

DISCRIMINATION OF FINGERPRINTS AMONGST MALAY TWINS

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*To my beloved parents. Mr. Abd Latif Bin Abu Bakar and Mrs. Ramlah Binti Bujang,
my dearest family, not forgetting my supervisor, Madam Rugayah Binti Mohamed
and my co-supervisor, Mr. Puwira Jaya Bin Othman.*

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ABSTRACT

Fingerprints are the reproduction of ridges found on the tip of our fingers. In forensic investigation, a fingerprint is important physical evidence that can be used to link perpetrator to a crime. For identical twins, the development of their fingerprint start from the same DNA compared to fraternal twins. Fingerprints consist of three main patterns which are loop, whorl and arches which composed of minutiae that can be used to discriminate an individual. In this study, a total of 580 fingerprints were collected randomly from 29 pair of twins where 420 fingerprints obtained from identical twins while another 160 obtained from fraternal twins. Pattern analysis was done by using microscopic techniques and data obtained were analyzed using Statistical Package for Social Science 19 (SPSS 19) software. For minutiae distributions on thumb prints, the analysis was conducted by using Biometric Fingerprint Identification System (BIOFIS) system. On pattern analysis, 47.67% of identical twins have good correlation of fingerprints pattern with their sibling compared to fraternal twins (12.50%). For the minutiae distribution, it shows that the similarities of minutiae distribution on thumb prints for both identical and fraternal twins are not even reach 50% similar. The percentage of similarity on minutiae distribution is around 22.00%-46.07%. Based on this study, the fingerprints amongst twins can still be discriminated even identical twins possess a same DNA. The discrimination can be done due to the different amniotic flow and position of fetus in mother's womb that affected the ridge pattern formation on fingerprint. However, highest likeness in fingerprints was found in identical twins compared to fraternal twins due to the genetic variation.

ABSTRAK

Cap jari adalah pembentukan jalur yang terdapat di hujung jari kita. Dalam siasatan forensik, cap jari adalah satu bukti fizikal penting untuk mengaitkan pelaku dengan jenayah. Bagi kembar seiras, pembentukan cap jari mereka bermula dari DNA yang sama berbanding kembar seiras. Cap jari terdiri daripada tiga corak utama iaitu gelung, pusaran dan lengkungan yang terdiri daripada jalur-jalur jari yang boleh digunakan untuk membezakan antara individu. Dalam kajian ini, sebanyak 580 cap jari telah dikumpulkan secara rawak di kalangan kembar di mana 420 cap jari diperolehi daripada kembar seiras manakala 160 yang lain diperolehi daripada kembar tidak seiras. Analisis bentuk cap jari telah dilakukan dengan menggunakan teknik mikroskopik dan data yang diperolehi dianalisis menggunakan perisian Pakej Statistik untuk Sains Sosial 19 (SPSS 19). Bagi analisis jalur-jalur cap jari pada cetakan ibu jari, analisis telah dijalankan dengan menggunakan Sistem Pengenalan Cap Jari Biometrik (BIOFIS) dan data yang diperolehi dianalisis dalam bentuk peratusan. Berdasarkan analisis untuk bentuk cap jari, 47.67% daripada kembar seiras mempunyai kolerasi yang baik dalam bentuk cap jari dengan pasangannya berbanding kembar tidak seiras (12.50%). Untuk analisis jalur-jalur jari, ia menunjukkan bahawa persamaan pengagihan jalur-jalur pada cetakan ibu jari untuk kedua-dua kembar seiras dan kembar tidak seiras, kurang daripada 50% yang sama. Peratusan persamaan mengenai pengagihan jalur-jalur pada cetakan cap jari adalah sekitar 22.00% -46.07%. Berdasarkan kajian ini, cap jari di kalangan kembar masih boleh didiskriminasikan walaupun kembar seiras memiliki DNA yang sama. Diskriminasi boleh dilakukan kerana terdapat perbezaan aliran cecair ketuban dan kedudukan janin di dalam rahim yang menjejaskan pembentukan rabung corak pada cap jari. Walau bagaimanapun, persamaan yang tinggi dari segi cap jari ditemui pada kembar seiras berbanding kembar tidak seiras disebabkan variasi genetik.

