

# Correlation of lip patterns, gender, and blood group in North Kerala population: A study of over 800 individuals

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## Introduction

The word forensic is derived from the Latin word *forēnsis*, meaning “before the forum”.<sup>[1]</sup> Forensic science is vital in establishing the identity of living or dead individuals by either inclusion or exclusion of their unique traits and

## Abstract

**Context:** With the ever-changing field of criminal justice, the constant revision of criteria for acceptable evidence by the judiciary poses new challenges in forensic investigation. The applicability of cheiloscopy in individual identification is an area of extensive research in recent years. **Objectives:** The aim of the present study was to determine the distribution of different lip print patterns in North Kerala population, to assess any sexual dimorphism in lip patterns, and to correlate lip print patterns with ABO and Rh blood groups. **Materials and Methods:** A total of 858 students, 471 males and 387 females, from different colleges in the district of Kozhikode in North Kerala were included in the study. Lip prints were obtained using lipstick and cello tape and transferred onto white papers. Blood group of the participants was noted. **Results:** The most predominant pattern observed was Type I (48.3%), followed by Type II, Type III, Type IV, Type I', and Type V. We also observed that the lower lip exhibited an overwhelming predominance of Type I pattern in the North Kerala population while the upper lip showed a more even distribution. Gender-wise difference was observed with Type II being the most common in males and Type IV being the predominant pattern in females. No correlation was obtained between the blood groups and lip patterns. **Conclusion:** The potential usefulness of cheiloscopy in forensic medicine still remains largely untapped and under-recognized. Similar studies in different populations with large sample sizes will allow a more definite picture of lip print patterns to emerge.

**Key words:** Blood group, cheiloscopy, gender

features.<sup>[2]</sup> With the ever-changing field of criminal justice, the constant revision of criteria for acceptable evidence by the judiciary poses new challenges in forensic investigation. Advanced technology not only enables the investigator to narrow down an investigation but also aids the criminal to

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commit crimes using innovative methods to avoid detection. In such a scenario, forensic experts also need to rely on adjuvant techniques for proper identification.

The importance of lip prints lies in the fact that the pattern is unique to an individual and is thus analogous to fingerprints. Lip grooves are formed in the 6<sup>th</sup> week of intrauterine life and remain unchanged throughout one's life. It has the unique ability of reverting to its original pattern following minor trauma, inflammation, and infections such as herpes.<sup>[3]</sup> Cheiloscopy, the study of lip prints, can aid as an adjunct in personal identification; alone or in combination with other techniques such as fingerprint analysis and DNA analysis.

The applicability of cheiloscopy in individual identification has been an area of extensive research in recent years. However, cheiloscopy has not gained sufficient acceptance among forensic experts as a method of individual identification. Most studies in this area have a limited sample size. Studies with larger samples along with standardization of technique for collection of lip prints, its classification, and interpretation are crucial in establishing the efficacy and reliability of this technique. Different cheiloscopy studies have shown that lip print patterns exhibit a population-wise dominance in India.<sup>[4]</sup> Very few studies regarding lip print patterns on Kerala population have been documented. The present study was undertaken to evaluate the lip print patterns in relation to gender in a large sample of North Keralites and to investigate whether the lip prints are unique to any particular blood group in the population under investigation.<sup>[5]</sup>

### Aims and objectives

1. To determine the distribution of different lip print patterns in the North Kerala population
2. To determine any sexual dimorphism in lip print patterns
3. To determine the distribution of different lip print patterns among participants having different ABO and Rh blood groups and to determine the correlation between their characters and blood groups.

### Materials and Methods

A total of 858 students, 471 males and 387 females, from different colleges in the district of Kozhikode in North Kerala were included in the study. All individuals were aged between 18 and 30 years.

### Inclusion criteria for subjects

1. Participants volunteering to participate in the study with prior informed consent
2. Participants native to North Kerala, i.e., Kasargod, Kannur, Wayanad, Palakkad, and Malappuram.

### Exclusion criteria for subjects

1. Patients with any congenital lip deformity, acute infection, or any other disease of the lips
2. Patients with known hypersensitivity to lipstick.

### Materials used

- Dark shade lipstick
- Earbuds
- Cello tape
- White paper
- Scissors
- Magnifying lens
- Cotton and vaseline.

