

Kertas Asli/Original Articles

Digital Approach for Lip Prints Analysis in Malaysian Malay population (Klang Valley): Scanning Technique (Analisis Cap Bibir Populasi Melayu di Lembah Klang secara Digital: Teknik Imbasan)

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ABSTRACT

Lip print is useful in forensic investigations for individual identification. The present study aimed to discriminate sex based on lip print patterns in Malaysian Malay population in Klang Valley using a scanning technique. Lip prints of 360 subjects (180 males and 180 females) were taken using the lipstick-cellophane tape technique, pasted onto A4 papers. These papers were then scanned using Brother DCP-J100 printer (300dpi resolution). The images were analysed using a software based on Suzuki and Tsuchihashi's classification. The lip print images were divided into six sections which are upper left, upper middle, upper right, lower right, lower middle and lower left. The Pearson chi-square test showed that there are significant differences ($p < 0.05$) between sexes in each section except for the upper middle section. In males, type V (irregular pattern) was the dominant pattern for upper left, upper right, lower right and lower left sections (ranging from 71.1% to 86.7%) while type IV (reticular pattern) was dominant at upper and middle sections (ranging from 57.2% to 66.1%). Type IV (48.3%) was dominant in upper middle section for female, while for the rest of the sections, type V was the dominant lip print pattern (ranging from 40% to 82.8%). These results showed that sex differentiation between males and females in Malaysian Malay population, Klang Valley can be suggested to be used for identification in forensic investigation.

Keywords: Suzuki and Tsuchihashi classification; sex determination; lip print; digital approach; Malaysian Malay population; Klang Valley; scanning technique

ABSTRAK

Cap bibir adalah berguna dalam penyiasatan forensik untuk proses pengenalpastian individu. Kajian ini adalah bertujuan untuk mendiskriminasi jantina berbeza berdasarkan corak cap bibir di kalangan populasi Melayu di Lembah Klang, Malaysia menggunakan teknik imbasan. Cap bibir 360 subjek (180 lelaki dan 180 perempuan) telah diambil menggunakan teknik gincu-pita selofan dan cap bibir dilekatkan ke atas kertas A4. Seterusnya kertas ini diimbas menggunakan pencetak Brother DCP-J100 printer (resolusi 300dpi). Imej cap bibir yang terhasil kemudian di analisa dengan perisian Photoshop berdasarkan klasifikasi Suzuki dan Tsuchihashi. Imej cap bibir dibahagikan kepada 6 bahagian iaitu kiri atas, tengah atas, kanan atas, kanan bawah, tengah bawah dan kiri bawah. Ujian khi-square Pearson menyatakan terdapat perbezaan yang signifikan ($p < 0.05$) antara jantina pada setiap bahagian kecuali bahagian tengah atas. Bagi lelaki, Jenis V (corak tidak teratur) adalah dominan untuk bahagian kiri atas, kanan atas, kanan bawah dan kiri bawah (71.1% ke 86.7%) manakala Jenis IV (corak retikular) adalah paling dominan untuk bahagian tengah atas dan bawah (57.2% ke 66.1%). Sebaliknya untuk perempuan pula, hanya Jenis IV (48.3%) mendominasi bahagian tengah atas manakala Jenis V (40% ke 82.8%) adalah dominan untuk semua bahagian. Hasil kajian ini dapat digunakan untuk membantu dalam proses identifikasi jantina di kalangan populasi Melayu Lembah Klang, Malaysia.

Kata kunci: klasifikasi Suzuki dan Tsuchihashi; penentuan jantina, cap bibir; digital; populasi Melayu Malaysia; Lembah Klang, teknik imbasan

INTRODUCTION

In forensic science, lip print can be used as evidence for identification, just like finger prints and DNA. Lip print can be found on surfaces such as drinking glass, clothing, cutlery or cigarette butt at a crime

scene (Randhawa et al. 2011). It is very useful in forensic investigation and it has been verified as a unique criterion for individual identification (Sivapathasundharam et al. 2001). Lip print is unique for one person just like a fingerprint, even for a monozygotic twin (Saraswathi et al. 2009).

Lip prints are the lines between the labial mucosa and outer skin on the human lip (Eldomiaty et al. 2014). Each person has their own special characteristics of lip print pattern. Races and ethnicity of a person has different patterns on their lip print (Verghese & Mestri 2011) while parent's lip print pattern had some similarities with their children (Gondivkar et al. 2009). Lip print also does not change with time and can be used for personal identification (Bindal et al. 2009; Coward 2007). Trauma or diseases such as herpes infection on the lips will not change the lip print pattern on a person (Gondivkar et al. 2009).

