



Identification Of Fingerprint Patterns And Axial Triradius Digital Angles On Male Prisoners At Prison X In 2021

Dinda Nafatilana¹, Trisnawati Mundijo², Mitayani Purwoko^{*2}

¹Bachelor of Medicine, Undergraduate Study, Faculty of Medicine, Universitas Muhammadiyah Palembang, Palembang, 30263, Indonesia

²Department of Medical Biology, Faculty of Medicine, Universitas Muhammadiyah Palembang, Palembang, 30263, Indonesia

*Corresponding Author: mitayani@um-palembang.ac.id

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ABSTRACT

Dermatoglyphics is the science of describing streaks on the skin at the tips of the fingers and toes as well as the palms and feet and skin folds on both palms. Several studies have shown a distinctive dermatoglyphic tendency in prisoners. This study aims to determine the fingerprint pattern and the angle of ATD in male prisoners involved in murder and sexual crimes at Prison X. The research sample was obtained by total sampling. The sample size was 113 people. Fingerprint patterns were taken using the Digital persona U.are.U 4500 Fingerprint reader and the ATD angle using a wet stamp on plain paper. The results showed that the dominant fingerprint patterns were the ulnar loop (341 of 720 fingers) and plain whorl (202 of 720 fingers). The dominant ATD angle was $>50^\circ$. In conclusion, there is no distinctive trend in the fingerprint patterns of male inmates, but there is a distinctive trend in the ATD angle.

Keywords: Axial Tri-Radius Digital, Fingerprint patterns, prisoners

ABSTRAK

Dermatoglifi merupakan ilmu tentang gambaran guratan-guratan pada kulit diujung jari tangan dan kaki juga telapak tangan dan kaki serta lipatan kulit pada kedua telapak tangan. Beberapa penelitian menunjukkan adanya kecenderungan dermatoglifi yang khas pada narapidana. Penelitian ini bertujuan untuk mengetahui bagaimana pola sidik jari dan sudut ATD pada narapidana pria yang terlibat kasus pembunuhan dan kejahatan seksual di Lembaga Pemasyarakatan X. Sampel penelitian didapatkan dengan cara *total sampling*. Besar sampel sebesar 113 orang. Pengambilan pola sidik jari menggunakan alat *Digital persona U.are.U 4500 Fingerprint reader* dan pengambilan sudut ATD menggunakan cap basah pada kertas polos. Hasil penelitian menunjukkan bahwa pola sidik jari yang dominan adalah pola *ulnar loop* (341 dari 720 jari) dan *plain whorl* (202 dari 720 jari). Sudut ATD yang dominan adalah $>50^\circ$. Kesimpulan, tidak ada kecenderungan yang khas pada pola sidik jari narapidana pria, namun ada kecenderungan yang khas pada sudut ATD.

Kata kunci: axial triradius digital, dermatoglifi, narapidana, pola sidik jari

1. Introduction

Fingerprints are included in the main part of dermatoglyphics, the science of the description of streaks on the skin at the tips of the fingers and toes as well as the palms and feet and skin folds on both palms of an individual. Dermatoglyphics has three main parts, namely the number of triradius, the total number of tendrils, and the Axial Triradius Digital (ATD) angle. The ATD angle itself means the angle formed by the meeting of 2 lines from the triradius points a, t, and d where the line is drawn from triradius a to triradius t, then triradius t to triradius d (Reddy, Sankar, E.T., & Govulla, 2013).

Differences in fingerprint patterns can be seen from the pattern and number of strokes on the fingertips that can be used as a tool to determine the presence of abnormalities in an individual. Fingerprints themselves



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have three main patterns, namely arch, loop, and whorl (Narayana, Rangalah, & Khalid, 2016; Oktarianti, Yunitasari, & Mahriani, 2019). Based on several previous studies, the ATD angle in the criminal group ranged from 37°-38° (Aida, Roesma, & Tjong, 2015). The whorl pattern was more prominent in the criminals than in the control group (Sudha, Singh, & Sodhi, 2021). Ismurizal conducted a study on fingerprint patterns and ATD angles on male prisoners in North Sumatra with the results that the most fingerprint pattern was an ulnar loop (62.7%) and the least was accidental whorl (1.5%). Meanwhile, the ATD angles of the right hand and left hand of male criminals were 35° by 2.4%, 35°-50° by 90.2%, and 50° by 7.3% (Ismurizal, 2019).

Currently, there is no specific report on male prisoners in Palembang, so this study was conducted to see if there is a trend in fingerprint patterns and ATD angles in prisoners in Prison X. This study aimed to identify the fingerprint patterns of male prisoners and find the fingerprint pattern trend of criminals.

