komering population.

2. Methods

This research is descriptive research with a cross-sectional study approach. The research was conducted from April to August 2021. The target population of the study was the Komering population, with the population registered with the Gunung Batu Family Association (IKA GUBA) of East Komering Ulu as the target population. Sampling in this study used the Total Sampling technique. The inclusion criteria of the study were the Komering population who were male and female, aged 18-65 years, with the results of the interview stating the descent of the original and mixed Komering population and registered in the community of Komering people in Palembang city. The exclusion criteria of the study are the Komering population who have trauma on the palm, such as being injured and experiencing inflammation on the palms.

The fingerprint patterns identified from the samples were Simple arch, Tented arch, Ulnar loop, Radial loop, Double loop, Whorl, Accidental whorl, and Central pocket whorl. Categorization of ATD angles were <30°, 30-45°, and >45°. The research data is primary data obtained directly from the research subject, namely the Komering population in Palembang city, in the form of a picture of the fingerprint pattern and ATD angle (Figure 1) applied to an ink pad.

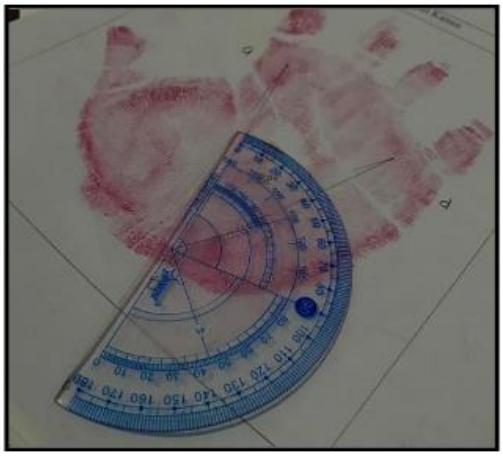

Figure 1. The measurement technique of ATD angle using a protractor.

3. Results and Discussion

The population of Komering IKA GUBA Komering Ulu Timur has 54 active members. However, only 43 active members can be studied for dermatoglyphics because there are two respondents with fingerprints that cannot be studied. After all, one respondent had contact dermatitis, and one respondent had injured hands, while nine other members refused to be studied. The research respondents were 24 men and 19 women with an age range of 18-65 years (Table 1). Based on hereditary history, six respondents were mixed Komering descendants who came from a mixture of Rejang Bengkulu, Malay, Sundanese, Madurese, Musi (Sekayu), and Minangkabau tribes.

Table 1. Characteristics of Respondents

Characteristics	Frequency (persons)	Percentage (%)
Sex		
Male	24	55.8
Female	19	44.2
Tribe		
Indigenous Komering tribe	37	86.0
Mixed Komering tribe	6	14.0

The frequency distribution of fingerprint patterns showed that the ulnar loop pattern (Figure 2) was the pattern with the highest frequency of 254 (Table 2). The ATD 30°-45° angle (Figure 3) was the most common angle of both the right and left palmar hands (Table 3).

Table 2. Distribution of fingerprint patterns in the Komering population

Fingerprint Patterns	Frequency (fingers*)	Percentage (%)
Simple arch	5	1.16
Tented arch	17	3.95
Ulnar loop	254	59.07
Radial loop	19	4.42
Double loop	15	3.49
Plain Whorl	115	26.74
Accidental whorl	1	0.23
Central pocket whorl	4	0.93
Total	430	100.0

* Based on the examination of 10 fingers from 43 respondents

Table 3. Distribution of ATD angle in Komering population

Angle magnitude	Left Palmar		Right Palmar	
	Frequency (persons)	Percentage (%)	Frequency (persons)	Percentage (%)
<30°	1	2.3	0	0.0
30°-45°	37	86.0	38	88.4
>45°	5	11.6	5	11.6
Total	43	100.0	43	100.0

Figure 2. Ulnar loop found on right middle finger (Source: personal data)

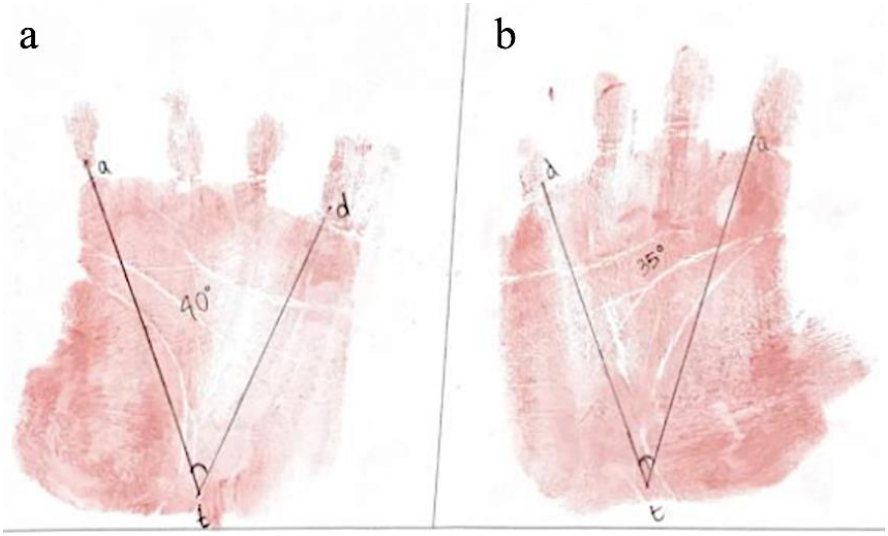

Figure 3. The results of ATD angle: a) ATD angle from right hand; b) ATD angle from left hand (Source: personal data).

