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**CONSISTENCY OF SUZUKI-TSUCHIHASHI AND RENAUD METHODS IN
 DETERMINING DOMINANT LIP PRINT PATTERNS IN MALES AND FEMALES**

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ABSTRACT

Introduction: Forensic odontology is a branch of dentistry that focuses on the resolution of forensic cases. This discipline encompasses identifying personal information, including age, race, and gender. One of the methods utilized is lip print analysis. **Objective:** To determine the consistency of Suzuki-Tsuchihashi and Renaud methods in determining dominant lip print patterns in males and females. **Methods:** This study employs a cross-sectional design with an observational approach, involving 100 respondents (50 males and 50 females) aged 18–25 years selected using quota sampling. Lip print patterns were classified using the Suzuki-Tsuchihashi and Renaud methods, and the data were analyzed to determine the consistency between Suzuki-Tsuchihashi and Renaud methods. **Results:** The Cohen's Kappa analysis showed level of consistency in males is fair ($\kappa = 0.230$; $p = 0.302$) and moderate in females ($\kappa = 0.422$; $p = 0.531$). In both groups, p -values greater than 0.05 indicate no statistically significant difference between the Suzuki-Tsuchihashi and Renaud methods. **Conclusion:** There is no statistically significant difference between the Suzuki-Tsuchihashi and Renaud methods. However, both methods demonstrate a fair to moderate of level of consistency in classifying dominant lip print patterns in males and females.

Keywords: Forensic Odontology, Gender Identification, Lip Print, Renaud Method, Suzuki-Tsuchihashi Method

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INTRODUCTION

According to *Federation Dentaire Internationale*, forensic odontology is a branch of dental science that aims to help resolve forensic cases that can't be identified by fingerprints and DNA. One of the roles of forensic odontology is to identify unknown individuals. The aim of identification is to determine age, sex, and race. The application of forensic odontology helps resolve jurisdictional issues in courts scientifically in order to achieve the rightness¹.

Gender determination is a primary focus in the investigation of unknown individuals. Various methods have been developed to identify gender. One approach is morphological analysis, which includes oral and paraoral hard and soft tissues. Hard tissues can be analyzed using odontometry or orthometry, while soft tissues can be analyzed using lip prints. Between 1985 and 1997, the lip print technique was used in 85 cases, including 65 robberies, 15 murders, and 5 assaults. In 34 cases, identification was positive, indicating that the lip print technique was comparable to other types of forensic evidence².

Lip prints are lines of wrinkles forming grooves on the inner labial mucosa and the vermilion border, or the outermost lip skin. These lines develop into distinctive patterns and do not change from as early as six weeks of gestation until death, despite factors such as minor trauma, pathological conditions, climate variations, infections, and inflammation such as herpes³.

Identification using lip prints is simple, inexpensive, and effective for determining identity. One of the advantages of lip prints is their ability to determine gender. Differences in lip print patterns between males and females are closely related to an unknown individuals⁴. The researcher is interested in conducting a final project based on the background and fundamental principles of forensic odontology.

METHODS

Material

The sampling technique uses non probability sampling technique, namely quota sampling⁷. This sampling technique does not provide equal opportunities for each individual by dividing the population into several small groups⁸. The age range between the sample included 18-25 years due to the maturity of the female lip on the upper

lip after the age of 14 years and the lower lip after the age of 16, while in the males it reached maturity at the age of 18 years⁹. The respondent race uses the Mongoloid race because it is geographically found in Asian regions.

The determination of samples was based on the *Slovin* formula with a *marginal error* rate of 5% resulting in a sample that was suitable for the research needs, precisely for 100 people¹⁰. The inclusion criteria in this study were students of the Faculty of Dentistry, Universitas Brawijaya with Mongoloid races at the age of 18-25 years totaling 50 males and 50 females without *lipstick* allergies that had filled in *informed consent*. The study protocol was reviewed and approved by the Institutional Ethics Committee of Universitas Islam Negeri Maulana Malik Ibrahim Malang (approval number: [No, 49/40/EC/KEPK-FKIK/09/2024]). while the exclusion criteria included students who were uncooperative, had inflammation of the lips, and had lip growth deformities.

