

The Relationship Between Lip Morphometry and Self-Perceived Lip Attractiveness: A Cross-Sectional Study

Relación Entre la Morfometría Labial y la Autopercepción del Atractivo Labial: Un Estudio Transversal

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SUMMARY: Despite the importance of the lips and the perioral region in facial aesthetics, the relationship between self-perceived lip attractiveness and the morphometric proportions of this region has been investigated to a limited extent. This study aimed to evaluate this relationship. A total of 210 healthy young adults (110 women, 100 men) were included. Anthropometric measurements of the lips and perioral region were obtained from frontal facial photographs, and morphometric ratios were calculated. Self-perceived lip attractiveness was assessed using a visual analog scale (VAS). Data were analyzed separately for women and men. A significant positive correlation was identified between self-perceived lip attractiveness and the upper-to-lower vermilion ratio in both women ($r_s=0.445$, $p<0.001$) and men ($r_s=0.473$, $p<0.001$). In contrast, significant negative correlations with self-perceived lip attractiveness were observed in both sexes for the upper lip-to-upper vermilion ratio (women: $r_s=-0.545$, $p<0.001$; men: $r_s=-0.519$, $p<0.001$), the total lip-to-total vermilion ratio (women: $r_s=-0.378$, $p<0.001$; men: $r_s=-0.308$, $p=0.002$), and the mouth width-to-total vermilion ratio (women: $r_s=-0.414$, $p<0.001$; men: $r_s=-0.371$, $p<0.001$). The lower lip-to-lower vermilion ratio and the mouth width-to-philtrum width ratio were not significantly associated with self-perceived lip attractiveness in either women or men. In addition, no differences were observed between the two sexes in lip and perioral ratios or in self-perceived lip attractiveness. Certain quantitative morphometric ratios of the lips and the perioral region are associated with individuals' self-perceived lip attractiveness, with similar patterns observed in women and men.

KEY WORDS: Anthropometry; Lip; Esthetics; Self-Assessment.

INTRODUCTION

The perception of facial aesthetics is a multidimensional phenomenon resulting from the interaction of anatomical structures with perceptual and cultural processes (Arian *et al.*, 2023). The contribution of different facial components to the evaluation of facial attractiveness has long been investigated; it is accepted that these contributions are shaped not by absolute dimensions but by the proportional relationships between the components (Pallett *et al.*, 2010). Within this framework, the lips and the perioral region are regarded as key determinants of aesthetic perception due to their central position on the face and their direct involvement in facial expressions (Kar *et al.*, 2018).

A substantial proportion of studies on lip aesthetics are based on attractiveness assessments performed by external observers or on experimental approaches in which specific lip proportions are visually manipulated

(Heidekrueger *et al.*, 2017; Frank *et al.*, 2022). These studies indicate that lip and perioral proportions may influence perceptual evaluations, while also suggesting that reported preferences and normative values can vary across populations. Moreover, it is well recognized that the proportional contribution of anatomical components to facial attractiveness may differ according to the evaluation method employed (Todd *et al.*, 2005; Ren *et al.*, 2021).

However, aesthetic assessments in clinical practice are often shaped by an individual's perception and satisfaction with their own appearance (Rustemeyer *et al.*, 2010). The literature has demonstrated that individuals' self-assessments of attractiveness may differ from attractiveness evaluations made by external observers (Springer *et al.*, 2012; Kanavakis *et al.*, 2021). However, despite these findings, studies directly examining the relationship between

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quantitative morphometric measurements of the lips and the perioral region and individuals' self-perceived aesthetic appreciation of their own lips remain limited.

Anthropometric measurements and ratios are widely used in the quantitative assessment of the perioral region because they provide standardization and allow for comparability between individuals (Scott *et al.*, 2006; Sadacharan, 2016; Ren *et al.*, 2021; Frank *et al.*, 2022; Hasibuan *et al.*, 2024). Photograph-based morphometric studies provide a practical and reproducible approach in aesthetic research when appropriate image acquisition and measurement protocols are applied (Sadacharan, 2016; Bahsi *et al.*, 2022). However, how such quantitative indicators relate to subjective aesthetic evaluations has not yet been sufficiently elucidated. Therefore, the present study investigated the relationship between photograph-based perioral morphometric ratios and self-perceived lip attractiveness in a sample of young adults, with these associations evaluated separately in women and men. This approach aims to examine an assessment framework that has been only limitedly addressed in the existing literature.

