Relationship Between Lip Print Pattern and Tongue Rolling Among Ogori Magongo Ethnic Group of Kogi State, Nigeria

Ade Stephen Alabi[1], Elizabeth Oreka Sayeed[1], Oluwadamilola Olamide Fadipe[2], Joshua Honor Ojo[*3].

[1]Department of Anatomy, University of Ilorin, Ilorin; [2]Department of Microbiology, Obafemi Awolowo University, Ile-Ife; [3]Anatomy Programme, College of Health Sciences, Bowen University, Iwo, Nigeria

Corresponding author: Joshua Honor Ojo

E-mail: joshua.ojo@bowen.edu.ng

ABSTRACT

Lip prints are a constant anatomical structure and are absolutely unique to an individual and thus are an infallible means of personal identification. 201 males and 201 females participated in the study. The lip prints were obtained using carbon black powder, lip gloss and a microscopic glass slide which was carefully placed on the lip of the individual. The data were analyzed using the chi-square test and P≤ 0.05 was considered significant. The results showed that **Type II** and **Type I** lip Print patterns were the predominant patterns for both Males and Females. There was a significant difference in lip prints of both males and females. There was a higher frequency in the number of non-tongue rollers than that of those who could roll their tongue, with no significance to sex. Most significantly, a new kind of lip print pattern was discovered as Type V*. This rare lip print pattern appears to be a straight horizontal line. There seems to be no relationship between tongue rolling and lip print in relation to sex. In conclusion, the unique lip print pattern discovered among Ogori Magongo ethnic group of Nigeria and its sexual difference with their inability to roll their tongue are important forensic anthropometry.

Keywords: cheiloscopy, lip prints, tongue rolling, Ogori Magogo, forensic anthropometry

INTRODUCTION

Human identification is of paramount importance, and it is indeed challenging considering the fact that every individual has a distinctive trait. This requires a combination of different procedures to individualize a person or an object[1]. "Identity" is a set of physical characteristics, functional or psychic, normal or pathological, that define an individual [1].

Fingerprints postmortem reports, and of late, DNA fingerprinting have been successful in personal identification in the field of forensic science. Just like these methods, lip prints can be instrumental in identifying a person positively and can be used to verify the presence or absence of a person at the scene of crime [2].

Although DNA profiling, fingerprints, anthropometric data, dental records can be used as standard methods, sometimes it becomes obvious to employ other methods such as cheiloscopy, palatoscopy and other odontometric measurements that are capable of giving comparatively reliable results when performed systematically [3].

Cheiloscopy has been reported easier to perform and helpful due to its unique pattern and often more helpful in criminal investigations when other identification methods or parameters are either not available or difficult to analyze [4]. The interesting aspect of cheiloscopy is that the wrinkles and cracks of the lips specifically maintain the uniqueness and recordibility when the question of sex determination or of identity of that person comes. Study shows that lip print pattern does not change even as age advances [4]. Since lip prints are unique like the fingerprints for an individual, it has also been used as a supplementary tool to verify the presence or absence of a person at the site of crime [5]. The significance of cheiloscopy is linked to the fact that lip prints are inherent, once developed at the 6th month of intrauterine life they are permanent, unalterable even after death, and unique to each person except for monozygotic twin [6].

MATERIALS AND METHODS

A sample size of 402 subjects was obtained from the population of individuals within the age range of 15 - 65 years of Ogori Magongo ethnic group of Kogi State Nigeria. The sample size comprises of 201 males and 201 females, calculated using the Fischer's formula for large population (>10,000) or infinite population for determining sample size and it states thus:

Ade Stephen Alabi[1], Elizabeth Oreka Sayeed[1], Oluwadamilola Olamide Fadipe[2], Joshua Honor Ojo[*3].

$$S = \frac{z^2 \underline{x\ p\ x\ q}}{d^2}$$

Where: Z= 1.96; P= proportion= $\underline{\text{age group}}$

Total population

Q= 1-p   D= tolerance level = 0.05

Methodology

All the participants were briefed about the purpose of study and Informed Consent form which was attached to the questionnaire were given to the subject for approval before the commencement of the research. For participants below 18 years, the informed consent form was given to their Guardian before the research was conducted. All the experimental procedures were done by strictly following the experimental guidelines of University of Ilorin ethical review.

