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Lip Print Patterns Of Saudi Arabian Subjects Visiting A Dental School

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Abstract

Background: Lip prints are creases on the vermilion border of the lips, formed due to the elevations and depressions on them. Lip print patterns are considered to be valuable biometric technique in forensic investigation. Globally, a number of studies have reported that establish lip-prints to be unique to an individual and can be a valuable source of DNA that can help in personal identification. Despite the usefulness and its assistance in solving the crime scene, lip print studies in the Kingdom of Saudi Arabia are very few. Therefore, we undertook this study to add more to the scanty existing information.

Aim: 1) To investigate the potential role of lip-prints in human identification. 2) To verify the potential for sex determination from lip print in Saudi Arabian individuals visiting the outpatient department of a private dental school in Jeddah, Saudi Arabia.

Methods: A total of 485 subjects were recruited from the screening clinic of a dental school in Jeddah, Saudi Arabia. The lip prints of eligible and consenting study subjects was recorded using red/brown lipstick on the white paper that was scanned and converted to digital image. The scanned images were viewed using Photoshop image editing software that inverted images to grayscale. The lip prints in the six study areas of the upper and lips were categorized according to Renaud’s classification. The frequency of each type of lip print was calculated as a percentage. Chi (χ²) test was used to establish the association between the print type and the gender of participant with the confidence level fixed at 95% and a P value of <0.05 was considered statistically significant.

Results: The most predominant type of lip print in the study population was type J (upper lip=42.0% and lower lip= 26.31%) and no two individuals among the study subjects showed similarity in the six lip print areas examined. However, there was no statistically significant correlation between the gender and the lip print type.
Conclusion: Based on our results we conclude that: 1. The lip prints of Saudi Arabian subjects are unique to every individual 2. No statistically significant difference was established between the gender and the type of lip prints of the study subjects.

**Keyword:** Lip prints, chieloscopy, lip crease, forensic dentistry, personal identification.
Introduction

Lip prints or cheiloscopy (Greek words cheilos: lip, skopein: to observe) is study of creases on the vermilion border of the lip. It has been considered valuable biometric method to identify an individual [1], [2], [3], [4] and [5]. According to Caldas, in the year 1902, the term chieloscopy was first coined, and Santos, in the year 1966, was the first to classify the pattern of lip prints patterns as simple and compound[6], followed by Suzuki and Tsuchihashi (1971), categorized them into five fundamental patterns [7] and later in 1973, Renaud classified them into ten different categories [8]. According to Soliman, subsequent researchers sought to add more details to the existing classification such as; 1) In 1977 Fahmy and Hassan specified the direction of branching and defined a pattern that could not fit with any of the regular groups, 2) Afaf and El-Sharawy described the primary and secondary branches of the grooves and 3) Afify et al. in 1989 differentiated the bifurcate from the branched type and added the X type, K type and braid shaped sutures [9]. However, the classification given by Suzuki and Tsuchihashi seems to be most widely used in the literature [7], [10] and [11].

According to Spencer DE, Edmond Locard, a French criminologist in the year 1932 recognized the role cheiloscopy in nailing the perpetrator of a crime [12]. Later in 1950, Snyder reiterated the importance of lip print as a tool of personal identification [13]. Lately, lip prints (cheiloscopy) have attracted the attention of many researchers as a new tool for human identification in both civil and criminal disputes, because studies have proved lip prints are unique and do not change during the life of a person [14].

The lip prints are identifiable as early as sixth week of intrauterine life and they possess a unique ability to recover after undergoing alterations during minor trauma, inflammation and even diseases that affect the vermilion border of lip (e.g. herpes). The lip print characteristics and the form of furrows does not vary even under the influence of environmental factors [15]; however, major or repeated trauma can alter the lip morphology thereby flaw the cheiloscopy
studies [10] and [16]. Although Suzuki and Tsuchihashi reported similarities between the lip prints of uni-ovular twins; they are not exactly identical [7]. The lip prints of parents and children and those of siblings have shown dissimilarities as well. Numerous studies have suggested that variations in patterns among males and females could help in sex determination as well [6], [17] and [18].

The moisture from minor salivary and sebaceous glands of the lips can leave invisible (latent) lip prints on cigarettes, duct tapes, cups and clothing [11] and [19] which makes cheiloscopy an effective personal identification tool of not only the visible lip prints but also the latent ones that can be rendered visible using the fingerprint dusting powder (aluminum or silver powder) [20] and [21]. The uniqueness of human labial lines extends beyond its usefulness in the lip-print analysis, new and latent lip-prints can also help detect the DNA of the individual [22] and [23]. Hence, the lip-prints can genetically profile the person who made them (Castell et al.) [24]. For the aforementioned reasons, establishing lip prints records of all individuals in a certain location can be vital to create database that could be valuable in handling civil and criminal issues.