MATERIAL AND METHOD

Study Design

This study is a cross-sectional study examining the relationships between photographic-based perioral morphometric ratios and subjective lip preference. Analyses were planned separately for female and male participants.

Participants

Students from the Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Istanbul Aydın University were invited to participate in this study. The sample size was calculated using G*Power software based on the detection of the relationship between VAS scores and the upper-to-lower vermilion ratio, which was defined as the primary analysis of the study. In preliminary data, the Spearman correlation coefficient between the upper-to-lower vermilion ratio and VAS scores was $r_s = 0.404$ in women and $r_s = 0.411$ in men. Power analysis was conducted assuming a two-tailed test, an alpha level of 0.05, and a statistical power ($1-\beta$) of 0.90, yielding a minimum required sample size of approximately 61 participants for each sex group. A total of 210 volunteers (110 women and 100 men) completed the study. Individuals with a history of craniofacial trauma or surgery, those with dermatological lesions in the perioral region that would affect measurements, those who had undergone aesthetic procedures on the lips and surrounding area, and those with

beard or mustache that covered the lip margins were excluded from the study.

Ethical Approval

This study was approved by the Non-Interventional Clinical Research Ethics Committee of Istanbul Aydın University (Date: 17.07.2024, Decision No: 58/2024). The research was conducted in accordance with the principles of the Helsinki Declaration, and informed consent was obtained from all participants.

Photograph Acquisition

Photographs were taken under standard conditions by the same researcher using the same device (Apple iPhone 13 Pro). Photographs were taken in a well-lit room without flash. The distance between the camera and the participant was kept constant at 2 m. All images were taken in the frontal plane, with the participants' heads in an anatomical position and their facial expressions neutral. A millimeter ruler was used close to the face plane during photography to ensure calibration of the measurements.

The resulting images were checked before analysis; photographs that did not meet the standard criteria were retaken. Suitable photographs were coded, stored digitally, and used in the analysis phase.

Morphometric Measurements

The obtained digital images were transferred to ImageJ software for measurement and analysis purposes. Before making measurements on the images, a calibration process was performed within the software, using the millimeter ruler used during the photo shoot as a reference.

The anthropometric reference landmarks used for the morphometric assessment of the perioral region were defined as Subnasale (sn), Labiale superius (ls), Stomion (sto), Labiale inferius (li), Sublabiale (sl), Cheilion (ch), and Crista philtri (cp) (Fig. 1). The selection of these landmarks and the linear measurements were performed based on the method described by Bahsi *et al.* (2022). Based on these reference landmarks, the following measurements were obtained by the same researcher: upper lip height (sn–sto), upper vermilion height (ls–sto), lower lip height (sto–sl), lower vermilion height (li–sto), total lip height (sn–sl), total vermilion height (ls–li), mouth width (ch–ch), and philtrum width (cp–cp). To assess measurement repeatability, photographs of 40 randomly selected participants (20 men and 20 women) were remeasured by the same researcher after a two-week interval. Intra-observer reliability was

analyzed using the Intraclass Correlation Coefficient (ICC; two-way mixed-effects model, absolute agreement), and the measurements were found to demonstrate excellent reliability (single-measure ICC = 0.996; 95 % CI: 0.993–0.998). Using the obtained linear measurements, the following ratios were calculated: upper-to-lower vermilion ratio ($ls-sto$)/($li-sto$), upper lip-to-upper vermilion ratio ($sn-sto$)/($ls-sto$), lower lip-to-lower vermilion ratio ($sto-sl$)/($li-sto$), total lip-to-total vermilion ratio ($sn-sl$)/($ls-li$), mouth width-to-total vermilion ratio ($ch-ch$)/($ls-li$), and mouth width-to-philtrum width ratio ($ch-ch$)/($cp-cp$).