The lip print was taken by applying the lip balm evenly but lightly on the participants' lips. If the participant was wearing a coloured lip stick, a baby wipe was used to clean the lip stick so the lips can be clean and dry for clearer result.

Then the microscopic glass slide was taken by the edges and placed firmly on the participants' lips once. Moving of the slide on the participant's lip could cause the print to smear. After that, the fine carbon black powder (toner) was gently dusted on the surface of the slide that has the print. The toner applied was very light, and any residue of toner was blown away. Hand gloves were worn so that the carbon black powder does not stain the hands or get under the fingernails.

The slide was then placed on the participant's questionnaire. The side without the print was placed on the paper. A piece of transparent cellophane tape was then cut with scissors and used to tape the slide to the paper. No bubbles were formed when this was done. The prints taped to the paper were read directly. Magnifying lens was used to read prints that were not clear enough. Individuals were shown how to roll their tongue and told to do the same. Those who could were marked, yes on the questionnaire while those who could not were marked, no.

Analysis of lip print

The lip print Classification adopted for this design was Suzuki and Tsuchihashi Classification [7].
Type I: Vertical, comprising of complete end-to end longitudinal fissures;
Type I': Comprises of incomplete versus longitudinal fissures;
Type II: Branching Y shaped pattern;
Type III: Interspersed groove – cross pattern;
Type IV: Reticular -chequered pattern fence like
Type V: Others/ Undifferentiated

For the analysis of the prints, the print was divided into 6 compartments for both lower and upper lip for perfect and accurate estimation. They found that any type might be found at any of the six areas described. In recent time the incidence of the different types of lip prints according to the Suzuki and Tsuchihashi classification are reported from six different compartments [8].

UR: Upper right (UR) compartment; UM: Upper middle (UM) compartment; UL: Upper left (UL) compartment; LR: Lower right (LR) compartment; LM: Lower middle (LM) compartment; LL: Lower left (LL) compartment.

Statistical analysis

Descriptive statistics for variables were used with tables. The percentage distribution of lip prints pattern for the following parameters (Sex, ability to roll tongue) was calculated using the SPSS (Statistical package for the social sciences, version 20.0) software. Statistical significance was considered when (P=0.05 or P≤ 0.05).

RESULTS

Results from the analysis were presented in tables and graphs. All variables were in categorical form and, therefore, presented as frequency (percentages). The distribution of the lip print types and test of sex-associated differences for the upper and lower quadrants are presented in Tables 1 and 2 respectively, while the tongue rolling ability and test of sex-differences were presented in Table 3.

As a result of chosen lip print classification, which included a special type (V*), in carting out the Chi-square Automatic Interaction Detector (CHAID) analysis, the data was excluded for rarity. The results for the CHAID model to evaluate the possible relationship between tongue rolling and the lip print pattern were presented in Figures 1-2.

Chi-square analysis showed that sex was a significant influence for lip print pattern in all quadrants of the lip and the t-test showed no difference in the mean tongue rolling ability of males and females (p>0.05).

Table 1: Distribution of lip print types on the upper quadrants and test of association

Quadrants	Sex	Lip print pattern							Chi-Square Tests		
		Type I	Type I'	Type II	Type III	Type IV	Type V	Type V*	Df	X²	P-value
URQ	Male	50	19	70	17	12	29	3	6	15.239	**0.018**
		25.00%	9.50%	35.00%	8.50%	6.00%	14.50%	1.50%			
	Female	37	22	72	10	33	24	6			
		18.14%	10.78%	35.29%	4.90%	16.18%	11.76%	2.94%			
	Total	**87**	**41**	**142**	**27**	**45**	**53**	**9**			
		21.53%	**10.15%**	**35.15%**	**6.68%**	**11.14%**	**13.12%**	**2.23%**			
UMQ	Male	81	25	28	6	47	11	2	6	10.031	0.123
		40.50%	12.50%	14.00%	3.00%	23.50%	5.50%	1.00%			
	Female	59	34	24	8	69	8	2			
		28.92%	16.67%	11.76%	3.92%	33.82%	3.92%	0.98%			
	Total	**140**	**59**	**52**	**14**	**116**	**19**	**4**			
		34.65%	**14.60%**	**12.87%**	**3.47%**	**28.71%**	**4.70%**	**0.99%**			
ULQ	Male	45	19	78	12	15	26	5	6	17.849	**0.007**
		22.50%	9.50%	39.00%	6.00%	7.50%	13.00%	2.50%			
	Female	28	24	59	19	35	31	8			
		13.73%	11.76%	28.92%	9.31%	17.16%	15.20%	3.92%			
	Total	**73**	**43**	**137**	**31**	**50**	**57**	**13**			
		18.07%	**10.64%**	**33.91%**	**7.67%**	**12.38%**	**14.11%**	**3.22%**			

Ade Stephen Alabi[1], Elizabeth Oreka Sayeed[1], Oluwadamilola Olamide Fadipe[2], Joshua Honor Ojo*[3].