Despite their usefulness in personal identification and assistance in solving the crime scene, lip print studies are very scanty, especially in the Kingdom of Saudi Arabia. While, globally (Japan, India, Iran, Egypt, Spain and Nigeria) a number of studies have reported the individuality of lip prints and personal identification [7], [25], [26], [27] and [28], to our knowledge only one study (MA El Domiaty et al in 2010) has been published in the electronic databases from the Kingdom of Saudi Arabia (from Almadinah Almonawarah province) on this subject. Therefore, to contribute to the scanty cheiloscopic literature of Saudi Arabian population, we conducted this study to investigate the potential role of lip prints in human identification and to verify the potential for sex determination from lip print in Saudi Arabian
individuals visiting the outpatient department of a private dental school in Jeddah, Saudi Arabia.

Materials and Method

The study design and settings: This analytical cross-sectional study was conducted in the screening clinic of a private dental school in Jeddah, Saudi Arabia from January 2017 to December 2020.

The study participants/Study subjects: A total number of n=435 were included in our study; the number of participants required to achieve the study objectives was calculated using the G power sample calculator. A sample size of 385 subjects was arrived at α=0.05, β=0.95, effect size=1 confidence level fixed at 95%. We increased the number of study subjects to 435 to increase the power of the study. We used a non-probability convenient sampling technique to recruit the study subjects. The following criteria was considered to enroll the subject into the study;

The study inclusion criteria: Saudi Arabian Nationals in the age group legally eligible to give voluntary informed consent.

The study exclusion criteria:

1. Non-Saudi Nationals
2. Subjects who refuse to consent for the study
3. Subjects with a history of sensitivity to lip stick
4. Subjects with congenital lip defects (cleft lip and palate and commissural lip pits)
5. Subjects with active lesions on the vermilion border of lips
6. Subjects with trauma to the lips

Collection of study data:
Materials used: Red or brown (Mikyajy, shade# 801 or 902 respectively), non-persistent, non-glossy, non-metallic lip stick, cotton tip applicator (Ear bud), white papers (white A4 ROCO Premium 80-g copy papers), makeup removing wipes and transparent scotch tape (3M) to cover and secure the lip print on the paper.

Recording the lip prints: Using disposable cotton tip applicator, a thin uniform layer of lipstick was applied on cleaned and dried vermillion area of lips in closed position. Three minutes after the application of the lip stick, lip impression was made by applying direct light pressure by the lips on the folded white paper (A. Aggrawal et al) [29]. A piece of transparent scotch tape was applied immediately on surface of the recorded lip print to prevent smudging and loss of details. The recording procedure was repeated in case any defect was observed in the recorded lip print to ensure having a clear lip print record of every single participant. Attention was paid to hygiene while recording the lip prints. After confirming the proper registration of all areas of the lips on paper, the lipstick remaining on the lips was cleaned using make-up remover wipes.

Examination of the Lip prints (outcome measurement):

To ensure the validity and reliability of the outcome measured, the lip prints were examined by two trained and calibrated (Kappa value= 0.84) examiners who were blinded to the identity of the lip print they examined. The lip prints on the white paper were scanned and converted to digital images using a digital image scanner (Cannon) set at 600 dpi. The scanned images were saved as TIFF (Tagged Image File Format) files to retain maximum details. The saved images were viewed in Photoshop image editing software to categorize them according to Renaud’s classification (because Caldas et al. [6] considered it to be the most complete classification) as shown in table 1 [8]. Using the Photoshop CS6 (Version 13.1.3) image editing software, the image was first inverted to grayscale, then using the digital marker, the lips prints were divided
into six topographic areas [upper right (UR), upper middle (UM), upper left (UL), lower right (LR), lower middle (LM) and lower left (LL)] (Bowers and Johansen) [30].

While analyzing the prints, the most lateral part of the lip print (near the angles of the mouth) were excluded as this area is usually wrinkled [28]. Furthermore, the classification of any topographic area was based on the numerical superiority of the groove types in the area under consideration/examination.