The study of the arrangement and pattern of the lines that appear on the red part of the lip is called cheiloscopy (Prabhu et al. 2012). There are many classifications introduced by previous researches, such as Marti'n Santos, Suzuki and Tsuchihashi, Renaud, Afchar-Bayat and Jose' Maria Dominguez (Caldas et al. 2007). There were 6 types of lip print pattern based on Suzuki and Tsuchihashi (Tsuchihashi 1974): type I is a complete vertical, type I' is an incomplete vertical, type II is branched, type III is intersected, type IV is a reticular pattern and type V for irregular pattern. For the current study, Suzuki and Tsuchihashi classification was chosen as suggested by previous researchers, for its simplicity (Augustine et al. 2008).

The aim of the study is sex determination based on lip print analysis in Malaysian Malays population of Klang Valley. Lip print identification has been accepted as an admissible evidence at court starting from 1961 when a lip print was found on a glass door at a homicidal crime scene (Kasprzak 1990). Later from 1968 till now, lots of researchers had published their studies on cheiloscopy, especially in India, as shown in Table 1. Cheiloscopy is relatively new and less reported in Malaysia. Only few researchers studied lip prints involving Malaysian (Abdel Aziz et al. 2016; Durbakula et al. 2015; Neo et al. 2012; Nur Sabrina Sarah et al. 2019; Rao et al. 2014; Wan Rafiuddin et al. 2018).

The purpose of this research was to discriminate sex among Malaysian Malay population in Klang Valley using a digital approach, as compared to visual comparison using magnifying glasses, with more than 100 subjects. For this research, 360 lip prints were obtained and analysed with a software, for better viewing of the lip print images.

METHODOLOGY

A total of 360 samples were collected in Malay population (180 males and 180 females). All of them are categorized as convenient subjects. A written consent form was obtained from each subject before sampling process. Exclusion

factors for this research are hypersensitivity to lipstick and dry, pierced, inflammation or defects or surgical scars on lips (Prabhu et al. 2013). Ethic approval was received from institutional ethics committee (Code: UKM PPI/111/8/JEP-2018-133).

The lip prints were taken following Neo et al. (2012) method: The subjects were required to clean their lips with wet tissues to remove any foreign substances. Lipstick was gently applied on their upper lip, then on their lower lip with only a single stroke with the lipstick brush. The lipstick (Silkygirl code 03 Siren Red colour) used was less greasy to avoid smudging on the lip and non-glossy for optimum print visibility (Neo et al. 2012). The brush was cleaned before using it again on the next subject.

Lip impression was lifted using a cellophane tape (brand Sheng Long Tape). The width was 45 mm, which was adequate to capture the whole lip print. The cellophane tape was pressed on the subject's lip after the lipstick was applied. Adequate pressure was put on every part of the lip to avoid smudging. It was then lifted carefully and pasted in on A4 size paper. The A4 papers were then scanned using Brother DCP-J100 with resolution of 300 dpi. The images were analyzed using Adobe Photoshop CS6. The image was cropped and inverted into white and black scale for further analysis. The lip prints were then divided into six sections for analysis which are upper left (UL), upper middle (UM), upper right (UR), lower right (LR), lower middle (LM) and lower left (LL), from top to bottom, clockwise (Figure 1). Every grooves were identified, noted, counted and each lip print was grouped according to the most dominant pattern of groove. After that, results were analyzed using Statistical Package Social Sciences (SPSS). Chi-square test for independence variable was calculated to determine the differences in lip prints between male and female in Malaysian Malay population. A value of $p < 0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

Table 2 showed percentage of lip print pattern in each section. For UL (76.1%), UR (77.5%), LR (83.3%) and LL (82.5%) sections, type V was the dominant pattern while type IV was dominant for UM (52.8%) and LM (51.7%) section. For the whole section, there were no type III except for the UL section.