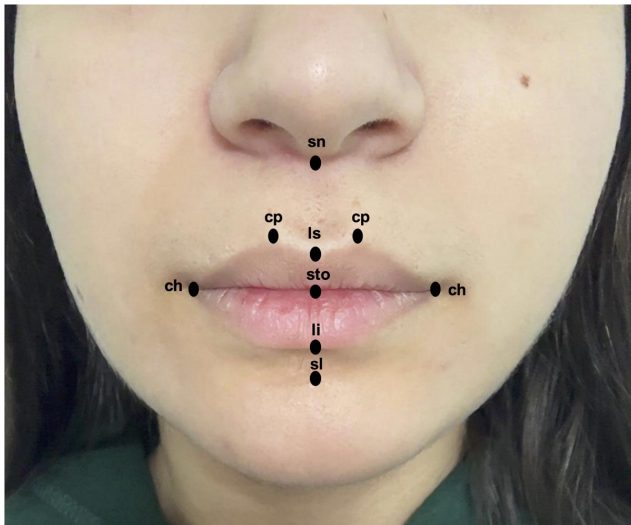


Fig. 1. Anthropometric landmarks of the perioral region. sn: subnasale; ls: labiale superius; sto: stomion; li: labiale inferius; sl: sublabiale; ch: cheilion; cp: crista philtri.

Subjective Lip Preference Assessment

The Visual Analog Scale (VAS) is a measurement tool used to quantitatively assess individuals' subjective experiences such as pain, aesthetic perception, and satisfaction level (Kramer *et al.*, 2024). In this study, participants' level of liking for their lips was measured by asking them to mark their lips on a 10 cm long VAS. The endpoints of the scale were defined as 0=I don't like it at all and 10=I like it very much. The distance of the point marked by the participants from the starting point was measured and converted into a numerical score on the 0-10 range.

Statistical Analysis

Statistical analyses were performed using SPSS software (version 26.0; IBM Corp., Armonk, NY, USA). The distribution of continuous variables was assessed using the Shapiro–Wilk test and distribution plots (histograms and Q–Q plots). Based on distributional characteristics, variables were expressed as mean $\pm$ standard deviation and median

(minimum–maximum). Comparisons of morphometric ratios and VAS scores between women and men were conducted using the Mann–Whitney U test. As the primary analysis of the study, the relationship between VAS scores and the upper-to-lower vermilion ratio was examined separately in women and men using Spearman's rank correlation coefficient (r_s), and a p value < 0.05 was considered statistically significant for the primary analysis. Associations between VAS scores and the other morphometric variables were treated as secondary analyses and were likewise tested using Spearman correlation analysis. To control for the increased risk of Type I error due to multiple comparisons, Bonferroni correction was applied to the secondary correlation analyses, and the significance level was set at $\alpha = 0.05/6$ (0.0083). All statistical tests were conducted as two-tailed.

RESULTS

A total of 210 participants (110 women and 100 men) were included in the study. In men, the mean age, height, and body weight were 21.3 ± 1.9 years, 176.4 ± 7.7 cm, and 75.5 ± 13.5 kg, respectively, while in women these values were 20.9 ± 2.1 years, 162.4 ± 4.7 cm, and 58.5 ± 9.8 kg.

Descriptive statistics for VAS scores and morphometric ratios in women and men are presented in Table I. No statistically significant differences were observed between women and men in terms of morphometric ratios or VAS scores (all $p > 0.05$).

The correlations between VAS scores and morphometric ratios in women and men are summarized in Table II. Based on the adjusted significance level ($\alpha = 0.0083$), a moderate positive correlation was identified between VAS scores and the upper-to-lower vermilion ratio in both sexes (women: $r_s = 0.445$, $p < 0.001$; men: $r_s = 0.473$, $p < 0.001$). In addition, a moderate negative correlation was observed between VAS scores and the upper lip-to-upper vermilion ratio in both groups (women: $r_s = -0.545$, $p < 0.001$; men: $r_s = -0.519$, $p < 0.001$).

