ABSTRACT

Some factors have been found to influence lip print patterns in individuals. The aim of this study is to evaluate the relationship between lip print pattern and season of birth in a Nigerian population.

A total 764 adults were purposively selected from a two closely related tribe in the north central geopolitical zone of Nigeria. There lip prints were obtained by applying lip gloss and print on a glass slide. Each lip was divided into 6 quadrants and studied under magnifying lens. Lip print patterns were grouped using Hassan Fahmy (1977) classification. Statistical analysis was done using Statistical Package for Social Sciences (SPSS version 23). Lip print types were expressed as frequency and proportion for each lip quadrant. Correlations between male and female lip print pattern and their season of birth was done using Chi-square test. The confidence level was set as 95% while statistical significance was set at $p<0.05$.

Result showed a consistent prevalence of type III and IV in the entire upper and lower quadrant, while the least expressed were type I' and II. Qualitative analysis of association between season of birth and lip print pattern showed no significant distributional difference between those born during wet and dry season in the entire upper and lower quadrant. These finding has provided further fact to prove that cheiloscopy is a reliable tool for personal identification.

Keywords: Lip prints, Cheiloscopy, Season of Birth, Nigeria

INTRODUCTION

The use of finger print technique in forensic investigation has gained such a huge awareness that criminals are now quite conscious to avoid leaving their finger prints on crime scenes (Kumaran et al. 2017). Though there are other common methods for resolving identity disputes such as DNA comparison, dental structures etc. there is still the need to find a more accessible tool for crime scene investigation. Lip print also known as Cheiloscopy is one of such tools. It was first recommended in 1932 as evidence in court by Edmond Locard in France (Syndar, 1950). and ever since, it has come under strong consideration over the years as a much reliable method for personal identification just like finger prints (Singh et al. 2011).

Lip prints were first described by Fischer as the lines that forms furrows or grooves on the sulci labiorum (red part) at the transition zone (vermillion border) of the human lips (Singh et al. 2011). It was Tsuchihashi and Suzuki, two Japanese scientists in the period 1968-71, that later established that the arrangement of these lines are unique to each person after examining 1364 individuals (Tsuchihashi, 1974; Suzuki & Tsuchiahashi, 1971). There have also been more recent studies across different population to establish the uniqueness of lip print as a tool for personal identification (Kapoor & Badiye, 2017; Naik et al. 2017; Bindal et al. 2009), sex determination (Vahanwala, 2005; Sharma et al. 2009; Gondivkar et al. 2009; Kenneth et al. 2018), ethnic differentiation among others (Jeergal et al. 2016; Oladipo et al. 2018; Alabi et al. 2019).

Although lip prints are unique to individuals and does not change from the sixth week of intrauterine life till death (Alabi et al. 2019), they show few or no similarity between parents and children and even siblings (Saad et al. 2005; Ghalant et al. 2013). However, some factors have been found to correlate with lip print pattern like individual temperament (Abidullah et al. 2015) and finger prints (Negi, 2016; Kumaran et al. 2017). However, the effect of environmental factors on lip print patterns is not yet fully understood.

Pre and perinatal exposure to certain environmental factors can influence the developmental outcomes in an individual (Waldie et al. 2000; Singh 2005). What has not been fully verified is if the climatic season of conception and birth of an individual plays a significant role in the types of lip print pattern they bear. Only a few literatures are available especially in Nigeria in this regard (Alabi et al. 2019; Adamu et al. 2013). The aim of this study is to determine the influence of season of birth on the prevalence of lip print pattern in a Nigerian population

METHODOLOGY

Study Population

The study was conducted in ten different local governments in Niger state for a period of three weeks. Niger state is located in north central, Nigeria. According to 2006 national population census, Niger state population had been projected to be 3,954,772 by 2016, with the Nupe tribe numbering up to 1,759,874 and Gbagyi. 1,198,318 (National Population Commission, 2006).