### Recording and analyzing the lip prints

The lips of the individuals were cleaned, and lipstick was applied using earbuds. The lip impressions were transferred to the sticky side of the cello tape applying uniform pressure, and the tape was removed in a single jerk motion. The cello tapes with the impressions were then taped onto a white paper which served as a permanent record. Magnifying glasses were used to study the recorded lip prints. Each impression was divided into four quadrants and was assigned the digits one to four in a clockwise sequence starting from the participant's upper right. To classify the lip prints, the classification proposed by Suzuki and Tsuchihashi was used Type I - Complete vertical, Type I' - Incomplete vertical pattern, Type II - Branching or "Y" pattern, Type III - Criss-cross pattern, Type IV - Reticular pattern, and Type V - All other patterns [Figures 1-6].

Blood groups were noted to know if there was any correlation between the lip prints and blood group of the participants.<sup>[6]</sup>

### Statistical analysis

All data were entered in Microsoft Excel and analyzed using SPSS package (version 14, Chicago, USA). The predominant lip patterns for the different groups were calculated using percentage method. Chi-square test was used to analyze and compare the lip print patterns. The level of significance was set at  $P < 0.05$ .



**Figure 1:** Type I - Complete vertical pattern



Figure 2: Type I' - Incomplete vertical pattern

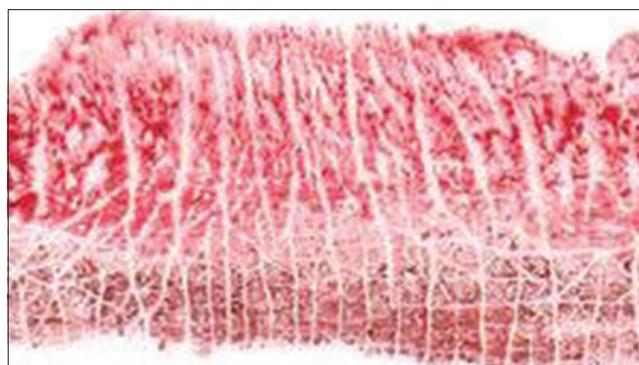


Figure 3: Type II - Branching or 'Y' pattern



Figure 4: Type III - Criss-cross pattern

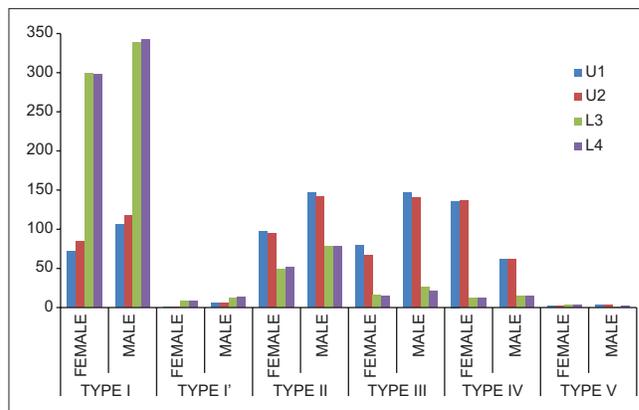


Figure 5: Type IV - Reticular pattern

## Results and Discussion

In the present study, Tsuchihashi classification of lip pattern was used as it is the most widely followed and encompasses all types of lip patterns. The most predominant pattern observed was Type I (48.3%) when all the four quadrants in both the upper and lower lips of the entire study population were considered. This was followed by Type II (21.5%), Type III (14.8%), Type IV (13.1%), Type I' (1.6%), and Type V (0.6%) [Graph 1]. Various studies suggest that there exists a population-wise difference in lip pattern distribution in India. In a study comparing lip prints in Kerala population with Manipuri population by Koneru *et al.*, the vertical pattern was found to be more common in the Kerala population.<sup>[7]</sup> This is in consensus with our study of the North Kerala population. On the other hand, Verghese *et al.* in their study on the Kerala population found Type IV to be the most common pattern.<sup>[4]</sup> Augustine *et al.* and Saraswathi *et al.* noted the predominance of intersected pattern.<sup>[8,9]</sup> Similarly, Sivapathasundharam *et al.* in his study on Indo-Dravidian population noted that Type III pattern was predominant.<sup>[10]</sup>

Hirth *et al.* (1975) and later Augustine *et al.* (2008) in their respective studies had observed that branched pattern was more common in the upper lip while the lower lip predominantly had a simple pattern.<sup>[8,11]</sup> This finding is in agreement with our study wherein we noted that the lower lip showed an overwhelming predominance of



Graph 1: Distribution of lip print patterns in males and females

vertical pattern with 74.4% and 74.6% in the two lower lip quadrants. This was followed by Type II, III, IV, I', and V (14.8/15.0, 4.9/4.2, 3.1/3.1, 2.3/2.4, and 0.5/.6%, respectively in the left/right lower quadrants). The upper lip quadrants showed a more even distribution of the various lip print configurations, with the percentages of Types I, II, III, and IV falling between 20 and 28%. However, the percentages of Types I' and V were <1%.