Statistical methods

The data was analyzed using IBM SPSS Version 22 software. The frequency of each type of lip print was calculated as a percentage. Chi-square ($\chi^2$) test was applied to check for the association between the lip print type and the gender of the participants. The confidence level was fixed at 95% and P value was regarded statistically significant when <0.05.

Results

The total study sample comprised of n=435, of which 194 were males and 241 were females. The age of study subjects’ ranged from 21 to 46 years (mean age 33.50±12.50), and the age distribution can be observed in Table 2.

Though we examined six different quadrants of every individual lip-print, however, we focus here mainly on UM and LM, as this area is most suitable for observing the pattern of lip prints [28].

Overall type J and C lip prints showed the highest frequency of occurrence in the UM and LM respectively. Followed in decreasing order by type C and A in the UM, whereas type E and J were most frequently observed in LM area. The distribution of lip-prints in different areas examined, the gender distribution and the correlation with sex is shown in table 3, 4 and figure 1. The upper lip (UL) predominantly showed type J (42.0%) lip-prints pattern followed by type
C (23.71%) and type E (11.91), while type I lip prints occurred with least frequency of occurrence at 0.43%. Whereas in the lower lip (LL), type C and type J pattern of lip-prints were almost equal in occurrence with 26.96% and 26.31% respectively, followed by E and G type at 22.93% and 11.83% respectively. While type B lip prints showed the least frequency of occurrence in LL, type F and I pattern of lip-print were completely absent.

Both male and female study subjects showed a predominance of type J pattern of lip-prints at 34.48% and 33.83% respectively followed by type C (21.19%), E (19.91%) and type G (15.40%) in males. The female study subjects showed almost similar pattern of distribution as male study subjects (i.e. type C followed by type E and G) with a difference in the frequency of their occurrence (type C=29.48%, type E=15.21% and type G=11.48%).

The distribution of patterns in both males and females is shown in table 4 chi-square test did not show significant difference between the lip print patterns of males and females in different lip-print areas examined.

Discussion

Lip-prints reportedly appear as early as 16th week of intrauterine life [9]. The concomitant rhythmic peri-oral muscular activity (lingual and mandibular movement) pre-disposes the formation of permanent lip-prints [31]. The lip-prints are grooves and furrows on the lip that provide salivary channels to hydrate the lip. Lip-prints are present on upper and lower lip as well, the variations in the lip-pattern between the upper and lower lip is attributed to the
functional significance [17]. The uniqueness of lip-prints depends upon the way the lips relax to produce a particular pattern, is a widely accepted fact [14]. Studies suggest, though the DNA sourced from lip-prints and subsequent typing of these Low Copy Number (LCN) of the DNA may produce only partial DNA profiles (due to technical artifacts resulting from LCN), yet the uniqueness and usefulness of human labial lines may extend beyond lip-print analysis to being a potential source of DNA and an adjunct to personal identification [22], [23]. Hence, the lip-prints can genetically profile the person who made them (Castell et al.) [24]. Studies exploring the role of heredity in lip-prints have reported positively significant resemblance with the parents but not with the siblings [32].

Personal identification of the deceased in a mass disaster or criminal proceedings has been vital since time immortal [33]. Among many methods of human identification, lip-prints have gained popularity lately due to the ease of recording it and its potential to accurately identify the person.

We used Reunad’s classification in our study for easy and direct comparison with prior study conducted in Saudi Arabia [2]. Reunad’s classification constitutes nine types of lip-print pattern: among them eight lip-prints were the same as described by Renaud, while the last (ninth) one (type J) was the newly described by El Domiaty et al, which is characterized by the presence of the horizontal grooves with other type of the grooves [2].

The purpose of our study was to determine the pattern of lip prints of Saudi Arabian individuals and correlate the lip print pattern and gender. Comparing our study observations with other studies reported in the literature have revealed a mix of both similar as well as contradictory results.

Lip-print type
Although, some areas of lip-prints examined showed similar lip-print pattern or no lip-prints at all, however, other areas examined showed two or more types of grooves, these findings are consistent with other various prior population based studies dating back from the earliest to the most recent ones. Suzuki in 1967 and later Tsuchihashi 1974 were the earliest investigators who reported the uniqueness of lip-prints based on their pioneering work on the Japanese population [34], [35].