Sample Size

Sample size was determined using Fishers formulae (Fisher, 1935).$SS = \frac{Z^2 \times p \times q}{d^2}$

For the Nupe tribe,

Z = 1.96

P = 0.445 (proportion of Nupe)

$$P = \frac{Nupe\ Ethnic\ group}{Population\ of\ Niger\ State} = \frac{1{,}759{,}874}{3{,}954{,}772} = 0.445$$

q = 1-p = 1 – 0.445 = 0.555

d = 0.05 (tolerance level of 0.05)

Therefore,

$$Sample\ size\ (SS) = \frac{1.96^2 \times 0.445 \times 0.555}{0.05^2} = 380$$

Adding 10% attrition rate of the sample size determined = 0.1×380 = 38

Total sample size = 380+38 = 418

For Gbagyi tribe,
Z = 1.96
P = 0.303 (proportion of the ethnic group)

$$P = \frac{Gbagyi\ ethnoc\ group}{Population\ of\ Niger\ State} = \frac{1{,}198{,}318}{3{,}954{,}772} = 0.303$$

q = 1-p = 1 – 0.303 = 0.697
d = 0.05 (tolerance level of 0.05)

Therefore,$Sample\ size\ (SS) = \frac{1.96^2 \times 0.303 \times 0.697}{0.05^2} = 324$

Adding 10% attrition rate of the sample size determined = 0.1×324 = 32.4
Total sample size= 324+32 = 356
Therefore, total working sample for the two ethnic groups is= 356+418=774.

Inclusion Criteria

All subjects had to be indigenes of Nupe or Gbagyi tribe from both parents up to the second generation. All subjects had to be between the ages of 18 and 64years. All subjects were confirmed to be healthy and free from any deformity, congenital anomaly of the lips, inflammation of the lips or history of any craniofacial surgery.

Sampling Technique

Informed consent was obtained from study cohorts who met the inclusion criteria, after which a structured questionnaire was administered by trained research assistants. Literate subjects were asked to fill the required information while subjects who could not write were assisted.

The following procedures were then followed to obtain their lip prints;

- The subjects were made to stand in an anatomical position while their lips were cleaned. Females with lip stick used facial wipes.
- Lip gloss was applied once in a single motion
- Glass slide was placed on the lip and removed in a single motion for print collection.
- Carbon fine powder was sprinkled on the lip print to preserve the print.
- Cello tape was used to attach the well-developed lip-print to the space provided for it on the questionnaire.

Figure 1. Process of picking lip prints from subjects on glass slide

Determination of Season of birth

Month of birth was used to divide the subjects into dry and wet season of birth. The season of birth was defined as wet season from April to October and dry season from November to March.

Data Analysis

Analysis commenced by dividing both upper and lower lips into compartments as follows, Upper Right Quadrant (URQ), Upper Middle Quadrant (UMQ), Upper Left Quadrant (ULQ), Lower Right Quadrant (LRQ), Lower Middle Quadrant (LMQ), Lower Left Quadrant (LLQ).

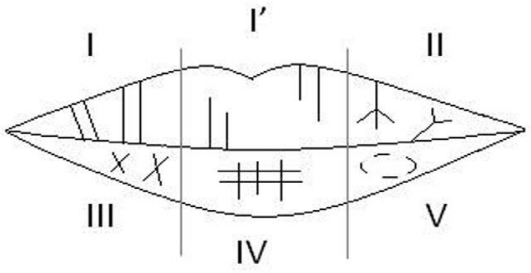

Figure 2. Types of grooves according to Suzuki & Tsuchihashi (1971).

The prints were then identified into types as proposed by Hassan & Fahmy (1977). They classified lip prints into six and differentiated the branched type (type II) into proximal (a) and distal (b). Hassan and Fahmy classification of lip grooves is as follows;

Type I Complete vertical

Type I' Incomplete vertical

Type IIa Branched proximal

Type IIb Branched distal

Type III Intersected

Type IV Reticular pattern

Type V Unknown

Statistical analysis

The data were analysed using SPSS version 23.0. Descriptive statistics were used to categorize demographic frequency and distribution patterns. Lip print types were expressed as frequency and proportion for each lip quadrant. Correlations between male and female lip print pattern and their season of birth was done using Chi-square test. The confidence level was set as 95% while statistical significance was set at $p<0.05$.

RESULT

In Table 1, Type III was seen predominantly in the upper right quadrant of 312(40.8%) of the total population understudy in both wet and dry season while Type I' was the least expressed 25(3.2%). There was no significant distributional difference in the print pattern of the population born in dry and the ones born in wet seasons (Male; χ^2=8.406, p=0.21, Female; χ^2= 10.667, p=0.099, Total;χ^2= 6.987; p=0.322).

