

Original Research

Anthropometric analysis of Lips and Philtrum: A Cross-sectional study

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ABSTRACT:

Background and Objectives: Among the various facial landmarks, the lips and philtrum play an important role in evaluating sexual dimorphism and optimal esthetic and facial reconstruction. The shape of the lips is affected by various factors like race, gender and ethnicity. The aim of the present study was to measure the various parameters of lips and philtrum which may serve as guideline for sexual dimorphism as well as esthetic facial reconstruction among the youth.

Materials and Methods: This study was a cross-sectional study conducted from March 2025 to August 2025 with a sample size of 300 medical students of age group 19-24 years from Nobel Medical College Teaching Hospital, Biratnagar, Nepal. For this study, direct lips measurement was performed with a closed lips position by the help of digital vernier caliper. The data were analyzed by applying t-test using SPSS version 19 and calculated as mean±standard deviation. The $p \leq 0.05$ were considered as the level of significance.

Results: The study showed that the sexual dimorphism exist in most of the lips and philtrum

parameters among the young male and female, the various parameters of lips and philtrum were statistically ($p < 0.05$) higher in male compared to the female. Height of philtrum and total surface area of the lips were not significant ($p > 0.05$). Triangular type of philtrum was more common in male and parallel type in female.

Conclusion: The study highlighted that the variations in the lips and philtrum parameters can be because of the geographical, racial, gender and nutritional aspect of the individual and applies significance to the forensic investigation, esthetic surgery and sexual dimorphism.

Keywords: Anthropometry, Lips, Philtrum, Sexual dimorphism

INTRODUCTION

The lips are the soft and mobile folds of muscle that surround the opening of the oral cavity. They contain the orbicularis oris muscle, the vessels and nerves of the upper and lower lips. Lips are covered outside by skin and inside by a mucous membrane [1]. The appearance of the lip is considered as one of the important landmarks in the facial aesthetic. The shape of the lip is affected by various factors like race, gender and ethnicity [2]. Anthropometry is measurement of linear and angular dimensions of the human body. Lips anthropometry enables to know the dimensions of lips and philtrum of a certain race and ethnicity. However, this percentage can vary widely by ethnicity and even among individuals within the same ethnic group [3]. The edges of the lips are covered with a red layer of skin, called vermilion, and are richly supplied with sensitive nerve endings. The vermilion color is the transition layer between the outer hair tissue and the inner mucous membrane. The vermilion skin is made up of three to five layers of cells and is very thin compared to the skin on the rest of the face, usually arranged in 16 layers of cells.

The mucous membrane of the lips is filled with capillaries that approach the translucent surface of vermilion, giving it its characteristic red color. In infants, the inner surface is much thicker, with sebaceous glands and small nodules called papillae. These structural adaptations appear to facilitate the suckling process in the baby [4]. A woman's lips are therefore sexually attractive for men as they are considered bio-indicators of women's health and fertility. Women's lipsticks (or collagen boosters) try to take advantage of this fact by creating the illusion that a woman has more estrogen than she actually has, and therefore she is prone to fat and attractiveness more than men [5].

As the lips are the dynamic focal point of the lower third of the face, lip reconstruction presents a unique challenge for plastic surgeons. No other tissue substitute can match their function in speech, deglutination, facial expression, and aesthetic balance. Lip reconstruction aims to achieve both functional and cosmetic goals, and the surgical methods used frequently overlap. The aesthetic objectives of lip restoration are to preserve the aesthetic balance of the vermiliocutaneous junction and lip aesthetic units while providing sufficient external skin replacement. Maintaining the intraoral mucosal lining and preserving the oral aperture's surface area are the functional objectives of lip repair [6].

