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Identification of Fingerprints Pattern in Mixed Family of Chinese-Javanese Ethnic

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ABSTRACT

The aim of this study is to identify fingerprints patterns from the mixed family of Chinese-Javanese ethnic. The fingerprint patterns divided into three main patterns, i.e. arch, loop and whorl. The respondents were determined based on inclusion criteria (subject of research qualified as a sample) and the exclusion criteria (subjects which could not be used as a sample) through interviews and questionnaires. First, respondent's fingers cleaned with alcohol or washed using soapy water. The patterns of fingerprint were taken by pressing one by one using an inked stamp pad. Then, printed on white paper which has been given a code and serial number of fingers for each respondent. The last step was to identify the specific characteristic of fingerprint patterns from the respondents and analyzed it while determining about similarity and variability of inter-generations. The results indicated that the mixed family of Chinese-Javanese ethnic had whorl variant pattern (plain whorl and double loop whorl) on the thumbs as a specific marker of Javanese ethnic. Otherwise, radial loop on the index and tented arch pattern on both index and little finger are the unique marker of Chinese 3thnic. Thus, both Javanese and Chinese ethnic have co-dominant fingerprint patterns for mixed family of Chinese-Javanese ethnic.

Keywords: *Chinese, ethnic, fingerprinting, Javanese*

INTRODUCTION

The human race was a classification system used to categorize humans by their phenotypic characteristics [1]. These characteristics included hair color, hair type, skin color, eye shape, and fingerprint patterns [2, 3, 4]. The fingerprint was the pattern of epidermal ridges on fingers, palms, and soles [5]. There were three main patterns on the fingerprint: arch, loop and whorl pattern (Figure 1). Specifically of total arches, 61.54 % arches are plain arches and 38.46 % arches are tented arches [6]. Loop is distinguished into a radial loop (when the loop opened toward the thumb) and ulnar loop (when the loop opened toward the little finger) [5]. Whorl occurred as four types including plain whorl, central pocket whorl, double loop whorl and accidental whorl [6, 7]. Several researches have been done to determine the characteristic pattern of fingerprints on an ethnicity. Previous our study, Arabian ethnic family have double loop both on thumb dominantly and Madurese ethnic family have plain whorl on the right thumb and left index finger [9, 10]. This study aims to identify the characteristics of the pattern of fingerprints on a mixed family of Chinese-Javanese ethnic.

(a) (b) (c)

Figure 1. The three main types of fingerprint patterns: arch (a), loop (b), and whorl (c) [8]

MATERIALS AND METHODS

Subject

This research was conducted from August to November 2016. Samples were collected and analyzed in the Biology Department, Faculty of Mathematics and

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Table 1. Fingerprint patterns on Chinese ethnic family (positive control)

Name	*Left*					*Right*				
Parental	**T**	**I**	**M**	**R**	**L**	**T**	**I**	**M**	**R**	**L**
Parent 1 (♂)	UL	TA	PA	TA	TA	UL	PA	TA	TA	PW
Parent 2 (♀)	UL	UL	UL	UL	UL	DLW	UL	UL	UL	UL
Filial 1										
Son in law 1 (♂)	UL	UL	DLW	PW	UL	DLW	TA	UL	CPW	UL
Daughter 1 (♀)	UL	TA	UL	UL	UL	UL	RL	UL	UL	UL
Daughter 2 (♀)	PW	TA	UL	UL	UL	PW	TA	UL	PW	UL
Filial 2										
Grandson (♂)	UL	UL	TA	UL	UL	UL	TA	UL	UL	UL