Table 2: Distribution of lip print types on the lower quadrants and test of association

Quadrants	Sex	Lip print pattern							Chi-Square Tests		
		Type I	Type I'	Type II	Type III	Type IV	Type V	Type V*	Df	X^2	P-value
LRQ	Male	49	28	76	20	8	18	1	6	13.341	**0.038**
		24.50%	14.00%	38.00%	10.00%	4.00%	9.00%	0.50%			
	Female	30	23	91	18	22	18	2			
		14.71%	11.27%	44.61%	8.82%	10.78%	8.82%	0.98%			
	Total	**79**	**51**	**167**	**38**	**30**	**36**	**3**			
		19.55%	**12.62%**	**41.34%**	**9.41%**	**7.43%**	**8.91%**	**0.74%**			
LMQ	Male	85	26	14	3	64	7	1	6	4.365	0.627
		42.50%	13.00%	7.00%	1.50%	32.00%	3.50%	0.50%			
	Female	80	18	18	5	70	10	3			
		39.22%	8.82%	8.82%	2.45%	34.31%	4.90%	1.47%			
	Total	**165**	**44**	**32**	**8**	**134**	**17**	**4**			
		40.84%	**10.89%**	**7.92%**	**1.98%**	**33.17%**	**4.21%**	**0.99%**			
LLQ	Male	43	27	83	19	12	13	3	6	14.762	**0.022**
		21.50%	13.50%	41.50%	9.50%	6.00%	6.50%	1.50%			
	Female	33	16	75	24	27	22	7			
		16.18%	7.84%	36.76%	11.76%	13.24%	10.78%	3.43%			
	Total	**76**	**43**	**158**	**43**	**39**	**35**	**10**			
		18.81%	**10.64%**	**39.11%**	**10.64%**	**9.65%**	**8.66%**	**2.48%**			

Note: URQ=Upper right quadrant, UMQ=Upper middle quadrant, ULQ=Upper left quadrant;

   X^2=Chi square, df=degree of freedom

Table 3: Mean, Standard deviation and t-test of mean difference

Sex	Tongue Rolling		Chi-Square Tests		
	Yes	No	df	X^2	P-value
Male	96	104	1	1.393	0.271
	48%	52%			
Female	86	118			
	42.20%	57.80%			
Total	**182**	**222**			
	45%	55%			

X^2=Chi square, df=degree of freedom
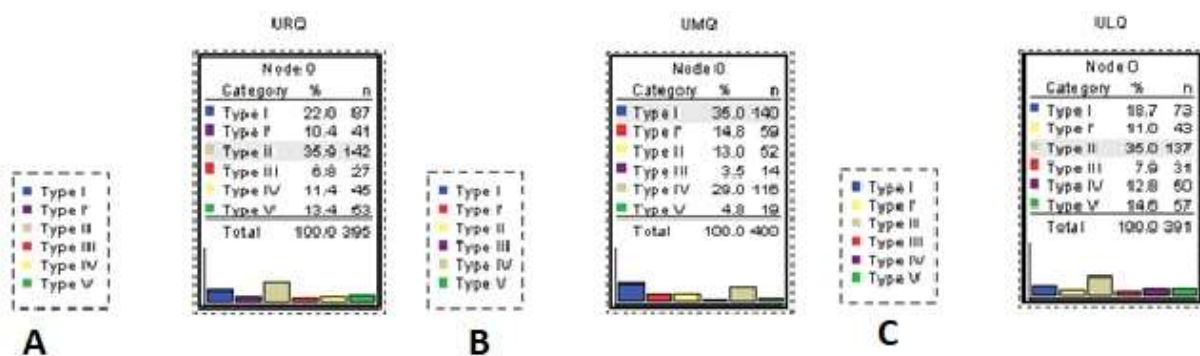
Figure 1: **A-** Decision tree for explaining the relationship between tongue rolling ability and the lip print pattern of the URQ; **B-** Decision tree for explaining the relationship between tongue rolling ability and the lip print pattern of the UMQ; **C-** Decision tree for explaining the relationship between tongue rolling ability and the lip print pattern of the ULQ.