In Table 2, Type III was seen predominantly in the upper middle quadrant of 299(39.1%) of the total population understudy in both wet and dry season while Type IIb was the least expressed 12(1.6%). There were no significant distributional differences in the print pattern of the population born in dry and the ones born in wet seasons (Male; χ^2= 5.72, p=0.455, Female; χ^2= 10.935, p=0.09, Total;χ^2= 4.341; p=0.63).

In Table 3, Type III was seen predominantly in the upper left quadrant of 313(41%) of the total population understudy in both wet and dry season while Type IIb was the least expressed 16(2.1%). There were no significant distributional differences in the print pattern of the population born in dry and the ones born in wet seasons (Male; χ^2= 7.792, p=0.254, Female; χ^2= 11.304, p=0.079, Total;χ^2= 4.921; p=0.554)

In Table 4, Type III was seen predominantly in the lower right quadrant of 372(48.7%) of the total population studied in both wet and dry season while Type I' was the least expressed 10(1.3%). There were no significant distributional differences in the print pattern of the population born in dry and the ones born in wet seasons (Male; χ^2= 4.591, p=0.597, Female; χ^2= 3.564, p=0.735, Total;χ^2= 4.574; p=0.599)

In Table 5, Type III was expressed predominantly in the lower middle quadrant of 322(42.1%) of the total population born both during wet and dry season while Type I' was the least expressed 9(1.2%). There were no significant distributional differences in the print pattern of the population born during dry and the ones born during wet seasons (Male; χ^2= 7.627, p=0.267, Female; χ^2= 5.910, p=0.433, Total;χ^2= 6.054; p=0.417)

In Table 6, Type III was expressed predominantly in the lower left quadrant of 378(49.5%) of the total population born both during wet and dry season while Type I' was the least expressed 9(1.2%). There were no significant distributional differences in the print pattern of the population born during dry and the ones born during wet seasons (Male; χ^2= 4.456, p=0.615, Female; χ^2= 4.602, p=0.596, Total;χ^2= 4.213; p=0.648)

Discussion

The effectiveness of cheiloscopy in personal identification seems to be gaining much approval with reports from several population establishing sexual dimorphism and ethnic differentiation (Sharma et al. 2014; Moshfeghi et al. 2016). In Nigeria, there is still a gap in the availability of data from the various ethnic groups in the country.

In this study, the analysis of qualitative cheiloscopy using the Hassan and Famhy characterisation revealed consistency in the prevalence of intersected (type III)and reticular (type IV) pattern in all the upper and lower lip quadrant of both sex, while there was scarcity of incomplete vertical (Type I') and branched distal (Type IIb) patterns. These findings are contrary to the report of (Alabi et al. 2019) in Ilorin and (Oladipo et al. 2018) among Igbos where type I and II were the predominant patterns. It was also established from our study that no two individual have identical pattern of lip prints.

However, because lip prints are formed during intrauterine life at about 6weeks of gestation (Oladipo et al. 2018), The patterns that eventually stays with an individual can be genetically altered if exposed to mutants or certain environmental factors (Singh, 2005). This study evaluated the possible effect of the season of birth as an environmental factor on lip print patterns.

The qualitative analysis of association between cheiloscopy and season of birth carried out on each lip compartment according to Suzuki & Tsuchilashi (1971) lip partitioning did not show significant distributional correlation in any of the upper or lower lip quadrants. A test of association in the *URQ* showed χ^2value of 6.987 and p = 0.322 in the total population. In the females'*UMQ*, there was a slightly high difference in the pattern distribution of those born during wet and dry season(χ^2= 10.935) but not significant(p=0.09). Similar pattern was seen in the females *ULQ* as well withχ^2=11.304 &p=0.07. These are the highest odds in our result. Throughout the lower quadrants there was no significant difference in the distribution of prints in the population born in both season. The lowest p value was seen in the *LMQ* of males (P=0.267).

Although, Weber and his colleagues had proven that height of an individual has a significant correlation to their month of birth (Weber et al. 1998), and Waldie et al. 2000 reported the effect of prenatal and postnatal exposure to sunlight as slightly impactful on human growth, there has not been any prior evidence from literature that season of birth have a significant influence on the predominance of any type of lip print pattern. The two major Nigerian studies in this regard "Sharma et al. 2014 and Adamu et al. 2013" reported no tangible association. The findings from this study have further corroborated these claims.

