

## Morphometric Analysis of Mandibula with MDCT Method in Turkish Population

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### Abstract

**Introduction:** The temporomandibular joint with the temporal bone allows the mandibular to move, which facilitates the chewing and digestion of food. In this study, it was aimed to measure the morphometric parameters of the mandibles in the Turkish population and to evaluate the effectiveness of measurements in gender determination.

**Method:** The study was performed on 100 individuals (50 females-50 males) who were scanned with Multidetector Computed Tomography (MDCT) and applied to the Department of Radiology, Konya Education and Research Hospital, Health Sciences University. Individuals ranging in age from 20 to 80 were included in the study.

**Results:** In our study, 7 different parameters of mandibula were measured and mean values were determined. We investigated whether statistically significant differences exist between men and women.

**Conclusion:** In conclusion, we think that some values of the mandibular obtained in our study will constitute a reference range in Turkish society. We believe that these intervals will assist surgeons dealing with the jaw and face region and radiologists for diagnosis.

**Keywords:** Anatomy; Antropometry; Mandibula.

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### Introduction

Mandibula is the largest, strongest and only moving bone of the head skeleton. It consists of corpus mandibulae with teeth and horizontally extending and two ramus mandibulae extending vertically at the back. The angle where corpus and ramus meet is called angulus mandibulae [1]. The temporomandibular joint with the temporal bone allows the mandibular to move, which facilitates the chewing and digestion of food [2].

Gender determination from human remains is important in forensic medicine and anthropology, especially in criminal investigations, in the identification of missing persons and in attempts to restructure the lives of the old population. One of the important aspects of the science of forensic science is to determine gender from fragmented jaws [3]. Gender determination in the adult skeleton is the first step in the identification process and subsequent methods for age and height estimates are sex dependent. The reliability of gender determination depends on the completeness of the remains and on the sexual dimorphism rate found in the population. When the entire adult skeleton is available for analysis, gender can be

determined up to 100% accuracy, but in mass disasters with fragmented bones, sex determination with 100% accuracy is not possible and depends largely on existing parts of the skeleton [4]. The bones of the pelvis, skull and mandible are often used in gender determination. Among them, mandibular bones are preferred because they are compact, least destructible and have high strength [5]. The mandible can be used to distinguish between ethnic groups and genders [2].

In this study, it was aimed to measure the morphometric parameters of the mandibles in the Turkish population and to evaluate the effectiveness of measurements in gender determination. The findings of this study will form a reference range to assess gender determination ability in forensic analysis of selected parameters.

### Materials and Methods

The study was performed on 100 individuals (50 females-50 males) who were scanned with Multidetector computed tomography (MDCT) and applied to the Department of Radiology, Konya Education and Research Hospital, Health

Sciences University. Individuals ranging in age from 20 to 80 were included in the study.

In the first step of working; patients who had previously applied to the hospital and patients who obtained facial images with 64-section MDCT were identified. Morphological evaluation was then performed by detecting images on the sagittal, coronal, and axial planes. Morphometric measurements were made by the same person to minimize the error margin. The parameters that are measured and recorded in our work are as follows.

Length of Mandibular Body (LMB), Height of Mandibular Body (HMB), Thickness of Mandibular Body (TMB), Height of Mandibular Ramus (HMR), Width of Mandibular Ramus (WMR), Gonion Angle (GA), Bicondylar Width (BW).

The averages of the data obtained were used to determine whether the difference between the means of both genders was statistically significant using the T test.

## Results

In our study, 7 different parameters of mandibula were measured and mean values were determined. We investigated whether statistically significant differences exist between men and women. The values of LMB, HMB, HMR, WMR and BW were significantly higher in males than females ( $p < 0.05$ ). In the right and left side comparisons no significant difference was noted in any parameters. The data obtained according to sex and lateralization of male and female are given in Table 1 and Table 2 in detail.

**Table 1:** Comparison of the obtained data according to gender (mean  $\pm$  SD) (mm). (LMB: Length of Mandibular Body; HMB: Height of Mandibular Body; TMB: Thickness of Mandibular Body; HMR: Height of Mandibular Ramus; WMR: Width of Mandibular Ramus; GA: Gonion Angle; BW: Bicondylar Width).

Parameters	Female (n=50)	Male (n=50)	p
LMB	70.37 $\pm$ 4.98	77.61 $\pm$ 5.46	< 0.05
HMB	29.16 $\pm$ 2.08	30.49 $\pm$ 2.50	< 0.05
TMB	14.00 $\pm$ 1.66	14.53 $\pm$ 1.58	>0.05
HMR	56.42 $\pm$ 5.95	60.61 $\pm$ 5.05	< 0.05
WMR	29.53 $\pm$ 2.87	31.87 $\pm$ 3.35	< 0.05
GA	125.94 $\pm$ 4.82	124.86 $\pm$ 7.16	>0.05
BW	116.36 $\pm$ 5.28	121.29 $\pm$ 4.76	< 0.05

**Table 2:** Comparison of the obtained data according to lateralization (mean  $\pm$  SD) (mm). (LMB: Length of Mandibular Body; HMB: Height of Mandibular Body; TMB: Thickness of Mandibular Body; HMR: Height of Mandibular Ramus; GA: Gonion Angle).

