

## ORIGINAL ARTICLE

# Gonial Angle of Healthy Young Males and Females in Indonesia: A Study Using the Facial Photometry

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## ABSTRACT

**Introduction:** Photometry gonial angle is a simpler and economic method useful to determine sex dimorphism and in orthodontic and prosthetic treatment plans, compared to the more common technique e.g. radiomorphometry of panoramic images. We aimed to compare the right and the left gonial angles of the young healthy males and females based on their frontal facial photographs. **Methods:** Twenty Indonesian males and twenty females aged 19-25 years were photographed facing forward at the 1.5 m of distance from the 12 mp DSLR camera held by a tripod in the relax sitting position. Photometry was conducted using tpsDig2 ver 2.3 software. Data were analyzed with independent t-test using SPSS 24.0. Level of significant was  $p < 0.05$ . **Results:** The mean  $\pm$  SD value of the right gonial angle in males was  $133.7^{\circ} \pm 4.68$ ; the left side was  $133.6^{\circ} \pm 5.49$ . Whilst was  $134.2^{\circ} \pm 5.52$  and  $134.4^{\circ} \pm 4.98$  in the right and the left side on the females, respectively. No significant differences of the right or the left gonial angle were found between males and females ( $p=0.784$  and  $p=0.651$ , respectively). **Conclusion:** Photometry of the gonial angle was not significantly different between sexes in the current study; although future study with larger sample numbers and other methods should be done to confirm this.

**Keywords:** Gonial angle, Sexual dimorphism, Photometry, Young healthy adults

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## INTRODUCTION

The mandible is the strongest and largest bone in the facial region (1-3). Human mandible measurement is often used as part of the assessment of biological identity in forensic anthropological and odontological practices. This measurement includes the morphology, symphyseal form, gonial angle, gonial inversion and eversion and ramus flexure. The gonial angles give information about the shape of the mandible and the direction of lower facial growth development (1-3).

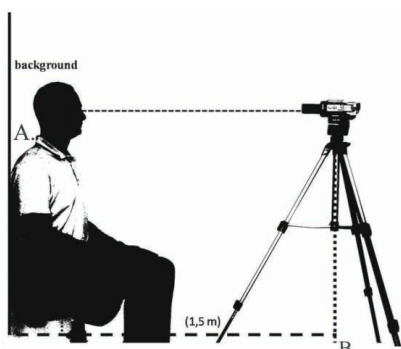
Sexual dimorphism can be determined using mandibular measurement differences of the gonial angle. Previous study reported significant differences between sexes in malocclusions. In females, this measurement was significantly smaller compare to in

males (2-4). This study was done using measurement was conducted based on the panoramic view of the frontal radiographs. Previous study by Sitanggang et al (2017), Kanya et al (2017), Azhari et al (2019) also used radiomorphometry to analyze and to compare various measurements of the mandible amongst different genders and age groups in Indonesia (5-7). However there was another technique called photometry that could also be implemented i.e. for orthodontic and prosthodontic treatment plans, and in forensic anthropometry (4, 8); whilst to the best of our knowledge has yet widely elaborated on the Indonesian population, as this might be the simpler and more economic alternative to the prior method.

The current study would be focused on the measurement of gonial angle on the healthy young males and females in Kediri city, Indonesia using the photometry analysis as a study to enrich the fundamental data of the facial anthropometry in specific cluster of age and ethnicity in Indonesia.

**MATERIALS AND METHODS**

A cross-sectional study was carried out in the primary This study was conducted in accordance to the ethical clearance guaranteed by the health research ethic committee of The Faculty of Dental Medicine, Universitas Airlangga no.171/HRECC.FODM/III/2020. Frontal facial photographs of twenty young healthy males and twenty young healthy females were taken using 12 mp DSLR camera held by dynamic tripod (Canon 1100D, Japan), further techniques were detailed as in Fig.1 (4, 8). Subjects were in the relax sitting position with eyes open and normal occlusion. Analysis of the gonial angle was based on the angle made by the lines between the zygion and the gonion, and between the gonion to gnathion (Fig.2). Photos that have been taken were saved in TIFF file format. The zygion is the most lateral point on the zygomatic arch, gonion is the most lateral point at the angle of the mandible and gnathion is the lowest point in the midline on the lower border of the chin (4, 8). Then the angle is measured by clicking the angle button in the software (Fig.2). All analysis were done using tpsDig2 ver 2.3 software (Rohlf, USA) (4, 8). Differences of the gonial angle between males and females (in each side) were analyzed using an independent t-test after tested with the normality and homogeneity tests. The level significant was  $p < 0.05$  (SPSS 24.0).