2. Methods

This study uses descriptive research using a survey method through a cross-sectional research design. The research was conducted from October to December 2021 at Prison X. The criteria for research subjects was male prisoners in Prison X with the types of crimes of murder and sexual crimes (rape, sexual harassment, sexual abuse) taken by total sampling. The exclusion criteria are prisoners who have trauma on the palm, such as being injured and experiencing inflammation on the palms. Primary data was the fingerprint patterns and palm print from 113 subjects.

Fingerprint patterns were taken using the Digital persona U.are.U 4500 Fingerprint reader. 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 in the form of a picture of the fingerprint pattern and ATD angle (Figure 1) applied to an ink pad. Data were analyzed univariately to calculate the frequency distribution of fingerprint patterns and ATD angles.

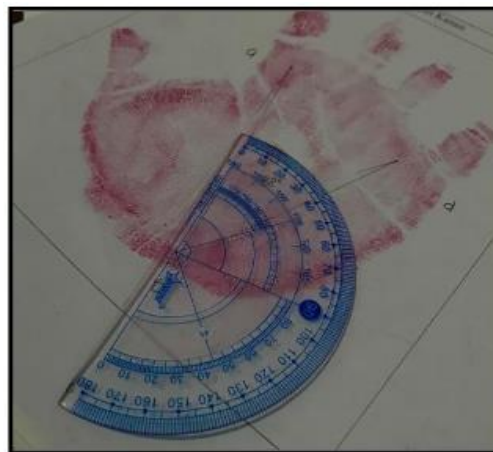


Figure 1. The measurement technique of ATD angle using a protractor.

3. Results and Discussion

This study collected the fingerprint patterns and ATD angles from 72 prisoners of murder crime (63.72%) and sexual crimes 41 prisoners of sexual crime (Table 1). The sexual crimes was classified into 3 types which are sexual harassment, rape, and sexual abuse.

Table 1. Characteristics of Crimes

Crime types	Frequency (persons)	Percentage (%)
Murder	72	63.72
Sexual harassment	27	23.89
Rape	5	4.42
Sexual abuse	9	7.96
Total	113	100.0

The study results obtained eight fingerprint patterns from male prisoners in Prison X (Figure 1), and the distribution for each pattern is described in Table 2.

Table 2. Distribution of fingerprint patterns in the prisoners

Fingerprint Patterns	Frequency (fingers*)	Percentage (%)
<i>Ulnar Loop</i>	521	46.11
<i>Radial Loop</i>	49	4.34
<i>Tented Arch</i>	48	4.25
<i>Plain Arch</i>	19	1.68
<i>Double Loop Whorl</i>	48	4.25
<i>Plain Whorl</i>	343	30.35
<i>Central Pocket Loop Whorl</i>	20	1.77
<i>Accidental Whorl</i>	82	7.26
Total	1,130	100.0

* Based on the examination of 10 fingers from 113 respondents

Table 3. Distribution of Fingerprint Patterns Based on Crime Type

Crime type	Fingerprint Patterns															
	UL		RL		TA		PA		DLW		PW		CPLW		AW	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1	341	47.36	37	5.14	33	4.58	3	0.42	33	4.58	20	28.0	16	2.2	55	7.64
2	121	44.81	7	2.59	4	1.48	6	2.22	9	3.3	97	35.9	2	0.7	24	8.89
3	25	50.00	1	2.00	2	4.00	0	0.00	3	6.0	14	28.0	2	4.0	3	6.0
4	34	37.78	4	4.44	9	10.00	10	11.11	3	3.33	30	33.33	0	0.0	0	0.0

1: murder; 2: sexual harassment; 3: rape; 4: sexual abuse

UL: ulnar loop; RL: radial loop; TA: tented arch; PA: plain arch; DLW: double loop whorl; PW: plain whorl; CPLW: central pocket loop whorl; AW: accidental whorl

Table 4. Distribution of ATD angle in the prisoners

Angle magnitude	Left Palmar		Right Palmar	
	Frequency (persons)	Percentage (%)	Frequency (persons)	Percentage (%)
<35°	0	0.0	0	0.0
35°-50°	42	37.17	27	23.89
>50°	71	62.83	86	76.11
Total	43	100.0	113	100.0

In Table 2, it is found that the percentage of the most fingerprint patterns in male prisoners in Prison X is the ulnar loop (46.11%), while the most minor pattern is the plain arch (1.68%). In this study, it was also found that in each crime type, the highest percentage of patterns is the ulnar loop. As for the percentage of the minor fingerprint pattern in the murder, sexual harassment, rape, and sexual abuse crimes are plain arch (0.41%), central pocket loop whorl (0.74%), plain arch (0.00%), central pocket loop whorl (0.00%) respectively (Table 3). The ATD angle in male prisoners is dominated by $>50^\circ$ angle (Table 4).