In our study, type J (horizontal with other forms) followed by type C (complete bifurcate) were the most prevalent type of lip-prints observed in both male and female study subjects. This finding is neither in full agreement nor disagreement with other prior studies conducted in the Kingdom of Saudi Arabia [2]. Type J lip-prints were found in the same area (i.e. UM area) in both male and female study subjects, and the type C lip-prints in UR and LR in male and female study subjects respectively. An earlier study by Domiaty et al (based on population of Madinah AlMunnawara, Saudi Arabia) had reported a total absence of type D lip-print, but we observed the type D lip-prints in both male and female study subjects in LL area with a frequency of 8.30 % and 4.30% respectively. This finding is agreement with earlier work of N.A. Sharma et al, who reported the occurrence of type D lip-prints with frequency ranging from 1.3 to 5.1%. Other population based studies centered on different ethnicities have also reported the uniqueness of lip-print patterns viz, the studies based on Egyptian population have reported that reticular pattern of lip-prints were the most prevalent types in Lower Egypt, while complete vertical type were prevalent in Upper Egypt [36], Spanish population based studies have reported; while lips-prints of type A were predominant in Nigerian population, the type C lip-prints were noted with significantly increased frequencies amongst the Spanish population [27]. Likewise Iranian studies have reported type V (irregular) to be the most common type of lip-prints in the Iranian population [25]. Whereas, numerous studies based on Indian population have reported almost equal frequency of type B and C lip-prints [27], [37], [38], the different
racial groups within the Indian population have also demonstrated the uniqueness of lip-print patterns within them [26]. Lastly, Costa and Caldas in 2012 reported type C to be the predominant type of lip-print patterns in the Portuguese population, which is closely related to the Spanish population in ethnicity [39].

Gender differentiation and type of lip-prints

A number of investigators have reported a very high success rate in accurately identifying the gender of the study subjects based on the lip-print types. However, we were unable to establish any significant gender identification ability of the lip prints in our study subjects. Our findings are consistent with other earlier studies that were conducted under similar study settings as ours; sample size, the lip print (Renaud’s) classification used which examined six different areas of the lips. 1) N. A. Sharma et al. who could not establish the gender differentiation based on lip prints of not one but four geographically varied population such as Indian, Spanish, Nigerians and also the Saudi Arabian study subjects [27]. 2) Ragab et al. could not significantly differentiate the gender of the study subject based on the lip print pattern of a very large population based (sample n=955) study [28]. The low reliability of lip prints in gender identification is also evidenced by the inconsistent findings reported by Vahanwala and Parekh and Sharma et al who initially demonstrated the uniqueness of lip prints in gender identification in 2000 and 2009 respectively [40], [41]. However, a later study conducted by Sharma N.A. et al. in 2014 that included data of aforementioned studies could not establish the gender identification ability of lip prints [27]. Inconsistent and contrasting outcomes reported by authors on the study subjects/population on two different occasion offers lip prints low credibility as a gender identification toll and on the other hand supports our study findings. Additional support to our study findings is that of Patel et al. who were unsuccessful in establishing any positive correlation between the lip prints and either the gender or the blood group of their study sample [42].
Conclusions

Though application of lip prints as a forensic identification tool can meet some technical limitations (such as partial and or incomplete lip prints recovered) in the real world that can pose difficulty in matching them with the existing databases. The following are our conclusions based on the findings of our study; 1) the lip-print of Saudi Arabian subjects is unique to every individual, 2) no statistically significant difference between the gender and the type lip-prints of study subjects.

Based on our study findings we can suggest that, classification of lip-print patterns in the population and investigation into the heredity of the lip print of individuals can add to useful data that makes cheiloscopy a comparable person identification tool to other means such as dactyloscopy. However, based on our study results we abstain from suggesting cheiloscopy for person’s gender identification.

Limitations

This study results should be interpreted with due cognizance owing to the fact that, we Based our study on convenient sample. However, we recruited only Saudi Arabian nationals as per the absolute inclusion criteria of our study.

The study subjects representing the Saudi Arabian population were recruited from the screening clinic of private dental school not from the general population. This shortcoming was overcome by ensuring all the study participants were Saudi Arabian national from Makkah region. Therefore, the study took longer than anticipated time to recruit the calculated sample size into the study.
Further studies can be conducted

This study should be considered a pilot study, future larger population based studies can create valuable forensic data asset that can provide an insight to the ethnicity of the offender. This could prove helpful in a country like the Kingdom of Saudi Arabian that hosts a medley of different Ethnicities. We also believe there is a great deal of potential to be explored in terms of the reliability of rating lip-print patterns consistently. The inter-rater reliability in identifying lip print patterns will also play a critical role, if lip-prints are to become an adjunct to other personal identification methods in criminal convictions. Also studies comparing the traditional method of lip print recoding with other methods such as lip photographs can yield easy and less laborious method of creating population based lip print records.