Methods

This research method uses a *cross sectional* quantitative method with an observational approach. This research was carried out at the Faculty of Dentistry, University of Brawijaya Malang, with a focus on analyzing lip prints. In this study, gender as the independent variable, while lip print patterns was considered the dependent variable. Meanwhile, age and race were maintained as controlled variables. The analysis of lip print patterns was conducted using two classification approaches: the Suzuki-Tsuchihashi method and the Renaud method¹¹. The Suzuki-Tsuchihashi classification system identifies five types of lip print patterns: Type I (vertical grooves), Type I' (partially vertical grooves), Type II (branched grooves), Type IV (checkered grooves), and Type V (unclassified patterns). On the other hand, the Renaud method categorizes lip prints into ten distinct types, including Type A (vertical grooves), Type B (incomplete vertical grooves), Type C (branched grooves), Type D (partially branched grooves), Type E (intersecting grooves), Type F (incompletely intersecting grooves), Type G (mesh-like grooves), Type H (X-shaped or comma-like grooves), Type I (horizontal grooves), and Type J (elliptical grooves)¹².

Data collection was carried out using white paper instruments, red *lipstick*, *cotton buds*, masks, gloves, tape, scissors, magnifying glass, wet wipes, dry wipes, and file folders. Before conducting the study, the researcher gave an explanation of *informed consent* to the respondents to get consent. Respondents' lips must be clean from lipstick and dirt by cleaning using wet and dry wipes. The researcher applied red lipstick with a *cotton bud* to the respondents' lips, then waited for three minutes, after which they applied the tape and let it sit for a few minutes. The lip prints printed on the tape are then removed and pasted on white paper given names, genders, and serial numbers. The analysis of dominant lip print pattern in males and females using the Suzuki-Tsuchihashi and Renaud methods was carried out with the help of a magnifying glass¹³.

Data analysis was carried out by normality test to determine the normality of data from free and bound variables with normal distribution or not. The *Kolmogorov Smirnov Two Way Sample* test was used to assess the normality of the data¹⁴. The Kruskal-Wallis test is used to determine the differences between variables. The Wilcoxon was used in this study to analyze dominant lip print patterns using Suzuki-Tsuchihashi and Renaud methods in male and female¹⁵. The measurement of the level of consistency dominant lip print pattern of males and females using the Suzuki-Tsuchihashi and Renaud methods was carried out by the Kappa Cohen test. Kappa Cohen's value is divided according to the tightness of the agreement, which is <0.20 (poor); 0.21-0.40 (fair); 0.41-0.60 (moderate); 0.61-0.80 (good); 0.81-1.00 (very good)¹⁶. High K value indicates a high level of consistency with no difference, while low K value indicates a minimal level of consistency with a difference¹⁷.

RESULTS

The results of the study obtained the dominant lip fingerprint pattern of 50 males and 50 females students of the Faculty of Dentistry, Universitas Brawijaya with the observation of intra-observers or one researcher.

Table 1. Normality Test Results of *Kolmogorov Smirnov*

Lip Prints	Statistics	Sig.
Suzuki-Tsuchihashi Male	0,192	0,000
Suzuki-Tsuchihashi Female	0,339	0,000
Renaud Male	0,193	0,000
Renaud Female	0,322	0,000

According to the results of the *Kolmogorov Smirnov test*, the overall data of Suzuki-Tsuchihashi and Renaud has a significant value of 0.000 which means a *p-value* <0,05. It can be concluded that the overall data distribution is not normal. The not normally distributed data was caused by the variation that was not evenly distributed in the dominant lip print patterns of the Suzuki-Tsuchihashi and Renaud methods. The results of the not normally distributed data lead this study to non-parametric statistical tests.

The results of the Kruskal Wallis test showed a *p-value* of < 0.05 in the variables of Suzuki-Tsuchihashi males (0,000). Renaud males showed *p-value* < 0,05 . Suzuki-Tsuchihashi females showed *p-value* < 0,05. Renaud females showed *p-value* < 0,05 . All of the variables indicates that there is a difference of male Suzuki-Tsuchihashi, male Renaud, female Suzuki-Tsuchihashi, and female Renaud.