The facial modiolus is a fibromuscular structure that is located 10 to 12 mm above the angle of the mouth, which is formed by the crossings of several facial muscle fibers, including orbicularis oris, levator and depressor anguli oris, risorius, platysma, buccinator, and zygomaticus major. Modiolus plays an essential role in anchoring these

muscles and thus facilitating the process of chewing, pronunciation and other facial expressions. In addition, modiolus is responsible for the production of facial dimples in a small number of subjects [7]. Lips thin out as people age and the wet line moves caudally; in addition, oral commissure begins to follow the downturn pattern as the age advances [8]. Apart from serving a baseline data for sexual dimorphism for forensic significance, it may also become a guideline for restoration or enhancement of esthetics using plastic surgery. There are currently no published data on lips anthropometric investigations among the Nepalese population. Thus, the aim of the present study was to assess the possibility of determining gender by lips and philtrum anthropology and to compare the observations with the previous published data.

MATERIALS AND METHODS

This was a cross-sectional, descriptive study conducted from March 2025 to August 2025 in the department of Anatomy of Nobel Medical College Teaching Hospital, Biratnagar, Nepal. A total of 300 medical students with equal male and female of age groups 19-24 years were randomly selected for the study.

Sample Size was calculated by using Cochran's formula [9];

$$X = \frac{Z^2 \times p(1-p)}{d^2}$$

Where, Z= 1.96 at 95% CI

P= expected baseline prevalence

q= 1-p

d= margin of error, 6%

Total sample size was calculated to be 267.

Apparently healthy medical students having full dentition without any gross damage to their lips and any developmental anomalies of the lips and palate were included and those with anomalies, malformation, deformities, inflammation, trauma and surgical scars (operations for cleft lip) of or around the lips were excluded from the study. Ethical approval was obtained from the Institutional Review Committee of Nobel Medical College Teaching Hospital, Biratnagar, Nepal (IRC No. 629/2022).

All the parameters of the lips and philtrum were measured in millimeters by the help of a digital vernier caliper. A questionnaire was handed to all the participants regarding the benefits of the study and informed consent was obtained. The participants were asked to sit down in the anatomical position and look to distant with no gesture (smile or scowl). It is the standard position of the normal state of head that has high repeatability. Anthropometric landmarks on the lips and philtrum were punctuated and measurements were obtained. After the completion of this phase, the obtained data were kept in SPSS software and Excel for statistical analysis. The data were analyzed by applying t-test using SPSS version 19 and calculated as mean±standard deviation. The $p \leq 0.05$ were considered as the level of significance.

Landmarks of the lips and philtrum (Fig.1):

In anthropometrics it is essential to determine the anatomically precise location on the head and face surfaces. Landmarks act as determiner of the linear distances and angles.

1. **Cheilion (ch):** The point at the corner of lips.

2. **Crista philtri (Cph):** is a point on a prominent spot of the philtrum located on the top line margin vermillion of the upper lip (the border between the lips and skin mucus which extends from one corner to the other corner of the lip).
3. **Stomion (sto):** is a point which is located at the intersection of the vertical and horizontal fissure and midline of the labial lips, while the teeth are normally on each other.
4. **Labial superius (Ls):** is a point on the upper vermillion line.
5. **Labial inferius (Li):** is a point on the lower vermillion line.
6. **Sub nasale (sb):** the point where they intersect the border of the upper lip and nasal septum [10].

Following parameters of lips and philtrum were evaluated:

- i. Width of mouth (ch-ch)
- ii. Height of mouth (ls-li)
- iii. Height of philtron (sn-ls)
- iv. Width of philtrum (cph-cph)
- v. Entire lips area (total area)
- vi. Types of philtrum