No additional node was created except the initial grouping and thus, it can be concluded that auricular dimensions do not explain the distribution of the lip print pattern at the URQ, UMQ, and ULQ.
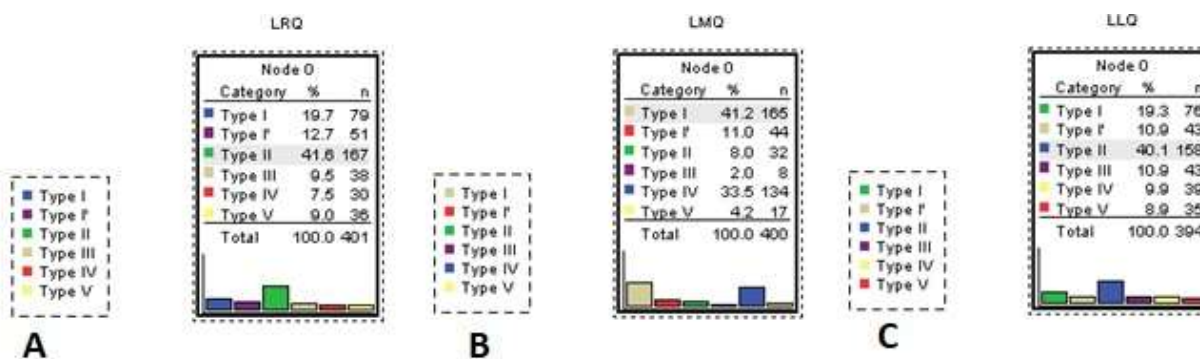

Figure 2: **A-** Decision tree for explaining the relationship between tongue rolling ability and the lip print pattern of the LRQ; **B-** Decision tree for explaining the relationship between tongue rolling ability and the lip print pattern of the LMQ; **C-** Decision tree for explaining the relationship between tongue rolling ability and the lip print pattern of the LLQ.

No additional node was created except the initial grouping and thus, it can be concluded that auricular dimensions do not explain the distribution of the lip print pattern at the LRQ, LMQ, and LLQ.

The decision tree in Figures 1 and 2 shows that no additional node was created except the initial grouping and thus, it can be concluded that tongue rolling ability

Ade Stephen Alabi[1], Elizabeth Oreka Sayeed[1], Oluwadamilola Olamide Fadipe[2], Joshua Honor Ojo[*3].

do not explain the distribution of the lip print pattern at the upper and lower lip quadrants.

Also, among Ogori Magongo ethnic group, there was a new kind of lip print pattern that was discovered and is represented in this work as Type V*. This rare lip print pattern appears to be a straight horizontal line. In Figure 3 below, a sample of Type V* is shown to appear on the Upper and lower right quadrants and the lower left quadrant.
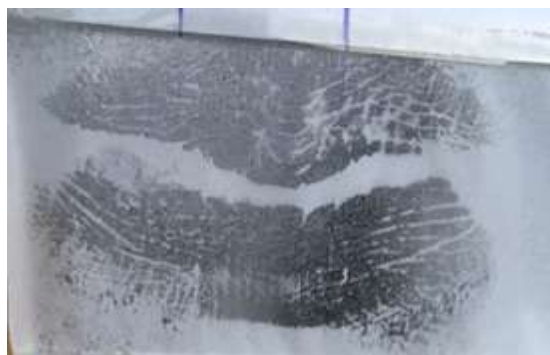
Figure 3:   **A sample of Type V***

Discussion

One of the difficult processes in forensic investigation is establishing the identity of a person. There is a huge pressure on the law to implement a method which provides suffice physical evidence which connect the offender to his crime. Theory of uniqueness was the mainly used principle in the identification of an individual[9]. Even though finger prints, DNA analysis, dental procedures are the common technique used in this purpose, the methods like Cheiloscopy can also be added to support the criminal investigation as it is a reliable method which will not alter during the life of a person [9]. In the past some researchers have worked on lip prints to prove that the gender difference does exist in lip print.