Conclusion

It has been further established from this study that no two individuals have the same lip print pattern, it was established that season of birth has no significant influence on the lip print distribution among the study population.

Acknowledgement

Special thanks to the Department of Anatomy for their backing and ethical approval throughout the period of study. Our appreciation goes to the Nupe and Gbagyi community chiefs who gave us approval to work within their communities and also we acknowledge the study cohorts who volunteered to be part of the study.

Ethical Approval

Ethical clearance was sort and obtained from the Department of Anatomy Ethical Review Committee of the University of Ilorin, Ilorin. The ethical approval no was *15/46KA034/09/2018*

Competing Interest

There was no conflict of interest declared by any party.

Availability of Data and Materials

The raw samples of lip prints are still available as well as the instrument used for the study.

Funding: The research was fully funded by the researchers.

Table 1: Chi-square test of association in lip print distribution at the upper right quadrant between males and females stratified by season

Season	Sex	URQ							Chi-square analysis		
		TYPE I	TYPE I'	TYPE IIa	TYPE IIb	TYPE III	TYPE IV	TYPE V	χ^2-value	P-value	Inf
Male	Dry	32 16.7%	12 6.3%	14 7.3%	7 3.6%	53 27.6%	60 31.3%	14 7.3%	8.406	0.21	NS
	Wet	40 21.1%	4 2.1%	10 5.3%	6 3.2%	59 31.1%	64 33.7%	7 3.7%			
	Total	**72 18.8%**	**16 4.2%**	**24 6.3%**	**13 3.4%**	**112 29.3%**	**124 32.5%**	**21 5.5%**			
Female	Dry	7 3.6%	1 0.5%	13 6.6%	2 1.0%	105 53.6%	56 28.6%	12 6.1%	10.667	0.099	NS
	Wet	13 7.0%	8 4.3%	6 3.2%	1 0.5%	95 51.1%	53 28.5%	10 5.4%			
	Total	**20 5.2%**	**9 2.4%**	**19 5.0%**	**3 0.8%**	**200 52.4%**	**109 28.5%**	**22 5.8%**			
Total	Dry	39 10.1%	13 3.4%	27 7.0%	9 2.3%	158 40.7%	116 29.9%	26 6.7%	6.987	0.322	NS
	Wet	53 14.1%	12 3.2%	16 4.3%	7 1.9%	154 41.0%	117 31.1%	17 4.5%			
	Total	**92 12.0%**	**25 3.3%**	**43 5.6%**	**16 2.1%**	**312 40.8%**	**233 30.5%**	**43 5.6%**			

Table 2: Chi-square test of association in lip print distribution at the upper middle quadrant between males and females stratified by season

Season	Sex	UMQ							Chi-square analysis		
		TYPE I	TYPE I'	TYPE IIa	TYPE IIb	TYPE III	TYPE IV	TYPE V	χ^2-value	P-value	Inf
Male	Dry	32 16.7%	10 5.2%	9 4.7%	2 1.0%	51 26.6%	75 39.1%	13 6.8%	5.72	0.455	NS
	Wet	32 16.8%	5 2.6%	10 5.3%	7 3.7%	57 30.0%	70 36.8%	9 4.7%			
	Total	**64 16.8%**	**15 3.9%**	**19 5.0%**	**9 2.4%**	**108 28.3%**	**145 38.0%**	**22 5.8%**			
Female	Dry	6 3.1%	1 0.5%	9 4.6%	2 1.0%	102 52.0%	64 32.7%	12 6.1%	10.935	0.09	NS
	Wet	13 7.0%	8 4.3%	6 3.2%	1 0.5%	89 47.8%	62 33.3%	7 3.8%			
	Total	**19 5.0%**	**9 2.4%**	**15 3.9%**	**3 0.8%**	**191 50.0%**	**126 33.0%**	**19 5.0%**			
Total	Dry	38 9.8%	11 2.8%	18 4.6%	4 1.0%	153 39.4%	139 35.8%	25 6.4%	4.341	0.63	NS
	Wet	45 12.0%	13 3.5%	16 4.3%	8 2.1%	146 38.8%	132 35.1%	16 4.3%			
	Total	**83 10.9%**	**24 3.1%**	**34 4.5%**	**12 1.6%**	**299 39.1%**	**271 35.5%**	**41 5.4%**			