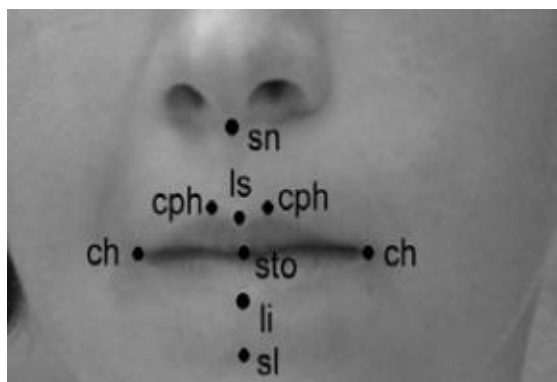


Fig. 1

RESULTS

The current study determined the baseline anthropometric values for a number of lip and philtrum parameters among the students of medical college. Table 1 presents the findings from the current investigation. It shows the different measurements of the lips and philtrum in both sexes. In the study, it is evident that all the metrics are considerably higher in males than in females ($p < 0.05$), except for the two parameters, which are not significant.

Table 2 presents the paired sample correlations between male and female lip parameters. A significant positive correlation was observed for mouth width ($r = 0.198$, $p = 0.015$) and philtrum width ($r = 0.321$, $p = 0.003$). A weak but significant negative correlation was found for lip height ($r = -0.163$, $p = 0.046$). In contrast, philtrum height ($r = 0.093$, $p = 0.256$) and lip area ($r = 0.149$, $p = 0.068$) did not show statistically significant correlations.

Table 3 shows the paired sample test comparing lip measurements between males and females. Statistically significant mean differences were observed for mouth width (mean difference = 8.466, $t = 20.265$, $p < 0.001$), lip height (mean difference = 3.420, $t = 12.227$, $p < 0.001$), philtrum height (mean difference = 1.633, $t = 2.474$, $p = 0.014$), philtrum width (mean difference = 3.013, $t = 20.352$, $p = 0.003$), and lip area (mean difference = 276.799, $t = 22.120$, $p < 0.001$), indicating significant differences between male and female measurements for all parameters.

Table 1: Descriptive statistics of variables by gender:

Parameters of Lips (in mm)	Male (Mean $\pm$ SD) (N=150)	Female (Mean $\pm$ SD) (N=150)	P value
Width of mouth (mm)	50.30 $\pm$ 3.77	41.83 $\pm$ 4.28	0.015 (<0.05)
Height of lip(mm)	24.88 $\pm$ 1.72	21.46 $\pm$ 2.68	0.046 (<0.05)
Height of philtrum (mm)	15.90 $\pm$ 8.09	13.26 $\pm$ 1.40	0.256 (>0.05)
Width of philtrum (mm)	12.94 $\pm$ 1.25	11.93 $\pm$ 1.77	0.003 (<0.05)
Total area of the lip (mm ²)	58.29 $\pm$ 1.06	43.61 $\pm$ 1.27	0.068 (>0.05)

Table 2: Paired Samples Correlations

Pair	Parameters	N	Correlation (r)	P Value
	Width of mouth Male & Female	150	0.198	0.015
	Height of lips in male & female	150	-0.163	0.046
	Height of philtrum in male & female	150	0.093	0.256
	Width of philtrum in male & female	150	0.321	0.003
	Area of lips in male & female	150	0.149	0.068

Table 3: Paired Sample Test

Pair	Paired Differences					T	Df	Sig. (2-tailed)
	Mean	SD	Std. Error Mean	95% confidence interval of the Difference				
				Lower	Upper			
Width of mouth in male & female	8.466	5.11	0.417	7.641	9.292	20.265	149	0.000
Height of lips in male & female	3.420	3.42	0.279	2.867	3.972	12.227	149	0.000
Height of philtrum in male & female	1.633	8.08	0.660	0.328	2.937	2.474	149	0.014
Width of philtrum in male & female	3.013	1.81	0.148	2.720	3.305	20.352	149	0.003
Area of lips in male & female	276.799	153.255	12.513	252.072	301.525	22.120	149	0.000

Table 4: Prevalence of types of Philtrum in Male and Female

Gender	Triangular	Parallel	Concave	Flat	Number (N)
Male	65 (43.33%)	45 (30%)	40 (26.66%)	05 (3.33%)	150
Female	50 (33.33%)	70 (46.66%)	24 (16.00%)	06 (4.00%)	150
Total	115 (38.33%)	115 (38.33%)	64 (21.33%)	11 (3.66%)	300