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LIST OF ABBREVIATIONS

BIOFIS	-	Biometric Fingerprint Identification System
DNA	-	Deoxyribonucleic Acid
FT	-	Fraternal twin
IT	-	Identical twin
p	-	Probability
r	-	Spearman's Correlation Coefficient
RMP	-	Royal Malaysia Police
SAS	-	Statistical Analysis System
SPSS	-	Statistical Package for Social Science
STATA	-	Statistic and Data

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CHAPTER 1

INTRODUCTION

1.1 Preamble

In forensic science, besides DNA, a fingerprint is the most crucial physical evidence for the forensic investigator. Locard's Exchange Principle is the maxim in forensic science. Based on Locard's Exchange principle, "whenever two objects come into contact with one another, there is exchange of materials between them". It means that, when a person hold or have a contact with other surface, he/she will leave his fingerprints behind. Therefore, fingerprints found at the crime scene can be used to link the perpetrator or victim for the investigated crime. Fingerprint can be defined as a complex pattern of ridges characteristic that have found on the outer layer of our skin called as epidermis (Saferstein, 2007).

Fingerprint identification has been a very valuable tool in law enforcement agencies in worldwide. Therefore, fingerprints have received considerable attention for being used for identification purposes whenever there was a need for positive identification as in crime, natural as well as man-made disasters. It has been many years where reliability of fingerprint evidence has been universally accepted. The use of fingerprint for identification is based on the immutability and individuality of the fingerprints. Immutability means that the fingerprint remains unchanged during an individual's lifetime. It cannot be altering except if there is an accident such as bruises and cut off the fingertips (Hrechak and McHugh, 1990; Han *et al.*, 2005). However, if the cells reproduce, the same pattern will be developing and they will

not be totally random pattern (Jain *et al.*, 2002). Individuality of fingerprints refers to the uniqueness of ridge characteristic or minutiae that make fingerprints can be systematically being classified (Saferstein, 2007).

1.2 Problem Statement

Most of the fingerprints recovered from the crime scene are usually in partial impression. Twins with maximum generic similarity will lead to the difficulty in investigation if only partial of their prints left at the crime scene. Even though in Malaysia, involvement of twins' especially identical twins in a crime is rarely reported, but this does not make an excuse to hold this study until Malaysia faces the real situation that involves twins later. Normally, eight to sixteen ridges characteristic is suggested to be sufficient in order to meet the criteria for individuality for the sake of identification purposes. However, due to the closest genetic-based relationship, those numbers might be insufficient to individualized fingerprint especially for identical twins.

1.3 Objectives of Study

The main objective of this study is to analyze the fingerprints amongst Malay twins. Details of the objectives are as follow:

- i. To identify and compare fingerprints pattern of twins.
- ii. To quantify the fingerprints pattern amongst twins.
- iii. To identify the similarity of minutiae distribution on thumb print between twins.

1.4 Significance of Study

This study will give an idea for the crime scene investigators in handling the physical evidence especially fingerprints found at the crime scene that involved twins as a perpetrator. From this study, the similarity of fingerprints amongst twins could be quantitatively determined and the information obtained can be used as a guideline in identification of fingerprints for twins because under the circumstances, the crime scene investigators only can compare a small number of ridge characteristic from the partial prints impression recovered at the crime scene. The results of this study can be beneficial to the Royal Malaysia Police (RMP) in handling their investigation. Even though in Malaysia, cases involved twins is rarely being reported, but this study can be more significance in future.

1.5 Scope of Study

The study involves the collections of visible twin's fingerprints for identical and fraternal twins amongst Malay races. For each respondent, all ten prints will be stamped and captured. The fingerprints pattern between identical and fraternal twins, between identical twins, and between fraternal twins will be compared. The research will be proceeding with minutiae-based matching for each category. However, if the result is not very significant to discriminate the identical twins, the finer details like sweat's pore location and breaks in epidermal ridges can be analyzed. The data will be tabulated and treated statistically using SPSS.

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