**Fig. 1 : Scheme of standard relax sitting position to capture the frontal photometry of each participant (4).** A. Subject sit on the chair, the eyes focused to camera lens B. Camera held by dynamic tripod to adjust camera position with the eyes position.



**Fig. 2 : Measurement of the gonial angle using tpsDig2 ver.2.3 software.** (A). Zygion point (B). Gonion point (C). Gnathion point (D). Tool to analyze angle.

**RESULTS**

In this study, there were 21 participants of the Javanese ethnic, whilst from other areas of Indonesia i.e. Nusa Tenggara Timur (7 participants), Kalimantan (5 participants), Sulawesi (4 participants), Nusa Tenggara Barat (1 participant), Balinese (1 participant), Sumatera (1 participant). The right and left gonial angles in males and females were detailed in Table I.

From this table, it was shown that the data normally distributed and homogenous, thus we continued to test using an independent t-test to seek any differences possible. There were no significant differences of the gonial angle between males and females in the left mandible ( $p = 0.651$ ); and of the right mandible gonial angle ( $p = 0.784$ ) (Table II).

**Table I : Mean±SD of the gonial angles in all participants**

Gonial Angle	Sex	N	Mean ± SD	Shapiro willk p value	Levene test p value
Left Mandible	males	20	133.6 ± 5.49	0.228	0.943
	females	20	134.4 ± 4.98	0.761	
Right Mandible	males	20	133.7 ± 4.68	0.061	0.484
	females	20	134.2 ± 5.52	0.254	

**Table II : The gonial angle analysis between males and females showed no significant differences in both sides**

Gonial angle	p
Left Mandible	0.651
Right Mandible	0.784

**DISCUSSION**

In the current study although the right and left gonial angles were not significantly different amongst the male and females, we found a slightly larger gonial angle in both sides of females compared to males. The difference of gonial angle might be correlated to several factors i.e. sex chromosomes where the XY chromosome would give difference expressions to the growth of tooth crowns and tooth roots. The size of the crowns and roots of the teeth will affect the mandibular arch, where in males this would be larger than females (9). Hazari et al (2016) revealed that in the mandible there was a statistically significant sexual dimorphism (10). Although different method such as using the radiograms the soft tissue would be neglected including the masticatory muscles, i.e., masseter and medial pterygoid (11).

Research conducted by Chole et al (2013) on the gonial angle using panoramic radiography shows that males have a smaller mandibular angle than females

and there are significant differences between males and females in India (12). Jambunath et al (2016) also reported that mandibular angle was bigger in females. These studies however, were done on the panoramic radiographs of the mandible, whilst in photometry the soft tissue in the form of facial muscles are involved thus slightly different results to our study might be due to this reason. The masseter and medial pterygoid muscles attached to the gonial angle region which can affect the shape of the mandibular body. When the contraction of these muscles got stronger, the gonial angle would be smaller. Males tend to have stronger masticatory muscles, the angle of the mandible would tend to be smaller than females (11).

Frontal photo analysis made to assess the dimensions of the face in a transverse and vertical directions as a whole. What can be seen is the relation between the width of bitemporal, bizygomatic, bigonial and mentale, and comparing the height of the face; determining the shape of the face (wide or narrow, long or short, rectangular or triangular shape). The advantage using photometry technique includes simpler, cheaper, faster methods than radiography analysis and could play as a valuable technique in the screening study (4, 13,14).

Interestingly Al-Shamout et al (2012) reported that the gonial angle of males has higher values than in females amongst adult Jordan people (14). This may be due to specificity of the middle-eastern race and/or combined to different extrinsic factor i.e. eating habits. Different ethnicity has been known to affect the gonial angle, Asian people for instance, are reported to have smaller gonial angle than the Caucasian people (14-16). Previous study by Shahabi et al (2009) in Iran also reported no significant differences in the gonial angle amongst different sexes (15). The same result also reported by Raustia and Salonen (1997), in their study of gonial angle between sexes in Finland (16).

Future study with larger number of participants with various age group and pathology correlation would be needed to confirm and to enrich our current findings.

## CONCLUSION

We found no significant difference of the gonial angle between healthy young adult males and females in both side of the mandible; slightly larger angle were observed in females than males.

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