Based on the results in Table 2, there is no difference between the pattern trend of prisoners and non-prisoner individuals. The loop pattern dominates the fingerprint patterns of male prisoners, and the arch pattern is the minor one. The fingerprint pattern in the non-prisoner population in Palembang City and Madiun City is dominated by a loop pattern (Mundijo & Alfanda, 2018; Purbasari, 2017). Research in the non-prisoner healthy African-American and Indian population obtained the highest frequency of fingerprint patterns in the loop pattern (Manikandan et al., 2019; Shukla et al., 2016; Wang & Alexander, 2014). The arch pattern evolved to the loop pattern and continues to evolve to the whorl pattern, so in humans today, it is rare to find people with arch patterns (Purbasari, 2017).

Previous research that studied the fingerprint patterns of prisoners showed similar results. In prisoners of the Gujarati population, the highest frequency distribution of fingerprint patterns was the ulnar loop pattern (Pandey & Vyas, 2014). This situation is probably because the ulnar loop pattern is the most common pattern found (Bansal, Badiye, & Kapoor, 2014). The results of this study are also in line with the female prisoners with murder crimes, which was the ulnar loop (Mundijo & Rezky, 2019).

Researchers also tried to compare fingerprints with several diseases. Research in Autism and Down's syndrome children in Palembang obtained the results of fingerprint pattern was most loop, while the most minor pattern was arch (Suciandari, Mundijo, & Purwoko, 2018). Mundijo's research examining fingerprint patterns in mentally disabled children in Palembang found that the highest frequency of fingerprint patterns was the ulnar loop, and the lowest was the accidental whorl (Mundijo & Alfanda, 2018). When compared with the results of the following studies, in this study, there are similarities for the highest fingerprint pattern, namely the loop pattern, and the lowest is the arch pattern. Hence, from these results, it is found that the results of this study, when compared with the non-prisoner population or other research on fingerprints of prisoners or research on several diseases, there is no distinctive trend in fingerprint pattern.

In the results of this study, the most significant percentage of ATD angles was at a magnitude of $>50^\circ$ at 62.83%, with an average ATD angle in the entire sample of male prisoners being 55.76° on the right hand and 54.48° on the left hand (Table 4). Similar results were obtained in Mundijo's research, where the most ATD angles in a sample of drug-using prisoners were at an angle of $>50^\circ$ as many as 14 people (58.3%) (Mundijo, Pramayastri, & Febiyolan, 2020). However, this differs from another research, which revealed that the ATD angle in the criminal group ranged from 37° - 38° (Aida et al., 2015). According to this study, there is a difference between the ATD angle in male prisoners and the general population.

Different results were also obtained from research by Ismurizal, who found that the ATD angles of male criminals are mostly 35° - 50° (Ismurizal, 2019). Researchers also tried to compare the results of the ATD angle in the study with the ATD angle in several diseases. The highest ATD angle in mild and moderate mental retardation was 35° - 50° (Mundijo & Alfanda, 2018). The average ATD angle of the right hand in patients with Thalassemia Major was 41.13° , and on the left hand was 39.52° (Robiatun, 2020). The average ATD angle in essential hypertension people was 43.16° (Jaya, Triwani, Yasin, Marwoto, & Lukman, 2014). Based on these results, there are differences in the typical tendency of the ATD angle of prisoners compared to normal individuals or other individuals with several diseases, as discussed.

4. Conclusion

The fingerprint pattern in prisoners cannot be used as a distinctive feature as a differentiator between prisoners and nonprisoners' individuals. At the same time, for the ATD angle, there is a distinctive difference in the ATD angle of the prisoners in this study, and further research on dermatoglyphic to confirm this.

5. Acknowledgement

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6. Conflict of Interest

Authors declare no conflict of interest.

References

Aida, N., Roesma, D. I., & Tjong, D. H. (2015). Analisis Sudut ATD pada Narapidana. *Jurnal Biologi*