Ethical consideration

The study was conducted as per the Declaration of Helsinki and its amendments. All the study participants gave a voluntary informed consent to be recruited into the study and the study participant’s data was maintained confidentially. The reported study design was approved by the Institutional Ethics Review Committee of Ibn Sina National College for Medical Studies (Approval No. H-05-01092016).

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Conflict of interest

The authors declare no conflict of interest with regards to the conduct and publication of this study.

Author’s contributions

All authors equally contributed to the design, research data collection and analysis, and writing of the manuscript.

Acknowledgement

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9. Soliman EM. Medicolegal study of dermatoglyphics and lip prints, Egypt [PhD Thesis]. [Egypt]: College of Medicine, Tanta University; 1996.


Table 1: Renaud’s classification of Lip-prints

<table>
<thead>
<tr>
<th>Type</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>Complete Vertical</td>
</tr>
<tr>
<td>Type B</td>
<td>Incomplete Vertical</td>
</tr>
<tr>
<td>Type C</td>
<td>Complete Bifurcated</td>
</tr>
<tr>
<td>Type D</td>
<td>Incomplete Bifurcated</td>
</tr>
<tr>
<td>Type E</td>
<td>Complete Branched</td>
</tr>
<tr>
<td>Type F</td>
<td>Incomplete Branched</td>
</tr>
<tr>
<td>Type G</td>
<td>Reticular Pattern</td>
</tr>
<tr>
<td>Type H</td>
<td>x or Comma Form</td>
</tr>
<tr>
<td>Type I</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Type J</td>
<td>Horizontal with others forms (vertical, bifurcate or branching)</td>
</tr>
</tbody>
</table>

Table 2: Demographic features of study subjects

<table>
<thead>
<tr>
<th>Demographic features</th>
<th>n=435</th>
<th>Age (Mean ± SD*)</th>
<th>20-30 years</th>
<th>31-40 years</th>
<th>41-50 years</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age and gender distribution</td>
<td></td>
<td>33.50 ± 12.50</td>
<td>15</td>
<td>20</td>
<td>9</td>
<td>44</td>
</tr>
<tr>
<td>Male %</td>
<td></td>
<td>18</td>
<td>26</td>
<td>12</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Female %</td>
<td></td>
<td>33</td>
<td>46</td>
<td>21</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Total %</td>
<td></td>
<td>33</td>
<td>46</td>
<td>21</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Frequency of Lip Print Type in %

<table>
<thead>
<tr>
<th>Lip Area</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Upper Lip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UL</td>
<td>2.8</td>
<td>1.5</td>
<td>25.3</td>
<td>2.9</td>
<td>17.8</td>
<td>0</td>
<td>20.3</td>
<td>3</td>
<td>0</td>
<td>26.4</td>
</tr>
<tr>
<td>UM</td>
<td>12.4</td>
<td>1.4</td>
<td>22.4</td>
<td>2.5</td>
<td>4.5</td>
<td>2.1</td>
<td>0</td>
<td>1.4</td>
<td>1.1</td>
<td>52.2</td>
</tr>
<tr>
<td>UR</td>
<td>0</td>
<td>0</td>
<td>37.6</td>
<td>1.7</td>
<td>18.1</td>
<td>0</td>
<td>17.3</td>
<td>2.1</td>
<td>0</td>
<td>23.2</td>
</tr>
<tr>
<td>Average Upper Lip</td>
<td>5.06</td>
<td>0.96</td>
<td>28.43</td>
<td>2.36</td>
<td>13.46</td>
<td>0.7</td>
<td>18.8</td>
<td>2.16</td>
<td>0.36</td>
<td>33.93</td>
</tr>
<tr>
<td>Male Lower Lip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LR</td>
<td>3.3</td>
<td>0</td>
<td>9.1</td>
<td>4.5</td>
<td>28.7</td>
<td>0</td>
<td>16.7</td>
<td>1.6</td>
<td>0</td>
<td>36.1</td>
</tr>
<tr>
<td>LM</td>
<td>8.4</td>
<td>1.4</td>
<td>22.5</td>
<td>6.4</td>
<td>18.5</td>
<td>0</td>
<td>4.0</td>
<td>1.6</td>
<td>0</td>
<td>37.2</td>
</tr>
<tr>
<td>LL</td>
<td>1.7</td>
<td>0</td>
<td>10.3</td>
<td>8.3</td>
<td>31.9</td>
<td>0</td>
<td>15.3</td>
<td>0.7</td>
<td>0</td>
<td>31.8</td>
</tr>
<tr>
<td>Average Lower Lip</td>
<td>4.46</td>
<td>0.46</td>
<td>13.96</td>
<td>6.4</td>
<td>26.36</td>
<td>0</td>
<td>12</td>
<td>1.3</td>
<td>0</td>
<td>35.03</td>
</tr>
<tr>
<td>Average Male (Upper + Lower Lip)</td>
<td>4.76</td>
<td>0.71</td>
<td>21.19</td>
<td>4.38</td>
<td>19.91</td>
<td>0.35</td>
<td>15.4</td>
<td>1.73</td>
<td>0.18</td>
<td>34.48</td>
</tr>
</tbody>
</table>