Table 3: Chi-square test of association in lip print distribution at the upper left quadrant between males and females stratified by season

Season	Sex	ULQ							Chi-square analysis		
		TYPE I	TYPE I'	TYPE IIa	TYPE IIb	TYPE III	TYPE IV	TYPE V	χ^2-value	P-value	Inf
Male	Dry	31 16.1%	13 6.8%	15 7.8%	5 2.6%	51 26.6%	64 33.3%	13 6.8%	7.792	0.254	NS
	Wet	32 16.8%	4 2.1%	10 5.3%	8 4.2%	57 30.0%	70 36.8%	9 4.7%			
	Total	**63 16.5%**	**17 4.5%**	**25 6.5%**	**13 3.4%**	**108 28.3%**	**134 35.1%**	**22 5.8%**			
Female	Dry	5 2.6%	1 0.5%	10 5.1%	2 1.0%	110 56.1%	56 28.6%	12 6.1%	11.304	0.079	NS
	Wet	12 6.5%	8 4.3%	6 3.2%	1 0.5%	95 51.1%	56 30.1%	8 4.3%			
	Total	**17 4.5%**	**9 2.4%**	**16 4.2%**	**3 0.8%**	**205 53.7%**	**112 29.3%**	**20 5.2%**			
Total	Dry	36 9.3%	14 3.6%	25 6.4%	7 1.8%	161 41.5%	120 30.9%	25 6.4%	4.921	0.554	NS
	Wet	44 11.7%	12 3.2%	16 4.3%	9 2.4%	152 40.4%	126 33.5%	17 4.5%			
	Total	**80 10.5%**	**26 3.4%**	**41 5.4%**	**16 2.1%**	**313 41.0%**	**246 32.2%**	**42 5.5%**			

Table 4: Chi-square test of association in lip print distribution at the lower right quadrant between males and females stratified by season

Season	Sex	LRQ							Chi-square analysis		
		TYPE I	TYPE I'	TYPE IIa	TYPE IIb	TYPE III	TYPE IV	TYPE V	χ^2-value	P-value	Inf
Male	Dry	22 11.5%	4 2.1%	14 7.3%	14 7.3%	74 38.5%	53 27.6%	11 5.7%	4.591	0.597	NS
	Wet	30 15.8%	1 0.5%	10 5.3%	11 5.8%	69 36.3%	59 31.1%	10 5.3%			
	Total	**52 13.6%**	**5 1.3%**	**24 6.3%**	**25 6.5%**	**143 37.4%**	**112 29.3%**	**21 5.5%**			
Female	Dry	4 2.0%	2 1.0%	10 5.1%	2 1.0%	114 58.2%	54 27.6%	10 5.1%	3.564	0.735	NS
	Wet	4 2.2%	3 1.6%	5 2.7%	3 1.6%	115 61.8%	51 27.4%	5 2.7%			
	Total	**8 2.1%**	**5 1.3%**	**15 3.9%**	**5 1.3%**	**229 59.9%**	**105 27.5%**	**15 3.9%**			
Total	Dry	26 6.7%	6 1.5%	24 6.2%	16 4.1%	188 48.5%	107 27.6%	21 5.4%	4.574	0.599	NS
	Wet	34 9.0%	4 1.1%	15 4.0%	14 3.7%	184 48.9%	110 29.3%	15 4.0%			
	Total	**60 7.9%**	**10 1.3%**	**39 5.1%**	**30 3.9%**	**372 48.7%**	**217 28.4%**	**36 4.7%**			

Table 5: Chi-square test of association in lip print distribution at the lower middle quadrant between males and females stratified by season