Table 3 showed the percentage of lip print pattern distribution in each section between male and female. For both sex, the most dominant pattern was type V and followed by type IV. In Malay male population, type V was most frequent for upper left, UL (71.1%), upper right, UR (72.2%), lower right, LR (86.7%) and lower left section,

TABLE 1. Comparison of cheiloscopy studies from previous researches and the result from the current study

Authors	Population	No. of subject	Lifting technique	Area of study	Dominant pattern found
Multani S et al. (Multani et al. 2014)	Indian	200 (100 males+100 females)	Lipstick-cellophane tape technique	Middle part only	I
Kinra M et al. (Kinra et al. 2014)	Indian	40 (20 males+20 females)	Lipstick-cellophane tape technique-bond paper	Middle part only	III
Remya S et al. (Remya et al. 2016)	Indian	200 (100 males+100 females)	Lipstick-cellophane tape technique – scanning technique	Middle part only (lower)	IV
Vergheese AJ et al. (Vergheese et al. 2010)	Indian	100 (50 males+50 females)	Lipstick-cellophane tape technique-bond paper	Middle part only (lower)	IV
Rao et al. (Rao et al. 2014)	Indian, Chinese, Malay (Melaka Manipal Medical College)	185 (61 Chinese, 63 Malay, 61 Indian)	Lipstick-cellophane tape technique-bond paper	Middle part only (lower)	V (Chinese) V (Malay) III (Indian)
Kumar A et al. (Kumar et al. 2016)	Indian	90 (45 males+45 females)	Lipstick-bond paper technique	Whole lips	IV
Vijay Kautilya D et al. (Kautilya et al. 2013)	Indian	100 (50 males+50 females)	Lipstick-cellophane tape technique-bond paper	Whole lips	I
Ishaq et al. (Ishaq et al. 2018)	Pakistan	250 (125 males+125 females)	Lipstick-cellophane tape technique-bond paper	Whole lips	I
Koneru et al. (Koneru et al. 2013)	Indian	60 (30 males+30 females)	Lipstick-cellophane tape technique	4 quadrants	I
Kapoor N et al. (Kapoor & Badiye 2017)	Indian	200 (100 males+100 females)	Direct photography technique (Nikon D3100 14.2 MP)	4 quadrants	I
Bindal U et al. (Bindal et al. 2009)	Indian	50 (25 males+25 females)	Lipstick-bond paper technique	4 quadrants	II
Manipady (Manipady 2001-2002)	Indian and Chinese origin students	50 Indian + 50 Chinese	Not Available	Not Available	II
Gondivkar et al. (Gondivkar et al. 2009)	Indian	140 (70 males+70 females)	Lipstick-bond paper technique	4 quadrants	II
Nagrle et al. (Nagrle et al. 2014)	Indian	500 (250 males+250 females)	Lipstick-bond paper technique	4 quadrants	III
Prabhu RV et al. (Prabhu, R. V. et al. 2012)	Indian dental students	100	Lipstick-cellophane tape technique– scanning technique (300dpi scanner)	4 quadrants	V
Durbakula et al. (Durbakula et al. 2015)	Indian and Malaysian dental students	64 (Indian: 16 males+16 females, Malaysian: 16 males+16 females)	Lipstick-cellophane tape technique-bond paper technique	4 quadrants	II (Indians) I' (Malaysians)
Neo et al. (Neo et al. 2012)	Malaysian Malays	88 (44 males+44 females)	Lipstick-cellophane tape technique	4 quadrants	I'
Neo et al. (Neo et al. 2012)	Malaysian Chinese	36 (18 males+18 females)	Lipstick-cellophane tape technique	4 quadrants	I
Abdel Aziz et al. (Abdel Aziz et al. 2016)	Malaysian and Egyptian	120 (Egyptian: 30 males+30 females, Malaysian: 30 males+30 females)	Lipstick-paper technique	4 quadrant	III in both Malaysian and Egyptian
Ragab et al. 2013	Egyptian population	955 (235 males+720 females)	Lipstick-paper technique and scanning technique (495MP)	6 sections	I – complete vertical (Renaud classification)

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Wan Rafiuddin et al. (Wan Rafiuddin et al. 2018)	Malaysian Malays	360 (180 males+180 females)	Lipstick-cellophane tape technique	6 sections	II
Nur Sabrina et al. 2018 (Nur Sabrina Sarah et al. 2019)	Malaysian Malays	360 (180 males+ 180 females)	Photograph on lipstick-cellophane tape technique (13MP mobile phone camera)	6 sections	V
Current study	Malaysian Malays	360 (180 males+ 180 females)	Lipstick-paper technique and scanning technique (300dpi scanner)	6 sections	V