In table 4, the prevalence of types of philtrum is tabulated, where we can observe triangular type of philtrum most common in male followed by parallel and concave type, least common is the flat type of philtrum and in JMCJMS | May-August | 2026

case of female, the parallel type of philtrum more common followed by the other types. Similarly, table 5 shows the comparison of anthropometric values of different

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Table 5: Comparison of lips parameters with the studies done in North Indians, White Americans, Malaysian Indian, Malays, Italians, Western Indians and Caucasians

Name of Authors	Regions of study, no. of subjects	Width of mouth	Height of lips	Width of Philtrum	Height of Philtrum	Surface area of lips
Present study	Eastern Nepal (n=300)	50.30±3.77(M) 41.83±4.28 (F)	24.88±1.72(M) 21.46±2.68 (F)	12.94±1.25(M) 11.93±1.77 (F)	15.90±8.09(M) 13.26±1.40 (F)	58.29±1.06(M) 43.61±1.27 (F)
Archana Goel et al.	North Indian (n=300)	47.17±3.4	-	-	-	-
Farkas et al.	White Americans (n=50)	54.1±3.8	-	-	-	-
Ngeow & Aljunid	Malay (n=50)	48.8±3.5	-	-	-	-
Ngeow & Aljunid	Malaysian Indian (n=50)	47.3±3.3	-	-	-	-
Khandekar	Western Indian	53.5±1.0	-	-	-	-
Hasibuwan Y. Lisa et al. (2023)	Indonesian adults	-	-	13.86 ± 2.23	14.19 ± 2.23	-
Othman et al. 2016	Malays	-	-	12.71 ± 1.95	10.40 ± 1.14	-
Yadav SK et al.	Central Nepal(n=400)	-	-	11.85±1.03(M) 10.95±1.44 (F)	14.30±2.15(M) 12.45±2.23 (F)	-

parameters of lips and philtrum with other studies done in different parts of the world.

DISCUSSION

Many plastic surgeons continue to hold differing views regarding the ideal technique or design for cleft lip repair, as well as the age at which the procedure should be performed. To cure a cleft lip, information regarding the growth rate of the craniofacial soft tissues, especially the upper lip, is crucial. In addition to serving as a benchmark for comparing postoperative outcomes, the regularity of morphological change in the normal upper lip could help the surgeon determine the precise time, design, and principle of cleft lip repair.

As a craniofacial landmark, lips are widely recognised as a crucial factor in forensic criminal investigations to identify a missing individual. Furthermore, a person's lips and

teeth have a significant impact on how others see them, and their harmony has social and psychological ramifications for all people [11].

The results showed that the average width of the mouth in the subjects considered for the study is 50.30±3.77 mm in males and 41.83±4.28 mm in females. Khandekar and colleagues reported the average mouth width of adult men in China (6.5 cm), Caucasian (3.6 cm) and Black (2.7 cm) [12]. A similar study conducted in India by Archana Goel et al showed the value of 47.31±3.40mm in males. A study done by Farkas et al. [10] in White Americans revealed the value of 54.1±3.80 mm, which is higher than the present value conducted in Nepal. The average height of lips is calculated to be 24.88±1.72 mm in males and 21.46±2.68 mm in females, which coincides with the study done by Meharnaz. The average height of philtrum in male and

female is respectively 15.90 ± 8.09 mm and 13.26 ± 1.40 mm which is similar to study done by Abrishami [13] et al in Mashad whose value was 17.93 mm in male and width was 14.98 mm. in the present study the width of philtrum is 12.94 ± 1.25 mm in male and 11.93 ± 1.77 mm in female. In a similar study conducted in central Nepal by Yadav SK et al [14], in 2018 showed that the length was 14.19 mm in males and 12.71 mm in females, and the width was 11.84 mm in males and 10.40 mm in females, which is slightly lower than the present study. The total surface area of the lip in males and females is scored as 58.29 ± 1.06 mm² and 40.6 ± 1.27 mm². According to Abrishami, it is 59.526 mm² [13].