A weak negative correlation was observed between VAS scores and the total lip-to-total vermilion ratio in both sexes (women: $r_s = -0.378$, $p < 0.001$; men: $r_s = -0.308$, $p = 0.002$). The relationship between VAS scores and the mouth width-to-total vermilion ratio was weakly negative in men and moderately negative in women (women: $r_s = -0.414$, $p < 0.001$; men: $r_s = -0.371$, $p < 0.001$). No significant correlations were observed between VAS scores and either the lower lip-to-lower vermilion ratio or the mouth width-to-philtrum width ratio (Table II).

Table I. Comparison of VAS scores and morphometric ratios in female and male groups.

Parameters	Women (n=110)	Men (n=100)	P
	Median (min-max)	Median (min-max)	
Upper-to-lower vermillion ratio	0.73(0.45-1.12)	0.69(0.14-1.21)	0.152
Upper lip-to-upper vermillion ratio	2.9(1.87-4.32)	3.06(2.09-5.8)	0.064
Lower lip-to-lower vermillion ratio	1.71(1.33-3.45)	1.76(1.31-3.44)	0.392
Total lip-to-total vermillion ratio	2.21(1.72-3.86)	2.31(1.66-3.79)	0.142
Mouth width-to-total vermillion ratio	3.01(1.88-5.76)	3.08(2.26-5.62)	0.120
Mouth width-to-philtrum width ratio	3.84(2.83-6.06)	3.65(3.04-5.69)	0.137
VAS score	8(0.7-10)	7.85 (0.90-10)	0.149

VAS: Visual Analogue Scale. Mann-Whitney U test was used.

Table II. Correlations between VAS scores and morphometric ratios in women and men.

Parameters	Women (n=110)		Men (n=100)	
	r_s	p	r_s	p
Upper-to-lower vermillion ratio	0.445	<0.001	0.473	<0.001
Upper lip-to-upper vermillion ratio	-0.545	<0.001	-0.519	<0.001
Lower lip-to-lower vermillion ratio	-0.096	0.316	-0.087	0.387
Total lip-to-total vermillion ratio	-0.378	<0.001	-0.308	0.002
Mouth width-to-total vermillion ratio	-0.414	<0.001	-0.371	<0.001
Mouth width-to-philtrum width ratio	0.157	0.100	0.037	0.714

Spearman's rank correlation analysis was used.

DISCUSSION

In this study, the relationship between perioral morphometric ratios and self-perceived lip attractiveness was evaluated separately in women and men within a sample of young adults. The findings indicate that, in both sexes, higher upper-to-lower vermillion ratios are associated with increased levels of attractiveness, whereas increases in the upper lip-to-upper vermillion and total lip-to-total vermillion ratios are associated with lower perceived attractiveness. In the present study, subjective lip attractiveness refers to participants' self-rated evaluations of their own lips as assessed using VAS.

In the literature, facial attractiveness is most commonly examined based on ratings provided by external evaluators or through digital manipulation of specific facial components (Scott *et al.*, 2006; Ren *et al.*, 2021; Frank *et al.*, 2022; Parul *et al.*, 2022). In such studies, the perceptual importance of different facial components contributing to facial attractiveness may vary according to the characteristics and professional background of the evaluators (Scott *et al.*, 2006). Indeed, it has previously been shown that orthodontists tend to focus more on the lips in aesthetic assessments, whereas lay evaluators place greater emphasis on the chin and other facial regions (Ren *et al.*, 2021). Similarly, perception-based studies investigating the contribution of facial components to attractiveness have highlighted the lip region as a key component of facial

aesthetics (Parul *et al.*, 2022; Hasibuan *et al.*, 2024). The contribution of the present study to the literature lies in the use of participants' self-rated lip attractiveness scores rather than external evaluations, and in examining these ratings in relation to standardized morphometric ratios within the same sample. This approach directly corresponds to the concept of individuals' satisfaction with their own appearance, which is frequently encountered in clinical practice, and emphasizes that observer-based attractiveness and subjective aesthetic satisfaction may not represent identical constructs (Springer *et al.*, 2012; Kanavakis *et al.*, 2021).

When the correlation pattern is examined, subjective lip attractiveness shows consistent and directional relationships with specific morphometric proportions rather than with all measured ratios. The most notable finding is the positive association between the upper-to-lower vermillion ratio and attractiveness scores, with the consistency of the association across both sexes suggesting that this ratio may represent a perceptually stable component. This finding indicates that, in perioral aesthetic perception, the relative prominence of the upper vermillion within the lip complex may be more determinative than absolute lip dimensions.