| Female Upper Lip | | | | | | | | | | |
| UL | 1.4 | 0.9 | 22.8 | 2.1 | 14.2 | 0 | 15.8 | 1.5 | 0 | 41.3 |
| UM | 6.9 | 0.3 | 12.1 | 1.3 | 3.5 | 3.7 | 0 | 1.1 | 0 | 71.1 |
| UR | 3.1 | 1.2 | 22.1 | 1.3 | 15.1 | 0 | 18.1 | 1.1 | 0.2 | 37.8 |
| Average Upper Lip | 3.8 | 0.8 | 19 | 1.56 | 10.93 | 1.23 | 11.3 | 1.23 | 0.06 | 50.06 |
| Female Lower Lip | | | | | | | | | | |
| LR | 1.1 | 0.7 | 41.2 | 4.1 | 25.3 | 0 | 11.9 | 3.1 | 0 | 12.6 |
| LM | 10.2 | 1.9 | 40.1 | 2.8 | 7.2 | 0 | 6.6 | 1.9 | 0 | 29.3 |
| LL | 1.5 | 0.5 | 38.6 | 4.3 | 26 | 0 | 16.5 | 1.7 | 0 | 10.9 |
| Average Lower Lip | 4.26 | 0.6 | 39.96 | 3.73 | 19.5 | 0 | 11.66 | 2.23 | 0 | 17.6 |
| Average Female (Upper + Lower Lip) | 4.03 | 0.91 | 29.48 | 2.64 | 15.21 | 0.61 | 11.48 | 1.73 | 0.03 | 33.83 |
Table 3: Area and gender wise distribution of lip prints

![Average distribution of lip print types in upper and lower lip](image)

<table>
<thead>
<tr>
<th>Lip-print Type</th>
<th>Male</th>
<th>Area</th>
<th>Female</th>
<th>Area</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>52.20%</td>
<td>UM</td>
<td>71.10%</td>
<td>UM</td>
<td>0.177</td>
</tr>
<tr>
<td>C</td>
<td>37.60%</td>
<td>UR</td>
<td>41.20%</td>
<td>LR</td>
<td>0.903</td>
</tr>
<tr>
<td>E</td>
<td>31.90%</td>
<td>LL</td>
<td>25.30%</td>
<td>LR</td>
<td>0.264</td>
</tr>
<tr>
<td>G</td>
<td>18.80%</td>
<td>UR</td>
<td>18.10%</td>
<td>UR</td>
<td>0.756</td>
</tr>
<tr>
<td>A</td>
<td>12.40%</td>
<td>UM</td>
<td>10.20%</td>
<td>LM</td>
<td>0.538</td>
</tr>
<tr>
<td>D</td>
<td>8.30%</td>
<td>LL</td>
<td>4.30%</td>
<td>LL</td>
<td>0.214</td>
</tr>
<tr>
<td>H</td>
<td>2.10%</td>
<td>UR</td>
<td>3.10%</td>
<td>LR</td>
<td>0.714</td>
</tr>
<tr>
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<td>UM</td>
<td>3.70%</td>
<td>UM</td>
<td>0.556</td>
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<tr>
<td>B</td>
<td>1.50%</td>
<td>UL</td>
<td>1.90%</td>
<td>LM</td>
<td>0.874</td>
</tr>
<tr>
<td>I</td>
<td>1.10%</td>
<td>UM</td>
<td>0.20%</td>
<td>UR</td>
<td>0.408</td>
</tr>
</tbody>
</table>

Figure 1: Average distribution of lip print types in upper and lower lip

Table 4: Correlation of lip prints with the gender of study subjects