Notes

T : Thumb R : Ring TA: Tented Arch DLW: Double Loop Whorl ♂ : Male

I : Index L : Little PA : Plain Arch CPW: Central Pocket Whorl ♀: Female

M : Middle UL : Ulnar Loop PW : Plain Whorl RL: Radial Loop

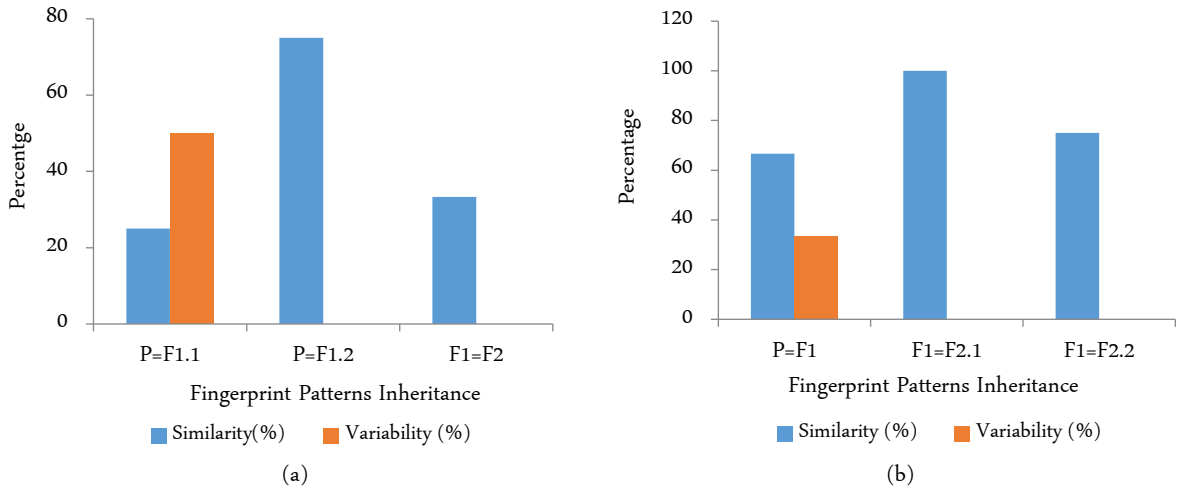

Figure 2. Similarity and variability of fingerprint patterns inheritance: a) Chinese ethnic family, b) Javanese ethnic family.

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Fingerprints were collected from five families consist of two or three generations, including a family of Chinese ethnic (positive control), a family of Javanese ethnic (negative control) and three mixed Chinese-Javanese families. The respondent's determination was done adjusting the sample criteria. There were inclusion criteria (the research subjects qualified as sample) and exclusion (the research subject could not be used as sample) [11].

Ethical consideration

The study was approved by the ethical review committee of medical research, Faculty of Medicine, Brawijaya University, Indonesia and informed consent forms were obtained from all participants.

Collecting fingerprints pattern

The respondents' fingers are cleaned with alcohol or soapy water and dried with tissues. Then, fingerprint pattern is taken by pressing each finger using inked stamp pad and printed onto white paper that has been coded and given serial numbers of fingers [9, 10]. Printing of fingerprint pattern is done by rotating the finger from the right to the left side or vice versa consistently [12].

Identification of fingerprint patterns

The fingerprint patterns are identified by tabulating the results using software *Microsoft Excel 2010*, as well as similarity graphic for each family. We determined the

fingerprints pattern whether it tends to follow typical Chinese or Javanese characteristics.

RESULTS AND DISCUSSION

Fingerprint patterns of Chinese ethnic family

In Chinese ethnic Families, ulnar loops appeared on both thumbs in parental 1 (P1) and all the fingers, except the right thumb on parental 2 (P2). Ulnar loops often appeared on the little finger, the left thumb, and the right middle finger. Widianto *et al.* (2007) mentioned that in Chinese ethnics, ulnar pattern appears dominantly on both middle finger and little fingers [9]. Based on Soma (2002), the existence of the ulnar loop for each individual was approximately 65 – 70%, so this pattern is often found rather than others [6]. However, in the Chinese ethnic Family, radial loops are known to be expressed as well as a tented arch which showed consistently in parental 1(P1), filial 1 (F1) and filial 2 (F2) (Table 1).

The highest similarity value existed between parental to the first filial of second child (F1.2); where the similarity value reached 75% (Figure 2a). Inherited patterns are ulnar loops, tented arch and plain whorl. Meanwhile, the smallest similarity value is owned by parent to first filial of first child (F1.1) by 25%, causing variable value reached 50% (Figure 2a). It happened because whorl plain on P1 was not expressed in F1.1. However, radial loop, which was not previously owned by parental, was expressed in F1.1, but did not appear on the filial 2 (F2). Thus, the similarity value between F1 to F2 was 33% (Figure 2a).

Fingerprint patterns of Javanese ethnic family

The Javanese ethnic family in Table 2 showed that the whorl pattern variant appeared more dominant than other patterns. For example, in parental, whorl appeared on all fingers. In addition, plain whorl and double loop whorl turned up on both thumbs respectively, while central pocket whorl showed on the two of middle fingers (Table 2).