Studies examining lip proportions based on perception and preference have reported that ratios perceived

as attractive do not reflect a single fixed value and that different proportions may produce variable outcomes in attractiveness evaluations (Heidekrueger *et al.*, 2017; Frank *et al.*, 2022). The findings of the present study suggest that the relationship between the upper and lower vermilion is associated with individuals' self-perceived lip attractiveness, indicating that these results are better interpreted within the framework of subjective evaluation rather than generalized based on universal ratios.

A negative association was observed between the upper lip-to-upper vermilion ratio and attractiveness scores in both sexes. This finding indicates that the proportional balance between the upper lip and the vermilion in the perioral region is related to subjective evaluation. In addition, the negative relationship between the total lip-to-total vermilion ratio and attractiveness suggests that the relative contribution of the vermilion within the overall lip structure may be associated with subjective lip attractiveness.

The negative association between the mouth width-to-total vermilion ratio and attractiveness indicates that perceived attractiveness decreases when mouth width is dominant relative to the vermilion. This finding may be related to a reduced visual prominence of the lips within the oral frame. The clinical utility of ratio-based assessment has also been discussed in the context of objectifying postoperative outcomes following reconstructive procedures. Accordingly, the use of anthropometric indices and photograph-based measurement methods has been recommended to enable standardized evaluation of postoperative appearance (Raschke *et al.*, 2012). Although the present study did not evaluate reconstructive or functional outcomes, it nevertheless provides a similar methodological framework in terms of enhancing interindividual comparability through a ratio-based approach.

The lack of a significant association between attractiveness and the lower lip-to-lower vermilion ratio as well as the mouth width-to-philtrum width ratio suggests that morphometric cues related to subjective attractiveness may be selective, and that not all perioral ratios reflect attractiveness variability to the same extent. In addition, the perceptual contribution of certain anatomical subunits, particularly the philtrum, may not be adequately captured by single linear measurements such as width alone. Indeed, studies examining the role of the philtrum in perioral attractiveness and age perception have emphasized that, in addition to dimensional characteristics, qualitative features such as contour may also influence perception (Nunes & Bran, 2021). Therefore, the lack of a significant association

for the philtrum related ratio may be attributable not to a limited perceptual relevance of the philtrum itself, but rather to the limited capacity of the applied metrics to capture its qualitative features. Similarly, the lower lip component may show weaker associations with attractiveness, particularly because contour and volumetric characteristics are insufficiently represented in two-dimensional, photograph-based linear measurements.

In the present study, the generally high attractiveness scores represent a finding that warrants methodological consideration. The most plausible explanation for this pattern is that the evaluation was based on participants' assessments of their own lips rather than on ratings provided by external observers. Previous studies have reported that agreement between self-assessments and observer-based ratings may be limited, and that individuals tend to evaluate their own appearance more favorably than others do (Greitemeyer, 2020). Springer *et al.* demonstrated that individuals perceive their own facial attractiveness as significantly higher than the ratings assigned by independent evaluators (Springer *et al.*, 2012). In addition, it has been reported that familiarity with faces may enhance attractiveness evaluations, and that exposure effects can be associated with more favorable ratings (Peskin & Newell, 2004). Accordingly, factors such as familiarity effects, self-acceptance tendencies, and social desirability may contribute to elevated attractiveness scores in self-assessments.

The absence of statistically significant differences between women and men in both morphometric ratios and subjective attractiveness levels, together with the generally similar correlation patterns, suggests that the ratios associated with subjective attractiveness may not differ by sex within this sample. However, this similarity should be interpreted as being limited to the characteristics of the studied population. Indeed, previous studies have shown that lip measurements and aesthetic preferences may vary across populations, and that reported normative values can be influenced by ethnic and cultural factors (Sadacharan, 2016; Kollipara *et al.*, 2017; Hasibuan *et al.*, 2024). In line with this perspective, regression-based morphometric models emphasize that facial aesthetics should be evaluated not according to fixed and universal standards, but within the framework of individual and population-specific harmony and proportional balance (Babacan & Deniz, 2025). Accordingly, the generalizability of the present findings requires confirmation through studies conducted in different age groups and diverse populations.