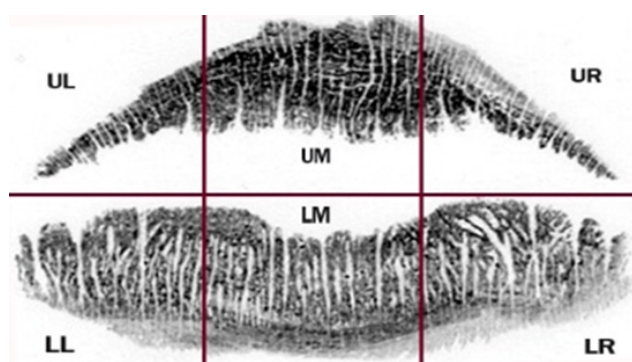


FIGURE 1: Section of lips from left to right as upper left section (UL), upper middle section (UM), upper right section (UR), lower right section (LR), followed by lower middle section (LM) and finally lower left section (LL) in a clockwise rotation for whole lips (Nur Sabrina Sarah et al. 2019)

TABLE 2. Percentage of lip print pattern in each section

	Upper Section				Lower Section	
	(UL)	(UM)	(UR)	(LR)	(LM)	(LL)
Type I	1.9	0.3	1.9	0.0	0.8	0.0
Type I'	2.2	1.4	1.9	1.4	8.9	0.6
Type II	10.0	5.0	9.7	12.5	10.0	14.4
Type III	0.3	0.0	0.0	0.0	0.0	0.0
Type IV	9.4	52.8	8.9	2.8	51.7	2.5
Type V	76.1	40.6	77.5	83.3	28.6	82.5

LL (85.6%). At upper middle, UM (57.2%) and lower middle, LM (66.1%), the dominant pattern was type IV. In Malay female population, upper middle, UM (48.3%) had type IV as dominant pattern while the rest had type V as the dominant pattern. As mentioned before, many researchers published lip print patterns involving Indians from India, only a few researchers studied Malaysians from Malaysia. Rao et al. (2014) studied 63 Malays and type V was the dominant lip print pattern. Durbakula et al. (2015) noted that type I' was the dominant lip print pattern among 32 Malays students from a dental school, Neo et al. (2012) analysed 88 Malays and type I' was the dominant pattern. Abdul Aziz et al. (2016) noted type III was the

dominant pattern for 60 Malays and Wan Rafiuddin et al. (2018) proved that type II was the dominant pattern from 360 males lip print. All these researchers used lipstick-cellophane tape technique and only Neo et al. (2012) and Durbakula et al. (2015) agreed with each other. On the other hand, Nur Sabrina Sarah et al. (2019) used a digitalised lip print analysis for 360 Malays samples and noted that type V was the dominant pattern. Hence, this current study explored more on Malays lip prints using a different type of digitalised lip print analysis, scanning 360 lip print patterns.

Pearson chi-square test showed a significant statistical difference between male and female ($p < 0.05$) for all sections except for the upper middle section, as shown in

TABLE 3. Percentage of lip print pattern distribution in each section between male and female

Type I		Lip print pattern					Total (%)	
		Type I'	Type II	Type III	Type IV	Type V		
Male	UL	2.2	1.1	10.6	0.0	15.0	71.1	100
	UM	0.6	1.7	3.3	0.0	57.2	37.2	100
	UR	3.3	1.1	12.8	0.0	10.6	72.2	100
	LR	0.0	0.6	8.3	0.0	4.4	86.7	100
	LM	1.1	5.0	10.6	0.0	66.1	17.2	100
	LL	0.0	0.5	8.9	0.0	5.0	85.6	100
Female	UL	1.7	3.3	9.4	0.6	3.9	81.1	100
	UM	0.0	1.1	6.7	0.0	48.3	43.9	100
	UR	0.5	2.8	6.7	0.0	7.2	82.8	100
	LR	0.0	2.2	16.7	0.0	1.1	80.0	100
	LM	0.6	12.8	9.4	0.0	37.2	40.0	100
	LL	0.0	0.6	20.0	0.0	0.0	79.4	100

Table 4. This result agrees with most of previous researchers from Table 1, that sex differentiation is possible based on lip prints, however, most of them had less samples, no more than 300 except for Nagrale et al. (2014) who had 500 subjects of Indian origin. Most of the researchers use less than 6 sections except for Wan Rafiudin et al. (2018) and Nur Sabrina Sarah et al. (2019).