Similar to Chinese ethnic, ulnar loops were shown on both little finger and middle finger in Javanese ethnic. The highest similarity found between filial (F) 1 and filial 2 first child (F2.1) reached up to 100% because all of the patterns that F1 has, had been inherited to F2.1. Variations of fingerprint patterns occurred between parental (P) to filial 1 (F1) by 33% (Figure 2b). Widianto *et al.* (2007) described that similarity between Chinese and Javanese ethnic was the ulnar loop on both little finger and middle finger [9]. Interestingly in this study Chinese ethnic family reached up to 75 % and Javanese family got 100 % of similarity value. In contrast, the level of

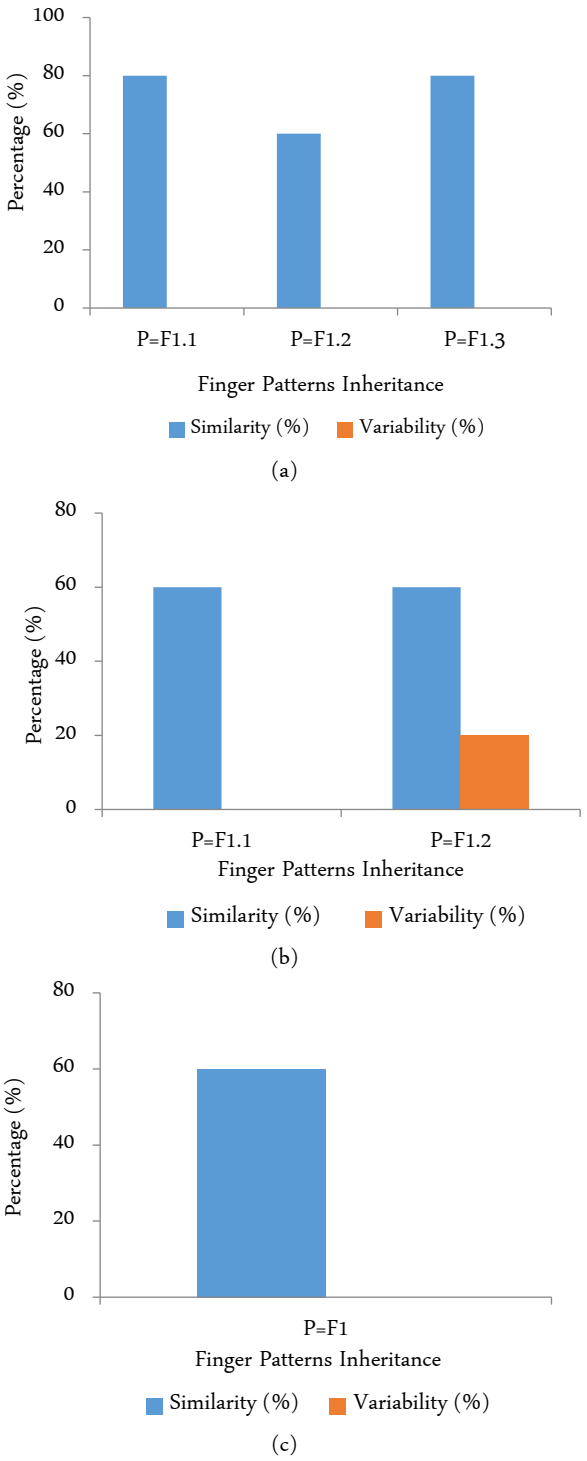

Figure 3. Similarity and variability of fingerprint patterns inheritance in Chinese-Javanese family: a) family I, b) family II, c) family III

variability of Javanese Ethnic family was lower than Chinese ethnic. This result indicated that the ulnar loop

Table 2. Fingerprint patterns on Javanese ethnic family (negative control)

Name	*Left*					*Right*				
Parental	**T**	**I**	**M**	**R**	**L**	**T**	**I**	**M**	**R**	**L**
Parental 1 (♂) † Parental 2 (♀)	PW	PW	CPW	PW	UL	PW	PW	PW	PW	PW
Filial 1										
Son (♂)	DLW	DLW	UL	PW	UL	UL	UL	UL	PW	UL
Daughter in law (♀)	PW	PW	CPW	CPW	UL	PW	PW	UL	UL	UL
Filial 2										
Grandson 1 (♂)	DLW	UL	CPW	PW	UL	PW	PW	CPW	PW	UL
Grandson 2 (♂)	UL	PW	UL	PW	CPW	UL	PW	PW	PW	UL