- Universitas Andalas, 4(1), 27–33. <https://doi.org/https://doi.org/10.25077/jbioua.4.1.%25p.2015>
- Bansal, H. D., Badiye, A. D., & Kapoor, N. S. (2014). Distribution of Fingerprint Patterns in an Indian Population. *Malaysian Journal of Forensic Sciences*, 5(2), 18–21.
- Ismurizal. (2019). Pola sidik jari dan sudut axial triradius digital (ATD) pada narapidana laki - laki di tahanan titipan (tahti) Polda Sumatera Utara. *Jurnal Penelitian Kesmas*, 2(1), 45–50. <https://doi.org/https://doi.org/10.36656/jpksy.v2i1.157>
- Jaya, H., Triwani, Yasin, H., Marwoto, J., & Lukman. (2014). Hubungan Pola Dermatoglifi Dengan Hipertensi Essensial. *Jurnal Keperawatan Soedirman*, 9(2), 126–133. <https://doi.org/http://dx.doi.org/10.20884/1.jks.2014.9.2.574>
- Manikandan, S., Devishamani, L., Vijayakumar, S., Palanisamy, G. S., Ponnusamy, P., & Jayakar, S. L. L. (2019). Dermatoglyphics and Their Relationship With Blood Group: An Exploration. *Journal of Pharmacy & BioAllied Sciences*, 11(Suppl 2), S285–S288. https://doi.org/https://doi.org/10.4103%2FJPBS.JPBS_13_19
- Mundijo, T., & Alfanda, V. (2018). Eksplorasi pola sidik jari dan sudut axial triradius digital (ATD) pada anak retardasi mental di Palembang. In *Proceeding Annual Meeting ke-6 APKKM* (pp. 65–67). Surabaya: Universitas Muhammadiyah Surabaya.
- Mundijo, T., Pramayastri, V., & Febiyolan, F. (2020). Pola Sidik Jari dan Besaran Sudut Axial Triradius Digital (ATD) pada Pengguna Narkotika Jenis Shabu-Shabu di Kota Palembang. *Magna Medika: Berkala Ilmiah Kedokteran Dan Kesehatan*, 7(2), 57–62. <https://doi.org/https://doi.org/10.26714/magnamed.7.2.2020.57-62>
- Mundijo, T., & Rezky, M. (2019). Dermatoglifi Narapidana di Palembang. *Syifa' MEDIKA: Jurnal Kedokteran Dan Kesehatan*, 9(2), 86–91. <https://doi.org/https://doi.org/10.32502/sm.v9i2.1662>
- Narayana, B. L., Rangalah, Y. K. C., & Khalid, M. A. (2016). Study of fingerprint patterns in relation to gender and blood group. *Journal of Evolution of Medical and Dental Sciences*, 5(14), 630–633. <https://doi.org/http://dx.doi.org/10.14260/jemds/2016/144>
- Oktarianti, R., Yunitasari, I., & Mahriani, M. (2019). Pola Sidik Jari Tangan dan Ciri Fisik Penderita Sindrom Down di Sekolah Luar Biasa (SLB) Kota Jember. *Berkala Sainstek*, 7(2), 34–38. <https://doi.org/https://doi.org/10.19184/bst.v7i2.12441>
- Pandey, A., & Vyas, J. M. (2014). A Comparative Case Study of Fingerprint Patterns in Male Convicts of Sabarmati Jail (Ahmedabad) in Gujarati Population. *Indian Journal of Forensic Medicine and Toxicology*, 8(2).
- Purbasari, K. (2017). Variasi Pola Sidik Jari Mahasiswa berbagai Suku Bangsa di Kota Madiun. *Florea: Jurnal Biologi Dan Pembelajarannya*, 4(2), 47–49. <https://doi.org/http://doi.org/10.25273/florea.v4i2.1813>
- Reddy, B. R. M., Sankar, S. G., E.T., R., & Govulla, S. (2013). A Comparative Study of Dermatoglyphics in Individuals with Normal Occlusions and Malocclusions. *Journal of Clinical & Diagnostic Research*, 7(12), 3060–3065. <https://doi.org/https://doi.org/10.7860%2FJCDR%2F2013%2F7663.3853>
- Robiatun, R. (2020). Pola Dermatoglifi Penderita Talasemia Beta Mayor Di RSUP Dr Mohammad Hoesin Palembang. *Jurnal Ilmiah Kebidanan Indonesia*, 10(4), 161–166. <https://doi.org/https://doi.org/10.33221/jiki.v10i04.835>
- Shukla, S., Sharma, N., Jain, S. K., Budhiraja, V., Rastogi, R., Garg, R., ... Shukla, S. (2016). A Study of Sexual Dimorphism in Finger Print Pattern in Indian Population. *Annals of International Medical and Dental Research*, 2(4), 169–173.
- Suciandari, A. R., Mundijo, T., & Purwoko, M. (2018). Dermatoglifi Pada Autisme Dan Sindrom Down di Palembang. *Magna Medika: Berkala Ilmiah Kedokteran Dan Kesehatan*, 1(5), 30–35. <https://doi.org/https://doi.org/10.26714/magnamed.1.5.2018.30-35>
- Sudha, I. P., Singh, J., & Sodhi, G. S. (2021). Digital Dermatoglyphics as predictive biomarkers of genetic Criminal Tendency. *Indian Journal of Science and Technology*, 14(23), 1944–1952. <https://doi.org/https://doi.org/10.17485/IJST/v14i23.578>
- Wang, L., & Alexander, C. A. (2014). Fingerprint Patterns and the Analysis of Gender Differences in the Patterns Based on the U Test. *International Transaction of Electrical and Computer Engineers System*, 2(3), 88–92. <https://doi.org/DOI:10.12691/iteces-2-3-2>