Lip print in relation to sex

According to the study by Vahanwala et al [10] Type I and I' patterns were dominant in females while type III and type IV were dominant in males. Similar results were obtained in a study conducted by Sharma et al [11] and Mallika et al [12]. In the study conducted by Gugulothu et al [13], Type II was the most common in both males and females constituting 35.2% and 37.0%, respectively. The results gotten from this research were also consistent with their studies, with slight differences.

The results gotten from this present study showed that there was a significant relationship between lip Print pattern and sex with the most prominent lip print pattern as Type II for both Male and Female, in both

the upper and lower lip quadrant. Except for the middle quadrant, where the most prominent lip print pattern was Type I in both Males and Females, for both the upper and lower lips.

In the past it was also proved that gender difference exists in lip print i.e. type-I and type-II, were the dominant female pattern while type-III and type-IV were prominent in male [14]. Another study showed that females have same pattern in all four quadrants of the lips while males have different pattern in the same individual [10]. In a study conducted by Ishaq et al [15] it shows that in females, Type I lip pattern was most predominant while in Males, Type III lip pattern was predominantly reported.

Varalakshmi and Sangeeta [9], in their study of lip print in establishing Identity of an Individual, showed that Type I pattern was most common both among male and females. Which was also similar to the results obtained by Roquaiya et al [16] which showed that Type I lip pattern was the most common pattern observed in the entire study population among both males and females. Type I' lip print pattern was also found to be more frequent among both the genders in a study conducted by Yandava et al [17].

Lip print in relation to ethnicity

Vats et al [18], in a study which was done on north Indian population, showed sexual dimorphism in the lip print patterns among different communities. Among Brahmin males, the most common patterns found were Type II and Type III as compared to Type IV and Type I' among Brahmin females. Among the Jat community, Type III was the most common pattern found in males and in females, mixed patterns were more common. Type V pattern was not found in any of the females. Results of the study were statistically significant.

In this study among the Ogori Magongo ethnic group, Type II was the most dominant lip print pattern found in both males and females. In addition, a unique Type V* lip print pattern was also found.

Tongue rolling in relation to sex and ethnicity

In the study conducted by Xin et al [19] to show the traits of five types of tongue movement in Han of Shanxi in China, the result showed that the frequency of tongue rolling was higher than the frequencies of the other tongue movement and there was no significant gender difference.

In this study among Ogori Magongo ethnic group, the frequency of non-tongue rollers is higher than the tongue rollers for both the males and the females. And

no significant difference in the relationship between tongue rolling, sex and ethnicity.

Odokuma et al. [20] in their study to show tongue rolling and tongue folding traits in an African population reported the incidence of tongue rolling to be higher in females than in their male counterparts. In a study conducted by Alabi et al [21] to determine the relationship of fingerprint and lip print in relation to tongue rolling among students in university of Ilorin Nigeria, showed that Type III, type IV and type II have an association with tongue rolling ability, and sex determinant in the URQ, UMQ, LMQ and LLQ of the lips. This is inconsistent with the result gotten in this present study, which showed no relationship between tongue rolling ability and lip print. No association between lip Print and tongue rolling among Ogori Magongo people however, there is paucity of literature on this association to compare the present findings with.

Conclusion

This present study shows that Type II lip print pattern is the most predominant for both males and females and a unique Type V* which are sexual dimorphic. It also shows a higher frequency in the number of none tongue rollers in both males and females than those who could roll their tongues, with no significant difference. The study shows no correlation between tongue rolling ability and lip print pattern.

Conflict of interest

This work is an original work and has not been published before now. Hence there is no conflict of interest involved in this work.

Authors' Contributions

Ade Stephen Alabi and Elizabeth Oreka Sayeed were responsible for the Concept and design of the study or acquisition of data or analysis and interpretation of data. Oluwadamilola Olamide Fadipe and Joshua Honor Ojo were responsible for Drafting the manuscript or revising it critically for important intellectual content. Ade Stephen Alabi and Joshua Honor Ojo were responsible for the final approval of the version to be published.

References

1. Gopichand, P. V., Kaushal, S. and Kaur, G. Personal identification using lip prints (Cheiloscopy) - A study in 500 Punjabi females. *J Indo Pac Acad Forensic Odontol;* 2010;1:20–22.