Season	Sex	LMQ							Chi-square analysis		
		TYPE I	TYPE I'	TYPE IIa	TYPE IIb	TYPE III	TYPE IV	TYPE V	χ^2-value	P-value	Inf
Male	Dry	30 15.6%	3 1.6%	6 3.1%	9 4.7%	61 31.8%	73 38.0%	10 5.2%	7.627	0.267	NS
	Wet	31 16.3%	1 0.5%	6 3.2%	1 0.5%	62 32.6%	78 41.1%	11 5.8%			
	Total	**61** **16.0%**	**4** **1.0%**	**12** **3.1%**	**10** **2.6%**	**123** **32.2%**	**151** **39.5%**	**21** **5.5%**			
Female	Dry	5 2.6%	2 1.0%	6 3.1%	3 1.5%	103 52.6%	67 34.2%	10 5.1%	5.910	0.4333	NS
	Wet	9 4.8%	3 1.6%	1 0.5%	3 1.6%	96 51.6%	68 36.6%	6 3.2%			
	Total	**14** **3.7%**	**5** **1.3%**	**7** **1.8%**	**6** **1.6%**	**199** **52.1%**	**135** **35.3%**	**16** **4.2%**			
Total	Dry	35 9.0%	5 1.3%	12 3.1%	12 3.1%	164 42.3%	140 36.1%	20 5.2%	6.054	0.417	NS
	Wet	40 10.6%	4 1.1%	7 1.9%	4 1.1%	158 42.0%	146 38.8%	17 4.5%			
	Total	**75** **9.8%**	**9** **1.2%**	**19** **2.5%**	**16** **2.1%**	**322** **42.1%**	**286** **37.4%**	**37** **4.8%**			

Table 6: Chi-square test of association in lip print distribution at the lower left quadrant between males and females stratified by season

Season	Sex	LLQ							Chi-square analysis		
		TYPE I	TYPE I'	TYPE IIa	TYPE IIb	TYPE III	TYPE IV	TYPE V	χ^2-value	P-value	Inf
Male	Dry	24 12.5%	4 2.1%	9 4.7%	13 6.8%	75 39.1%	55 28.6%	12 6.3%	4.456	0.615	NS
	Wet	25 13.2%	1 0.5%	8 4.2%	8 4.2%	70 36.8%	67 35.3%	11 5.8%			
	Total	**49** **12.8%**	**5** **1.3%**	**17** **4.5%**	**21** **5.5%**	**145** **38.0%**	**122** **31.9%**	**23** **6.0%**			
Female	Dry	2 1.0%	2 1.0%	7 3.6%	2 1.0%	120 61.2%	53 27.0%	10 5.1%	4.602	0.596	NS
	Wet	4 2.2%	2 1.1%	2 1.1%	4 2.2%	113 60.8%	54 29.0%	7 3.8%			
	Total	**6** **1.6%**	**4** **1.0%**	**9** **2.4%**	**6** **1.6%**	**233** **61.0%**	**107** **28.0%**	**17** **4.5%**			
Total	Dry	26 6.7%	6 1.5%	16 4.1%	15 3.9%	195 50.3%	108 27.8%	22 5.7%	4.213	0.648	NS
	Wet	29 7.7%	3 0.8%	10 2.7%	12 3.2%	183 48.7%	121 32.2%	18 4.8%			
	Total	**55** **7.2%**	**9** **1.2%**	**26** **3.4%**	**27** **3.5%**	**378** **49.5%**	**229** **30.0%**	**40** **5.2%**			