Based on Table 1, only few researchers analysed Malaysian Malay lip prints. Rao et al. (2014), Neo et al. (2012), Wan Rafiudin et al. (2018) and Nur Sabrina Sarah et al. (2019) researches involved Malaysian Malay while Durbakula et al. (2015) and Abdel Aziz et al. (2016) studies concentrated on Malaysian in general. Durbakula took 32 Malaysian dental students (males and females) lip prints using the lipstick-cellophane tape technique, pasted it onto a bond paper and divided the lip prints into 4 quadrants. Their result noted that type I' was the dominant pattern (Durbakula et al. 2015). Abdel Aziz et al. (2016) compared 60 Malaysian lip prints using the lipstick-paper technique, divided the lip prints into 4 quadrants and the result showed that type III was the dominant pattern. Neo et al. (2012) and Wan Rafiudin et al. (2018) used the lipstick-cellophane tape technique for lifting the lip prints. The difference were the number of subjects and lip print quadrants: Neo et al. (2012) had 88 subjects, 4 quadrants of lip prints while Wan Rafiudin et al. (2018) had 360 subjects, 6 sections of lip prints. Neo' result showed that type I' was dominant while Wan Rafiudin et al. (2018) noted that type II was dominant. All these researchers used non-digital approach for lip print analysis. Only study by Nur Sabrina Sarah et al. (2019) used photograph of the lip prints for comparison. 360 Malaysian Malays subjects' lip prints were taken using the lipstick-cellophane tape technique, pasted onto

the A4 paper, photographed with 13 megapixels mobile phone camera and 6 sections of lip prints were analysed using a software. Their result showed that type V was the dominant pattern). The current research used scanning image as compared to photograph of the lip prints and type V was noted to be the dominant pattern for Malaysian Malays population in Klang Valley. This suggested that digital analysis were able to have clearer visualisation of the lip prints.

Table 5 displayed the top three highest percentage of lip print pattern in 6 sections between males and females while Table 6 showed frequency of subjects with top three highest percentage of lip print pattern according to lip print section. Upper middle (UM) was not included because the chi-square test result was insignificant.

For the upper left section, both males and females have type II and IV lip print patterns however, males showed higher percentage of possible gender for both type II and IV, with 52.8% and 81.8%, respectively, if these types of lip print pattern were found at the crime scene. Males again dominated the upper right section with type II (65.7%) and type IV (59.4%). For the lower right section, if type I' or type II lip print pattern were discovered, female is the possible gender (80% and 67.4%, respectively), while type IV was highest among males (88.9%). For the lower middle section, females had the higher percentage for type I' (71.9%) and type V (69.6%) while type II (54.3%) and type IV (63.3%) were highest in males. The result also suggested that, for the lower left section, males could be the possible gender, if type IV was recovered from a lip print evidence. Basically, Table 6 can be used as gender identification of the lip print's owner if the person involved is believed to be a Malaysian Malay.

TABLE 4. Pearson chi-square test result

Section of lips	Significant value (<i>p</i>)	
Upper left	$p < 0.05$	Significant
Upper middle	$p = 0.237$	Not significant
Upper right	$p = 0.03$	Significant
Lower right	$p = 0.017$	Significant
Lower middle	$p < 0.05$	Significant
Lower left	$p < 0.05$	Significant

TABLE 5. Top three highest percentage of lip print pattern in different sections between males and females

		Dominant lip print pattern		
		Most dominant	Second	Third
Upper Left (UL)	Male	V	IV	II
	Female	V	II	IV
Upper Right (UR)	Male	V	II	IV
	Female	V	IV	II
Lower Right (LR)	Male	V	II	IV
	Female	V	II	I'
Lower Middle (LM)	Male	IV	V	II
	Female	V	IV	I'
Lower Left (LL)	Male	V	II	IV
	Female	V	II	I'

TABLE 6. Frequency of subjects with specified lip print pattern according to lip print section

Lip Section	Type	Frequency			Possible Gender
		Male	Female	Total	
UL	II	19	17	36	Male (52.8%)
	IV	27	6	33	Male (81.8%)
UR	II	23	12	35	Male (65.7%)
	IV	19	13	32	Male (59.4%)
LR	I'	1	4	5	Female (80.0%)
	II	15	31	46	Female (67.4%)
LM	IV	8	1	9	Male (88.9%)
	I'	9	23	32	Female (71.9%)
	II	19	16	35	Male (54.3%)
LL	IV	119	69	188	Male (63.3%)
	V	31	71	102	Female (69.6%)
	I'	1	1	2	Both (50.0%)
	II	16	36	52	Female (69.2%)
	IV	9	0	9	Male (100%)

CONCLUSION

Lip print analysis can be used as a guide for personal identification and sex differentiation between gender among Malaysian Malays. The current study could be useful in aiding personal identification for forensic science investigation if the person involve is a Malaysian Malay and the method could be extended for other races in Malaysia.

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