The results of the Wilcoxon on the male and female Suzuki-Tsuchihashi variables showed a significant value of 0.000 which indicates that *p-value* < 0.05 so that there is a difference between the two methods that are directly related. Significant differences were also obtained in the female Suzuki-Tsuchihashi variable and the male Renaud variable with a significance value of 0.000 with *p-value* < 0.05.

Table 2. Kruskal Wallis Test Results

Variable	Value	Df	Sig.
Suzuki-Tsuchihashi Male	40,816	5	0,000
Renaud Male	40,336	4	0,000
Suzuki-Tsuchihashi Female	45,965	6	0,000
Renaud Perempuan	41,007	4	0,000

Table 3. Results of the Suzuki-Tsuchihashi and Renaud Method Wilcoxon

Variable	Z-score	Sig.
Suzuki-Tsuchihashi Male and Renaud Female	-4,065	0,000
Suzuki-Tsuchihashi Female and Renaud Male	-5,396	0,000

Table 4. Results of the Kappa Cohen Test for Male and Female Calculation of the Suzuki-Tsuchihashi Method

Type	Male	(%)	Female	(%)
I	0	0	1	2
I'	4	8	9	18
II	14	28	29	58
III	9	18	4	8
IV	20	40	7	14
V	3	6	0	0
Total	50	100	50	100

The results of the Suzuki-Tsuchihashi calculation show that Type IV (40%) is the most dominant type in males with 20 respondents. Type II (58%) shows the most dominant type in females. The amount of samples for Suzuki-Tsuchihashi methods are 50 males and females.

Table 5. Results of Male and Female Calculations of Renaud Method

Type	Male	(%)	Female	(%)
A	0	0	0	0
B	4	8	10	20
C	10	20	20	40
D	0	0	3	6
E	0	0	0	0
F	2	4	2	4
G	20	40	7	14
H	11	22	5	10
I	0	0	3	6
J	3	6	0	0
Total	50	100	50	100

The results of the Renaud method calculation showed that the most dominant type of lip fingerprint pattern in males was type G with 20 respondents (40%). Type C with 20 respondents (40%) are dominant among females. The amount of samples for Renaud method are 50 males and females.

Table 6. Kappa Cohen Test Results

Method	Kappa Cohen's Values	Sig.
Suzuki-Tsuchihashi and Renaud males	0,230	0,302
Suzuki-Tsuchihashi and Renaud Female	0,422	0,531

The results of the Cohen Kappa test showed that the Suzuki-Tsuchihashi and Renaud male methods had a kappa value of 0.230 in a fair category with no difference between the two methods. The Suzuki-Tsuchihashi and Renaud methods for females had a kappa value of 0.422 in a moderate category with no difference between the two methods.

Table 7. Results of the Male Kappa Cohen Accuracy Test

Suzuki-Tsuchihashi					
				Total	
		NOT APPROPRIATE			
APPROPRIATE		20	10	30	
Renaud	NOT APPROPRIATE		5	15	20
	APPROPRIATE				
Total		25	25	50	

Based on the results of the Kappa Cohen accuracy test for males, there were 20 respondents who showed the compatibility of the dominant pattern of lip prints between the Suzuki-Tsuchihashi and Renaud methods in males. A total of 5 respondents had a conformity of the dominant pattern of lip prints based on the Suzuki-Tsuchihashi method, but did not show conformity with the Renaud method. Meanwhile, 10 respondents showed the conformity of the dominant pattern of lip prints based on the Renaud method, but did not have a conformity with the Suzuki-Tsuchihashi method. In addition, there were 15 respondents who did not show a match in the dominant pattern of lip prints between the two methods. Based on the accuracy test, both methods showed the same level of accuracy with the number of 20 respondents.

Table 8. Results of the Female Kappa Cohen Accuracy Test

		Suzuki-Tsuchihashi		Total
		NOT PPROPRIATPPROPRIAT		
Renaud	APPROPRIATE	21	0	21
	NOT APPROPRIATE	9	20	29
Total		30	20	50

Based on the results of the female Kappa Cohen accuracy test, there were 21 female respondents who showed the compatibility of the dominant pattern of lip prints between the Suzuki-Tsuchihashi and Renaud methods. A total of 9 respondents had a conformity of the dominant pattern of lip prints based on the Suzuki-Tsuchihashi method, but did not show conformity with the Renaud method. None of the respondents showed the conformity of the dominant pattern of lip prints based on the Renaud method but not the Suzuki-Tsuchihashi method. In addition, there were 20 respondents who did not show the compatibility of the dominant pattern of lip prints between the two methods. Both methods showed the level of accuracy with a total of 21 respondents.