This study has several limitations. First, due to its cross-sectional design, the relationships between perioral

morphometric ratios and subjective lip attractiveness cannot be interpreted causally, and the findings reflect only concurrent associations between variables. Second, lip attractiveness was assessed based on participants' self-evaluations of their own lips. This may have contributed to generally high attractiveness scores and to the lack of significant associations with some morphometric ratios. Third, the morphometric assessments were based on two-dimensional, photograph-based linear measurements. Although this approach was standardized, it provides only a limited representation of three-dimensional characteristics such as contour and volume of the lips and the perioral region; consequently, the perceptual contribution of certain subunits, particularly the philtrum and the lower lip, may not have been fully captured. Fourth, the study was restricted to a selected set of morphometric ratios. Given the multifactorial nature of perioral aesthetic perception, the contribution of other facial components not included in the present analysis cannot be excluded. Although standardization was ensured during image acquisition, minor variations related to facial expression and positioning could not be completely eliminated. Finally, the sample consisted of a single center population of young adults, and subjective attractiveness was assessed using a single measurement instrument. These factors may limit the generalizability of the findings to other age groups and populations.

CONCLUSIONS

In this cross-sectional study, the relationships between photograph-based perioral morphometric ratios and subjective lip attractiveness were evaluated separately in women and men within a sample of young adults. The findings demonstrated that subjective lip attractiveness was not associated with all morphometric ratios but showed significant relationships with specific proportions. Higher upper-to-lower vermilion ratio was associated with higher attractiveness, whereas increases in the upper lip-to-upper vermilion ratio and the total lip-to-total vermilion ratio were associated with lower attractiveness. The observation of similar correlation patterns in women and men suggests that, within this sample, the ratios related to subjective lip attractiveness may not differ significantly by sex. Overall, the findings indicate that perioral aesthetic perception may be more appropriately evaluated based on the balance between lip and vermilion components rather than on a single ideal ratio, and these findings may contribute to patient-centered aesthetic assessment and shared clinical decision-making.

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RESUMEN: A pesar de la importancia de los labios y la región perioral en la estética facial, la relación entre la autopercepción del atractivo labial y las proporciones morfométricas de esta región se ha investigado de forma limitada. Este estudio tuvo como objetivo evaluar dicha relación. Se incluyeron 210 adultos jóvenes sanos (110 mujeres y 100 hombres). Se obtuvieron mediciones antropométricas de los labios y la región perioral a partir de fotografías faciales frontales y se calcularon las proporciones morfométricas. La autopercepción del atractivo labial se evaluó mediante una escala analógica visual (EAV). Los datos se analizaron por separado para mujeres y hombres. Se identificó una correlación positiva significativa entre el atractivo labial autopercebido y la proporción entre el bermellón superior e inferior tanto en mujeres ($r_s=0,445$, $p<0,001$) como en hombres ($r_s=0,473$, $p<0,001$). En contraste, se observaron correlaciones negativas significativas con el atractivo labial autopercebido en ambos sexos para la proporción labio superior-bermellón superior (mujeres: $r_s=-0,545$, $p<0,001$; hombres: $r_s=-0,519$, $p<0,001$), la proporción labio total-bermellón total (mujeres: $r_s=-0,378$, $p<0,001$; hombres: $r_s=-0,308$, $p=0,002$) y la proporción ancho de la boca-bermellón total (mujeres: $r_s=-0,414$, $p<0,001$; hombres: $r_s=-0,371$, $p<0,001$). La proporción entre el labio inferior y el bermellón inferior, así como la proporción entre el ancho de la boca y el filtrum, no mostraron una asociación significativa con la percepción de atractivo labial en hombres ni mujeres. Además, no se observaron diferencias entre ambos sexos en las proporciones labiales y periorales ni en la percepción de atractivo labial. Ciertas proporciones morfométricas cuantitativas de los labios y la región perioral se asocian con la percepción de atractivo labial, observándose patrones similares en hombres y mujeres.

PALABRAS CLAVE: Antropometría; Labios; Estética; Autoevaluación.

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