2. Utsuno, H., Kanoh, T., Tadokoro, O. and Inoue, K. Preliminary study of post Mortem identification using lip prints. *Forensic science international;* 2005;149:129-132.

3. Caldas, I. M., Magalhaes, T. and Afonso, A. Establishing identity using cheiloscopy and palatoscopy. *Forensic Science International* 2007; 165:1-9.

4. Saad, W. M., Kameel, A. H., Hassan, F. Z. and El-Otiefy, M. A. Genetic studies on the inheritance of lip prints in cleft and palate. *Egypt Journal of Plastic Reconstruction Surgery;* 2005;29:9-12.

5. Sultana, Q., Shariff, M. H., Asif, M. and Avadhani, R. Cheiloscopy: A scientific approach for personal identification. *International Journal of Anatomical Research;* 2014;2 (4):668-672.

6. Rastogi, P. and Parida, A. Lipprints, an aid in identification. *Australia Journal of Forensic Scienc;* 2011;44:1-8.

7. Ranjan, V., Sunil, M. K. and Kumar, R. Study of lip prints: A forensic study. *J Indian Acad Oral Medical Radiology;* 2014;26:50-54.

8. Ravath, M. J., Girish, H. C., Murgod, S., Hegde, R. B. and Savita, J.K. Lip prints and inheritance of cleft lip and cleft palate. *Journal of Clinical Diagnosis Research;* 2014;8(7): ZC28-ZC32.

9. Varalakshmi, K. L. and Sangeeta, M. Cheiloscopy: study of lip print in establishing Identity of an Individual. *International Journal of Anatomy and Research;* 2019; 7(3.1):6751-6755.

10. Vahanwala, S. and Parekh, B. Study of lip prints as an aid to forensic methodology. *Journal of Forensic Medicine and Toxicology;* 2000;17(1):12-18.

11. Sharma, P., Saxena, S. and Rathod, V. Comparative reliability of cheiloscopy and palatoscopy in human identification. *Indian Journal of Dental Research;* 2009;20:453-457.

12. Mallika, R. and Goel, S. Cheiloscopy: A Deterministic aid for forensic sex

Ade Stephen Alabi[1], Elizabeth Oreka Sayeed[1], Oluwadamilola Olamide Fadipe[2], Joshua Honor Ojo[*3].

determination. *J Indian Acad Oral Med Radiol;* 2011;23:17-19.

13. Gugulothu, R. N., Alaparthi, R. K., Maloth, K. N., Kesidi, S., Kundoor, V. and Palutla, M. M. Personal identification and sex determination using cheiloscopy. *J Indian Acad Oral Med Radiol;* 2015;27:399-404.

14. Sonali, V., Nayak, C. and Pagare, S. Study of lip-prints as aid for sex determination. *Med Leg Update;* 2005;5(3):93-98.

15. Ishaq, N., Ehsan, U., Jawaad, I., Ikram, A. and Rasheed, A. Cheiloscopy; a tool for sex determination. *Professional Medical Journal*; 2014;21(5):883-887.

16. Roquaiya, N., Shyam, S. B., Aravindha, N. B. and Rajesh, E. Study of cheiloscopy pattern in Bihar population. *Journal of critical reviews;* 2020;7(14):3531-3536.

17. Yandava, S., Prasad, B., Jayasurya, V. and Surendar, J. Cheiloscopy –A Tool of Identification. *Indian Journal of Forensic Medicine & Toxicology;* 2020;14(3):692-698.

18. Vats, Y., Dhall, J, K. and Kapoor, A. K. Gender variation in morphological patterns of lip prints among some north Indian population. *Journal of Forensic Dental Science;* 2012;4(1):19–24.

19. Xin, H., Jian-Fei, Z., Zeng-Xian, L., Cui, L., Li-Tao, Y., Ning, W. et al. The traits of five types of tongue movement in Han of Shaanxi, China. *Anatomical Science International;* 2012;87:181-186.

20. Odokuma, E. I., Eghworo, O., Avwioro, G. and Agbedia, U. Tongue rolling and tongue folding traits in an African population. *International Journal Morphology;* 2008;26(3):533-535.

21. Alabi, A. S., Alawaye, L. A., Oyewopo, A. O. and Samson, A. O. Relationship of finger print and lip print in relation to tongue rolling among students of university of Ilorin, Nigeria. *Era's Journal of Medical Research;* 2020;7(1):8-13.