DISCUSSION

The dominant lip print pattern identified using the Suzuki–Tsuchihashi method was type IV in males and type II in females, whereas the Renaud method identified type G as dominant in males and type C in females. These findings are consistent with the study by Vanawala, which reported that the dominant lip print patterns in males are types III, IV, and V, while in females they are types I, I', and II. Furthermore, according to Domiaty's study using the Renaud method, type C is the most frequently observed pattern.

The similarity between the findings of the two methods indicates comparable pattern characteristics, in which types IV and G in males both exhibit box-shaped grooves or nets, while types II and C in females are included in the category of branched grooves¹⁸.

The similarity in the classification results shows that there are limitations in the shape of the pattern that appears on human lip prints. The shape of the human lip fingerprint pattern has a significant dominant pattern. The essence of both methods, if used on the same individual, will result in physical descriptions of lip prints that are similar to each other¹⁹.

The degree of accuracy that does not differ in the Suzuki-Tsuchihashi and Renaud methods indicates that both methods have the same ability to analyze the uniqueness of male and female lip prints. The uniqueness of the lip print pattern in each individual also contributes to the magnitude of the degree of accuracy in both methods. Like fingerprints, lip print patterns are permanent and do not change throughout a person's life. According to Mahmudah, research shows that there are specific lip print patterns on males and females that are unique. Another factor that maintains the accuracy of the Suzuki-Tsuchihashi and Renaud methods is the existence of a basic principle in lip fingerprint analysis, namely the concept of sexual dimorphism and the distribution of certain patterns in the

population²⁰.

The Suzuki-Tsuchihashi and Renaud methods have been used in various studies. The similarity and accuracy of the two methods is due to the grouping basis of similar lip print groove patterns. Both methods are effective because they are systematically used to identify and analyze lip print patterns in each individual, thus serving as an ideal lip print measurement tool in the forensic field.

The Suzuki-Tsuchihashi method is simpler in classification, while the Renaud method allows for more specific identification. Suzuki-Tsuchihashi method, lip print patterns are classified into six main categories that allow for the analysis of dominant lip print patterns, while the Renaud method uses a classification system that with ten categories of lip print patterns, provides more detailed information to distinguish between males and females.

The number of different categories between the Suzuki-Tsuchihashi and Renaud methods had no effect on the accuracy results because both methods aim to provide accurate identification of males and females as well as lip print patterns with the same biological characteristics²⁰.

CONCLUSION

Based on the study, there is a significant difference between the Suzuki-Tsuchihashi and Renaud methods ($p < 0.05$). However, the level of consistency between the two methods is categorized as fair to moderate based on Cohen's kappa values. Both methods show similar dominant lip print patterns in males and females, indicating consistency in pattern classification despite statistical differences. This is due to the dominant lip print patterns in male Suzuki-Tsuchihashi is type IV (checkered groove) which is identical to the dominant male Renaud with type G (mesh groove). The dominant lip print pattern in Suzuki-Tsuchihashi females is type II (branched grooves) identical to Renaud type C (branched grooves) female Renaud. The similarity of the accuracy of the Suzuki-Tsuchihashi and Renaud methods provides the conclusion that the two methods can be used to analyze lip prints on males and females without any significant differences.

SUGGESTION

1. Further research with the Suzuki-Tsuchihashi and Renaud methods used different researchers' perspectives to evaluate the level of consistency between researchers, with the aim of identifying the possibility of subjective bias in the precision analysis.
2. Conduct further research to analyze the level of consistency of Suzuki-Tsuchihashi and Renaud's methods in criminal investigations with samples from real cases to evaluate their practical application in the field of forensic odontology.
3. Increase the number of respondents to determine the level of consistency of the Suzuki-Tsuchihashi and Renaud methods when used in a wide range of people.

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