Notes

T : Thumb R : Ring TA: Tented Arch DLW: Double Loop Whorl ♂ : Male

I : Index L : Little PA : Plain Arch CPW: Central Pocket Whorl ♀: Female

M : Middle UL : Ulnar Loop PW : Plain Whorl RL: Radial Loop

Table 3. Fingerprint patterns on mixed Chinese-Javanese family

Family I										
Name	**Left**					**Right**				
Parental	T	I	M	R	L	T	I	M	R	L
Parental 1 (♂)	UL	UL	PW	PW	PW	UL	PW	UL	CPW	CPW
Parental 2 (♀)	DLW	PW	DLW	CPW	TA	DLW	PW	DLW	PW	TA
Filial 1										
Daughter 1 (♀)	PW	PW	UL	CPW	UL	DLW	UL	UL	PW	UL
Daughter 2 (♀)	UL	PW	PW	PW	UL	UL	PW	CPW	PW	CPW
Daughter 3 (♀)	DLW	DLW	UL	PW	UL	DLW	CPW	UL	PW	UL
Family II										
Parental										
Parental 1 (♂)	DLW	TA	UL	DLW	UL	PW	DLW	CPW	PW	UL
Parental 2 (♀)	DLW	PW	PW	PW	UL	PW	PW	UL	PW	PW
Filial 1										
Daughter 1 (♀)	UL	TA	TA	UL	TA	PW	UL	UL	UL	UL
Son 2 (♂)	UL	RL	UL	UL	UL	UL	PW	DLW	PW	UL
Family III										
Parental										
Parental 1 (♂)	UL	UL	UL	UL	TA	UL	TA	UL	UL	UL
Parental 2 (♀)	DLW	PW	UL	PW	UL	DLW	PW	UL	CPW	PW
Filial 1										
Son 1 (♂)	UL	TA	UL	UL	UL	UL	TA	UL	PW	TA

Notes

T : Thumb R : Ring TA: Tented Arch DLW: Double Loop Whorl ♂ : Male

I : Index L : Little PA : Plain Arch CPW: Central Pocket Whorl ♀: Female

M : Middle UL : Ulnar Loop PW : Plain Whorl RL: Radial Loop

of little finger and middle finger seem as specific fingerprint marker on both ethnics. Even though, this study need widely Chinese-Javanese families' population for future steps.

Fingerprint patterns of mixed Chinese-Javanese ethnic family

In the mixed Chinese-Javanese ethnic family, whorl pattern variants such as double loop whorl and central pocket whorl also appeared intensively. In P2 of family I, the tented arch pattern - which was a marker of Chinese Ethnic, still appear. However, in F1, the pattern is not expressed. Thus, it made the absence of variability in family I (Table 3). Nevertheless, the similarity value between P1 = F1 is quite high, where P = F1.1 and P = F1.3 has a similarity value of 80%. However, in family II, tented arch as marker of Chinese ethnic was appeared in parental 1 then inherited to daughter or filial 1 (F1).

The value of similarity in family II has the same value, equal to 60 % both P = F1.1 and P = F1.2 (Figure 3). It caused a missing pattern, i.e. central pocket whorl on F1. In addition, radial loop on the index finger in first filial of second child, were made variation of the pattern for this family because it did not appear in parental previously.

In the family III, P1 derived from Chinese ethnic has a dominant pattern of ulnar loop and maintained the tented arch on her finger. Then, those patterns are inherited to F1. Uniquely, F1 had some of whorl patterns as a marker of Javanese ethnic, appeared on the right ring finger (Table 3). There is no variation between P = F1, but the similarity value is known at 60% (Figure 3). It could be seen that the double loop whorl pattern as a marker of Chinese ethnicity was expressed both in parental and filial as well as the tented arch. Radial loop was showed too, but the appearance of this pattern was uneven in every mixed family.

Nevertheless, the features of a fingerprint depend on the nerve growth on the skin surface. This growth is determined by genetic and environmental factors such as nutrients, oxygen, and blood flow [13]. Furthermore, observation for fingerprint pattern can be done with any computing system using scanner or biomatrix to obtain more accurate result.

CONCLUSION

The Javanese marked by plain whorl and double loop whorl in the thumbs. The Chinese ethnic marker is shown by the existence of radial loop on the index finger and tented arch on the little and index finger. However, the mixed Chinese and Javanese ethnic family appear co-dominant.

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