Parameters	Right (n=100)	Left (n=100)	p
LMB	74.63 $\pm$ 6.37	73.35 $\pm$ 6.30	>0.05

HMB	29.96 $\pm$ 2.30	29.68 $\pm$ 2.47	>0.05
TMB	58.93 $\pm$ 4.56	58.51 $\pm$ 5.35	>0.05
HMR	30.74 $\pm$ 3.31	30.66 $\pm$ 3.36	>0.05
GA	125.19 $\pm$ 6.27	125.61 $\pm$ 5.98	>0.05

## Discussion

One of the important aspects of forensic science is to estimate sex from fragmented jaws. The definition of sex based on morphological markers can be subjective and possibly incorrect, but methods based on measurement and morphometry can be used for correctness and estimation. The mandibles were used for analysis due to two simple reasons for sex discrimination from the skull. The first is the lack of standards used, and the second is that the bone can usually be recovered without deterioration [6]. Mandibula can play a vital role in gender determination, because it is the most dimorphic bone of the skull [7]. Vodanović et al. recorded the LMB value as 81.41  $\pm$  3.04 mm in women and 88.34  $\pm$  4.66 mm in men. In a similar study, this value was 83.68  $\pm$  10.51 mm for women and 88.3  $\pm$  6.87 mm for men [8]. In our study, LMB was 70.37  $\pm$  4.98 mm in women and 77.61  $\pm$  5.46 mm in men. In our study, right and left comparisons were also made. This value was recorded as 74.63  $\pm$  6.37 mm on the right side and 73.35  $\pm$  6.30 mm on the left side. In our study, values belonging to male individuals were significantly higher than women. When we compare the average of the data obtained from this parameter with the literature data, it is observed that our data are lower.

Özer et al. detected, in their study, that HMB value was 30.3  $\pm$  2.97 mm in women and 29.15  $\pm$  4.82 mm in men. In another study, Vodanović et al. Found this value 29.96  $\pm$  1.21 mm for women and 31.68  $\pm$  2.6 mm for men. In our study, HMB was 29.16  $\pm$  2.08 mm in women and 30.49  $\pm$  2.50 mm in men. This value was recorded 29.96  $\pm$  2.30 mm on the right side and 29.68  $\pm$  2.47 mm on the left side. While the values of male individuals were significantly higher than women, there was no difference between right and left [9].

Mandibular fractures are the most common fractures encountered by a surgeon dealing with maxillofacial trauma repair. Depending on the extent of the fracture and the extent of the fracture, the mandibular fracture causes significant aesthetic and functional loss in the individual [10]. Kumar et al. found that the TMB was 14.60  $\pm$  1.35 mm for women and 14.60  $\pm$  1.35 mm for men. In another study, Özer et al. found that this value was 10.9  $\pm$  1.43 mm for women and 10.85  $\pm$  1.55 mm for men. In our study, the TMB was 14.00  $\pm$  1.66 mm for women and 14.53  $\pm$  1.58 mm for men [11].

In a study Çırak et al. detected, that HMR value was 45.91  $\pm$  8.22 mm in women and 56.66  $\pm$  7.43 mm in men. In another study, Damera et al. found that this value was 60.08  $\pm$  4.30 mm for women and 66.19  $\pm$  4.75 mm for men. In our study, the height of ramus mandibula was 56.42  $\pm$  5.95 mm in women and 60.61  $\pm$  5.05 mm in men. This value was recorded as 58.93

$\pm 4.56$  mm on the right side and  $58.51 \pm 5.35$  mm on the left side [12].

Sambhana et al. recorded the WMR value as  $25.09 \pm 2.99$  mm in women and  $27.17 \pm 3.03$  mm in men. In another study, Damera et al. found that this value was  $29.55 \pm 2.83$  mm for women and  $29.42 \pm 3.14$  mm for men. In our study, WMR was  $29.53 \pm 2.87$  mm for women and  $31.87 \pm 3.35$  mm for men. This value was recorded as  $30.74 \pm 3.31$  mm on the right side and  $30.66 \pm 3.36$  mm on the left side.

The diagnosis and treatment of facial asymmetry requires measurements of various osseous and soft tissues [13]. Lin et al. recorded the GA value as  $124.30 \pm 6.09$  mm in women and  $122.53 \pm 6.64$  mm in men. In another study, Özer et al. found that this value was  $125 \pm 5.79$  mm for women and  $122.41 \pm 7.38$  mm for men. In our study, GA was found to be  $125.94 \pm 4.82$  mm for women and  $124.86 \pm 7.16$  mm for men. This value was recorded as  $125.19 \pm 6.27$  mm on the right side and  $125.61 \pm 5.98$  mm on the left side [14].

Many methods have been developed over many years in the treatment of jaw fractures, which have a large prescription in oral and maxillofacial surgery. Treatment of condyle fractures in jaw fractures involving a wide range of treatment modalities is of great importance in terms of preventing the development of functional and anatomic disorders [15]. Çırak et al. recorded the BW value as  $111.63 \pm 4.43$  mm in women and  $119.44 \pm 7.6$  mm in men. In another study, Arat et al. found that this value was  $105.49 \pm 6.49$  mm for women and  $115.22 \pm 7.58$  mm for men. In our study, BW was found to be  $116.36 \pm 5.28$  mm for women and  $121.29 \pm 4.76$  mm for men.

In conclusion, we think that some values of the mandibular obtained in our study will constitute a reference range in Turkish society. We believe that these intervals will assist surgeons dealing with the jaw and face region and radiologists for diagnosis.

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