The varying populations have varying mean values for all lip morphometry parameters reported by various scientists in the literature. This may be caused by several variables, including variations in the respondents' ages, numbers, genders, and geographic locations, in addition to the technique used. A woman's lips are also a visible expression of her fertility. In a study conducted on the science of human attractiveness, Psychologists have concluded that a woman's facial and sexual attractiveness is closely related to hormone composition during puberty and development. Unlike testosterone's effect on men's facial structure, the effect of women's estrogen levels helps maintain a relatively "baby" and youthful facial structure during puberty and during adulthood. It has been shown that the more estrogen a woman has, the larger her eyes and fuller her lips are, features considered more feminine [15]. The shape and size of the lip is associated with sexual attraction in both men and women. Women are attracted to men with masculine lips that are medium in size and are neither

too big nor too small; they have to be strong and sexy. Overall, researchers have found that a small nose, large eyes, and full lips are sexual attractions for both men and women [16]. In the present study, the subjects included in the study had small eyes in the majority of females and larger eyes and lips in the male subjects, which made the subjects more attractive regarding the lip's parameters. The philtrum of the subjects included in the study shows different types according to the shapes: a parallel type of philtrum common in females (46%) and a triangular type common in males (43%), which is similar to the study done by Ibrahim Abdulrasheed et al. [17] in Nigerian populations. In a study conducted by Wong et al. [18]. Caucasian men and women were thought to have the most attractive faces but the least attractive lips, whereas Korean men and women were thought to have the most attractive lips but the least attractive looks. It's interesting to note that total facial beauty did not appear to be significantly influenced by the lips. An attempt has been made to compare the data only with those populations on whom the relevant data were available. A study conducted by Lisa et al. [19] showed that the average length and breadth of the philtrum in the Indonesian population were 13.86 ± 2.23 mm and 14.19 ± 2.23 mm, respectively, which is slightly lower than the values calculated among the Nepalese adults. The reason behind it may be the racial and geographical distribution of the above-mentioned populations.

CONCLUSIONS

The anthropometric parameters of the lips and philtrum were greater in males than in females, demonstrating significant sexual dimorphism and potential forensic utility.

These findings provide reference values for the Nepalese population aged 19–24 years and highlight the need for population-specific standards in cosmetic and reconstructive surgery.

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Author's Contribution: Conceptualisation, study design, data collection, data analysis and interpretation, manuscript drafting, critical revision of the manuscript for important intellectual content, and approval of the final version for publication- **SKS**