References

1. Abidullah M, Kumar MN, Bhorgonde KD, Reddy DS, 2015. Cheiloscopy and dactyloscopy: Do they dictate personality patterns?. Journal of forensic dental sciences. 7(2):114.
2. Adamu LH, Taura MG, Sadeeq AA, Asuku AY, Datti S, Abdu IT, 2013. The influence of season of birth on the pattern of lip prints in Nigeria. Bayero Journal of Pure and Applied Sciences. 6(2):6-9.
3. Alabi AS, Amedu NO, Olowo ST, Kareem SB, Lewu SF, 2019. Morphologic distribution of lip prints among genders, season of birth and different dialects of a Nigerian population. Journal of Environmental Toxicology and Public Health. 4:36-41.
4. Bindal U, Jethani SL, Mehrotra N, Rohatgi RK, Arora M, Sinha P, 2009. Lip prints as a method of identification in human being. Journal of the Anatomical Society of India. 58(2):152-5.
5. Eboh DE, 2012. A Study of Morphological Patterns of Lip Prints among The Yorubas in Okitipupa, South-western Nigeria. African Journal of Tropical Medicine and Biomedical Research. 4;1(4).
6. Fisher RA, 1935. The logic of inductive inference (with discussion). Journal of Royal Statistical Society. 98:39-82.
7. Ghalaut P, Bhagwath S, Saxena S, 2013. An Assessment Of Inheritance Pattern Of Lip Prints In North Indian Population. Indian Journal of Dental Sciences. 1;5(1).
8. Gondivkar SM, Indurkar A, Degwekar S, Bhowate R, 2009. Cheiloscopy for sex determination. Journal of forensic dental sciences. 1;1(2):56.
9. Hassan FZ, Fahmy SM, 1977. The pattern of lip prints in upper Egyptians. Assiut Medical J. 1(4):477-86.
10. Jeergal PA, Pandit S, Desai D, Surekha R, Jeergal VA, 2016. Morphological patterns of lip prints in Mangaloreans based on Suzuki and Tsuchihashi classification. Journal of Oral and Maxillofacial Pathology. 20(2): 320-327.
11. Kapoor N, Badiye A, 2017. A study of distribution, sex differences and stability of lip print patterns in an Indian population. Saudi journal of biological sciences. 1;24(6):1149-54.
12. Kenneth EU, Emelda OC, Obaje SG, Chinedu UG, 2018. Sexual dimorphism in the patterns of lip prints among students of Alex Ekwueme Federal University Ndufu-Alike Ikwo, Nigeria. European Journal of Biomedical. 5(10):379-84.
13. Kumaran SM, Bastia BK, Kumar L, Patel SH, 2017. Correlation between fingerprint and lip print pattern in Gujarati population. Medico-Legal Update. 17(1):217-21.
14. Moshfeghi M, Beglou A, Mortazavi H, Bahrololumi N, 2016. Morphological patterns of lip prints in an Iranian population. Journal of clinical and experimental dentistry. 8(5):e550.
15. Naik R, Mujib BA, Telagi N, Hallur J, 2017. Comparative analysis of lip with thumbprints: An identification tool in personal authentication. Journal of Oral and Maxillofacial Pathology: JOMFP. 21(1):171.
16. National Population Commission, Nigeria. Population Distribution by Sex, State 2006. (Cited 2020 July 1) Available online at: https://nigerianstat.gov.ng/download/474
17. Negi A, Negi A, 2016. The connecting link! Lip prints and fingerprints. Journal of forensic dental sciences. 8(3):177.

18. Oladipo GS, Alabi AS, Paul CW, Amadi PN, Paul JN, Robert FO, Amasiatu VC. and Gospel S, 2018. Cheiloscopy among the Igbo students in Madonna University Elele, Rivers State, Nigria. Saudi Journal of Biomedical Research, 3(3): 129-13.
19. Saad WM, Kamel AH, Hassan FZ, Elotiefy MA, 2005. Genetic studies on the inheritance of lip prints in cleft lip and palate. Egypt J PlastReconstr Surg. 29(1):9-12.
20. Sharma NA, Eldomiaty MA, Gutiérrez-Redomero E, George AO, Garud RS, Sánchez-Andrés A, et al, 2014. Diversity of human lip prints: a collaborative study of ethnically distinct world populations. Annals of Human Biology. 41(6):568-578.
21. Sharma P, Saxena S, Rathod V, 2009. Cheiloscopy: The study of lip prints in sex identification. Journal of forensic Dental sciences. 1;1(1):24.
22. Singh H, Chhikara P, Singroha R, 2011. Lip prints as evidence. Journal of Punjab Academy of Forensic Medicine & Toxicology. 11(1):23-5.
23. Singh I, 2005. Development of the face. In: Text book of human embryology. Jaypee Brothers: 231-236
24. Suzuki K, Tsuchiahashi Y, 1971. A new attempt of personal identification by means of lip print. Canadian Society of Forensic Science Journal. 1;4(4):154-8.
25. Synder LM, 1950. Textbook of Homicide investigation. Identification of dead bodies. 65.
26. Tsuchihashi Y, 1974. Studies on personal identification by means of lip prints. Forensic Science. 1;3:233-48.
27. Vahanwala S, Nayak CD, Pagare SS, 2005. Study of lip prints as aid for sex determination. Medico-legal update. 5(3):93-8.
28. Waldie KE, Poulton R, Kirk IJ, Silva PA, 2000. The effects of pre-and post-natal sunlight exposure on human growth: evidence from the Southern Hemisphere. Early human development. 1;60(1):35-42.
29. Weber GW, Prossinger H, Seidler H, 1998. Height depends on month of birth. Nature. 391(6669):754-5.