The research results on the Komering population in IKA GUBA Komering Ulu Timur Palembang city obtained the most fingerprint patterns, namely the ulnar loop. The nature of the fingerprint pattern can influence this result because the loop pattern is one of the most common fingerprint patterns found on human fingers, with the ulnar loop pattern being predominant to other patterns (Adamu & Taura, 2017; Wijerathne et al., 2013).

The Komering population belongs to the Mongoloid race, which is a Proto-Malayan nation (Darmanto, 2016). The results of this study, which obtained the most ulnar loop patterns similar to previous research which examined the Javanese sample population in Surabaya and showed that the fingerprints of Javanese samples were dominated by loop patterns (Hidayati, 2015). Fingerprint patterns in students from inter-tribal marriages such as Malay-Batak, Malay-Javanese, and Javanese-Minang showed the dominance of loop patterns compared to arch and whorl patterns (Chastanti, 2020). A study that examined the Muslim population in Maharashtra, India, a Mongolid race, also reported that the most extensive distribution of fingerprint patterns was dominated by the ulnar loop pattern (Kapoor & Badiye, 2015). Then a study which examined dermatoglyphic variations in the Asante population in Ghana, which belongs to the Negroid race, reported the distribution of fingerprint patterns in the Asante population in Ghana, namely the dominant loop pattern in men by 65.9% and in women by 68.4% (Awuah & Dzogbefia, 2017).

A study in the Bulgarian population, belonging to the Caucasoid race, reporting the highest pattern obtained in the Christian Bulgarian population is a loop with a percentage of 59%, in Muslim Bulgarians at 60%, and Turkish Bulgarians at 56.5% (Angelova & Georgieva, 2019). However, Mundijo & Purwoko's research reported the dominance of whorl fingerprint patterns (62.3%) in Palembang city residents (Mundijo & Purwoko, 2017). The study results differ because Mundijo & Purwoko's research did not differentiate the ethnicity of the research subjects.

Dermatoglyphic features, especially fingerprint patterns that are highly variable and unique in anthropometric aspects, are considered a way to determine race or population. Fingerprint variations in human populations compare patient abnormalities with healthy people based on gender and ethnic differences (Dunayev, Gunas, Popadynets, Kozoviy, & Kindrativ, 2021). In forensic medicine, fingerprint pattern variations are beneficial for narrowing down the identification of an individual to ensure individuality (Awuah & Dzogbefia, 2017). In addition, dermatoglyphic aspects can be used as specific markers in psychological identification as well as a person's behavior, lifestyle, mode of response, and life behavior, which can significantly accelerate the implementation of scientific developments in the daily practice of doctors, criminologists, investigative agencies, and other specialties (Dunayev et al., 2021). Although each individual shows differences in fingerprint patterns, fingerprint pattern identification can be easily done because the average frequency of each pattern and other characteristics show apparent variations among the population (Purbasari, 2017).

The ATD angle of 30°-45° dominates in the Komering population. This result is similar to previous research on a population of healthy students in Palembang, who also found that the dominant ATD angle was in the range of 30°-45° (Mundijo, 2017). The ATD angle in male prisoners in Medan, Sumatera Utara, also showed a domination in the range of 30°-50° (Ismurizal, 2019).

The dermatoglyphic distribution of both fingerprint patterns, ATD angles, and triradius sections differs in each population due to genetic factors. Genes encoding the structural arrangement of the triradius may differ in gene expression in each palm concerning the position of the triradius, resulting in differences in distribution. This gene expression occurs in the early stages of life and will remain for life. The unique and distinct distribution of triradius in each individual will be the same in each population within a race. Hence, it is evident that populations, groups, or countries that share a common ancestral history will have the same pattern of distribution presentation (Paul, Akinola, & Obiandu, 2019).

4. Conclusion

Ulnar loop fingerprint patterns and ATD angles in the normal range were most common in the Komering population of IKA GUBA Komering Ulu Timur living in Palembang city. These patterns and angles do not show any distinctiveness that can distinguish the Komering population from other tribal populations in Indonesia. Therefore, to find the distinctiveness of the Komering population, it is necessary to analyse fingerprint patterns, more specifically using indices such as Dankmeijer or Furuhata.

5. Acknowledgement

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6. Conflict of Interest

Authors declare no conflict of interest.

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