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REFERENCES

1. Standring S. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 41st Edition. Elsevier; 2016.
2. Fernández-Riveiro P, Smyth-Chamosa E, Suárez-Quintanilla D, Suárez-Cunqueiro M. Angular photogrammetric analysis of the soft tissue facial profile. *Eur J Orthod.* 2003; 25:393-99. DOI: 10.1093/ejo/25.4.393.
3. Trevidic P, Sykes J, Criollo-Lamilla G. Anatomy of the lower face and botulinum toxin injections. *Plastic Reconstruct Surg.* 2015; 136:55. DOI: 10.1097/PRS.0000000000001787.
4. Carey JC, Cohen MM Jr, Curry C, et al. Elements of morphology: standard terminology for the lips, mouth, and oral region. *Am J Med Genet A.* 2009; 149A:77-92. DOI: 10.1002/ajmg.a.32612.
5. Note, Science (2005-11-28). "Why do men find big lips and little noses so sexy? I'll paint you a picture – Comment – Times Online". The Times. London. Archived from the original on February 22, 2007. Retrieved 2007-12-12.
6. Adams W, Beran S. Lip, cheek, and scalp reconstruction; hair replacement. *Selected Readings in Plastic Surgery.* 2001; 15:2–16. [Google Scholar].
7. Samizadeh S, Pirayesh A, Bertossi D. Anatomical Variations in the Course of Labial Arteries: A Literature Review. *Aesthet Surg J.* 2019 Oct 15; 39(11):1225-1235. DOI: [10.1093/asi/sjy235](https://doi.org/10.1093/asi/sjy235)
8. Daniel CD. Lip implants, lip augmentation techniques emedicine WebMD 2008 Jan 25, URL: <http://emedicine.medscape.com/article/838222-overview> (accessed 10 Jun 2009).
9. Cochran, W.G. (1977) Sampling Techniques. 3rd Edition, John Wiley & Sons, New York.
10. Farkas LG, Katic MJ and Forrest CR. International anthropometric study of facial morphology in various ethnic groups/races. *J Craniofac Surg* 2005; 16: 615–646. DOI:10.1097/01.scs.0000171847.58031.9e.
11. Anamario-Violeta Tutuina, Simona Chiregi, Ligia Luminata et al, Epidemiological study on traumatic oral and maxillofacial injuries in victims of child physical abuse. *Romanian Journal of Oral Rehabilitation.* 2020; 12(2); 145-54.
12. Khandekar B, Srinivasan N, Mokal N, Thatte MR. Anthro pometric analysis of lip-nose complex in Indian population. *Indian Journal of Plastic Surgery.* 2005; 38(2):128-31. DOI: [10.1055/s-0039-1699120](https://doi.org/10.1055/s-0039-1699120).
13. Mehrnaz Abrishami et al. Photographic study of Lip Anthropometric pattern Development in the Fars family in Mashad. *Journal of Anatomical Sciences.* 2014; 11(4): 175-181. URL: <http://anatomyjournal.ir/article-1-83-en.html>.
14. Yadav SK, Malla BK, Shreevastav AK, Timsina RP and Shreevastav N. et al. Anthropometric study of philtrum and other nasal parameters in Nepal. *International Journal of Modern Anthropology.* 2018; 2(11): 163-180. DOI: 10.4314/ijma.v2i11.8.
15. Law Smith, Miriam J., Deady, Denis K., Moore & Fhionna R. et al. "Maternal tendencies in women are associated with estrogen levels and facial femininity". *Hormones and Behavior.* 2011;61 (1):12-6. DOI:10.1016/j.yhbeh.2011.09.005.
16. Wu SQ, Pan BL, An Y, An JX, Chen LJ, Li D. Lip Morphology and Aesthetics: Study Review and Prospects in Plastic Surgery. *Aesthetic Plast Surg.* 2019 Jun; 43(3):637-43. DOI: 10.1007/s00266-018-1268-x.
17. Ibrahim Abdulrasheed & Asuku Malachy Eneye. Philtral Columns and Nostrils shapes in Nigerian children: A Morphometric and Aesthetic Analysis. *Plastic Surgery International.* 2013 Jun 11; 2013(5):382754. DOI:10.1155/2013/382754.

18. Wong WW, Davis DG, Camp MC, Gupta SC. Contribution of lip proportions to facial aesthetics in different ethnicities: A three-dimensional analysis. *J Plast Reconstr Aesthet Surg.* 2010; 63(12): 2032–39. DOI: 10.1016/j.bjps.2009.12.015.
19. Hasibuan Y. L, Prasetyo T.A, Pramono Graciela Novian Triana Wahjoe. Enhancing Aesthetic Harmony: Comprehensive Anthropometric Lip Measurements in Youthful and Attractive Indonesian Adults for Precision Cosmetic Procedures. *JPRAS Open.* 2014; (39); 198-206. DOI: [10.1016/j.jptra.2023.12.014](https://doi.org/10.1016/j.jptra.2023.12.014). PMID: 38293286.