### Gender-wise distribution of lip prints

When gender-wise distribution of lip prints was analyzed, the distribution of patterns differed between males and females. In the upper lips, the most frequently observed lip print pattern in females was Type IV followed by



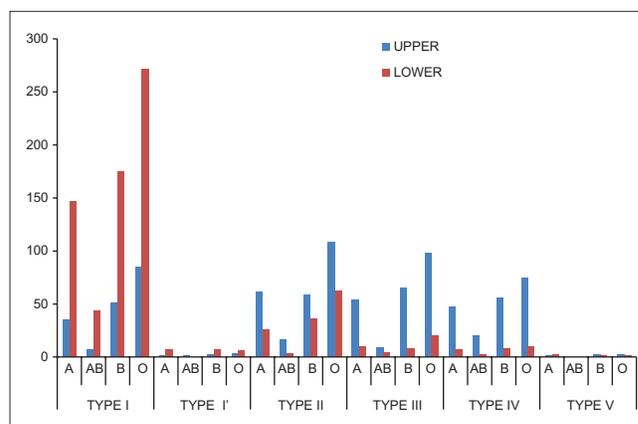
**Figure 6:** Type V - All other patterns

Type II, I, III, V, and I'. In males, the order was Type II, III, I, IV, I', and finally Type V. However, in the lower lip, males and females had a similar distribution of lip print patterns – Type I followed by Type II, III, IV, I', and V [Graph 1].

Therefore, in our study, we found that the upper lip can help in gender determination while the lower lip showed a more or less similar pattern distribution among males and females. A similar observation was also made by Padmavathi *et al.* in their study.<sup>[12]</sup> They observed that reticular and dotted patterns were commonly found in the upper lip of males and complex pattern in the upper lip of females. Gondivkar SM *et al.* in their study in seventy males and females were also able to predict the sex of the individual from lip prints with a high degree of accuracy.<sup>[13]</sup> Kumar *et al.* in their study on Pondicherry population found Type III to be the most predominant pattern in males. In females, they observed Type II to be the most predominant, and they found this difference to be statistically significant.<sup>[14]</sup>

### ABO

Of the 858 participants, 371 (43.2%) belonged to blood Group O, followed by 27% of B, 23.2% of A, and 6.2% of AB. It was observed that in the blood Group A patients, the upper lip showed a predominance of Type II, followed by Type III, IV, I, and finally Type V and I'. In the same group, the lower lip showed a predominance of Type I, followed by Type II, and all the remaining types constituting < 5% of the group [Graph 2]. Blood groups AB, B, and O also showed more or less the same order of lip print pattern distribution. In all these groups, the upper lip patterns comprised Types I, II, III, and IV showing negligible differences while Types I' and Type V were very rare (constituting <2%). The lower lips in these remaining groups were again found to be dominated by Type I pattern. In blood Groups A, B, and O, Type I was followed by Type II and then Types III/IV/I' and then Type V. This differed from the sequence observed in blood Group AB, where Type I pattern was followed by Types II/III, then Type IV, and no Type I'/V.



**Graph 2:** Distribution of lip print patterns in different blood group types

### Rh

Of the 858 participants, 800 (93.2%) were found to be Rh positive and the remaining 58 (6.8%) were Rh negative. No correlation was observed in terms of Rh positivity or negativity and lip print pattern distribution.

### Uniqueness of lip prints

In the present study, no two lip prints were identical. The lip being a muscular organ can undergo considerable variation in shape and size during different expressions. However, the basic patterns of the lip prints remain constant and individuals with a particular type of lip pattern will always exhibit the same pattern. However, due to the same reason, classification of lip prints based on size or shape of the entire lip becomes unreliable.

### Conclusion

The potential usefulness of cheiloscopy in forensic medicine still remains largely untapped and under-recognized. Similar studies in different populations with large sample sizes will allow a more definite picture of lip print patterns to emerge. To conclude, in the recent study, we observed a difference in lip print pattern types between males and females in the upper lip. In the lower lip, it appears that the North Kerala population has an overwhelming predominance of Type I pattern. No significant correlation was found between blood group type and cheiloscopic patterns.

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### Conflicts of interest

Nil.

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