Section: Anatomy

Original Research Article

# ROLE OF MORPHOMETRIC PARAMETERS IN DETERMINING THE GENDER OF HUMAN MANDIBLE IN JAIPUR REGION

**Lavina Sharma[1], Riya Narwani[2]**

[1]Ph.D Scholar, Department of Anatomy, Sawai Man Singh Medical College and Hospital, Jaipur, Rajasthan, India.
[2]Senior Professor, Department of Anatomy, Sawai Man Singh Medical College and Hospital, Jaipur, Rajasthan, India.

*Received* : 13/04/2025
*Received in revised form* : 02/05/2025
*Accepted* : 25/05/2025

*Keywords:*
*Breadth of Ramus, Coronoid breadth, Mandibular Index, Morphometry, Sexual Dimorphism.*

Corresponding Author:
**Lavina Sharma,**
Email: lavinas913@gmail.com

DOI: 10.47009/jamp.2025.7.3.141

Source of Support: Nil,
Conflict of Interest: None declared

*Int J Acad Med Pharm*
2025; 7 (3); 726-728

## ABSTRACT

**Background:** In human beings, mandible is one of the densest and therefore a strong facial bone and so is also well preserved for a long time as it resists post mortem decomposition. Compared to many other bones, it can even withstand moderate mechanical and thermal trauma without compromising its morphology. Mandible shows a high degree of sexual dimorphism. Morphological and Morphometric parameters were analysed in this study for determination of gender in an attempt to document the idiosyncrasies in its morphology in Jaipur region. **Materials and Methods:** This is a Observational Study. Five Morphometric parameters were examined in 90 mandibles (46 male & 44 female). **Results:** All metric parameters were statistically analysed and 'p value' determined for determination of gender. Morphometric parameters like Maximum Breadth of Ramus, Coronoid Breadth, Bicondylar Breadth and Body Thickness were found to be 'Statistically Significant' while the Mandibular Index was found to be 'Not Statistically Significant'. **Conclusion:** Determination of sex from the available skeletal remains is of great importance in anthropology and medico legal cases. The conventional methods for determination of sex by observation of morphological features depend on the ability as well as the experience of the examiner. We think that more reliance on metrical parameters would be scientifically more accurate. As the morphology of mandible depends on diet, genetics and socio- environmental factors, studies at various different regions would be more prudent.

## INTRODUCTION

Identification of individuals from skeletal remains is an important requirement in Anthropological study, Archaeological study, Medico-legal Scenario, Anatomical Study etc. For determination of various components of Identity, like Age, Stature, Race etc. determination of Sex is the beginning step i.e. we cannot start describing about the Age unless we know that the bone in question belongs to a male or a female. The time period of appearance of the Ossification Centres and their Fusion activity is different in Males and Females. So, by mere observation of an event, we cannot opine about the age of the bone. For example, if the lower end of the femur is fused with the shaft, then for giving our opinion about the age of this bone will require the knowledge about its Sex. If it is a female bone then the age will be 16 – 17 years and if it is a male bone, then the age will be 18 – 19 years.

The same holds true about determining the approximate Stature of an individual from the examination of the bone. After determining the length of the bone, we have to use different formulae for males and females.

So, we can safely summarize that in case of examination of a bone of an unknown individual, first and foremost feature of Identity that should be ascertained should be the Sex of the bone.

It has been observed that criminals have started to try to obliterate the identity of the victim by many methods including amputation. Thus many a times only a bone or part of a bone is available for forensic evaluation for identification.[1] Although pelvis and skull show more sexual dimorphism; Mandible being the most robust one is available for Sex Determination.[2] Many different studies have shown significant sexual dimorphism in Mandible.[3] Compared to other bones, mandible exhibits a strong resistance to environmental conditions and is therefore well preserved after death.[4]

The features of mandible vary from person to person and region to region. The factors like diet, life style and environmental conditions can influence the metric parameters of human mandible.[5] Thus, the morphological attributes of mandible in Jaipur region


ISSN (O): 2687-5365; ISSN (P): 2753-6556

tend to vary from those of other parts of the world. Therefore, a study in our region becomes important.

## MATERIALS AND METHODS

In this study we examined 90 dried human mandibles from museum and departments of Anatomy and Forensic Medicine of SMS Medical College, Jaipur (Rajasthan).

**Year and Period of the Study:** January 2025 – March 2025 (3 months)

**Inclusion Criteria**: Well-developed intact mandibles were included in this study.

**Exclusion Criteria**: Damaged, deformed or edentulous mandibles were excluded.

Based on the morphological features, mandibles were divided into 46 male and 44 female mandibles. The following five Morphometric Parameters were analysed.[4,6]

**Maximum Breadth of Ramus:** The line joining the posterior most point of the condyles with the anterior most point of the mandibular ramus.

**Coronoid Breadth:** Coronoid Breadth is the maximum breadth of the Coronoid Process on one side of the mandible.

**Bicondylar Breadth:** The distance that corresponds to the distance between the most lateral points of each of the two condyles.

**Body Thickness:** In a plane perpendicular to the body's longitudinal axis, body thickness is the thickness of the bone at the foramen mentum.

**Mandibular Index:** Length of Mandible / Bicondylar Breadth X 100

The parameters were measured on the right side using a Digital Vernier Callipers.

## RESULTS

The measurements of all the morphometric parameters were recorded in Microsoft Excel in Spread Sheet Programme. Subsequently, for Statistical Analysis of the data "Graph Pad Prism" (online) was used. The analysis of result was done by using "T-test Calculator" which is a component of "Graph Pad Prism" by the application of "Unpaired T-test".

The significance level was set at '$p<0.05$'. Thus, we obtained the 'p value', the confidence level, the 't value', mean, standard deviation and SEM (Standard Error of Mean).

We used "Student's T-test" and found that the difference was highly significant for all parameters except Mandibular Index. We also found the Standard Deviation was higher in Males which means that Males show greater variability compared to Females.

**Table 1: Descriptive analysis of various Metric Parameters in Male and Female mandibles**

| Parameter | Gender | Mean ± SD (in cm) | p value |
|---|---|---|---|
| Maximum Breadth of Ramus | Male | 2.97 ± 1.09 | <0.05 |
| | Female | 2.88 ± 1.04 | |
| Coronoid Breadth | Male | 7.09 ± 1.70 | <0.05 |
| | Female | 6.24 ± 0.76 | |
| Bicondylar Breadth | Male | 11.29 ± 1.31 | <0.05 |
| | Female | 7.27 ± 1.69 | |
| Body thickness | Male | 1.28 ± 0.46 | <0.05 |
| | Female | 1.08 ± 0.41 | |
| Mandibular Index | Male | 3.80 ± 1.22 | 0.13 |

## DISCUSSION

The morphological features of mandible show marked variation in different ethnicities, races and gender. Determination of sex of human mandible is dependent on morphological and morphometric parameters.[7] There is a problem with Morphological Parameters. Different observers have different ability and experience. Therefore, they may interpret the same Morphologic Feature differently. Thus, these Non-metric parameters become subjective and may suffer from 'Examiner Bias'. In comparison, the Metric Parameters are more objective and reproducible. Here, the 'Examiner Bias' is minimal or absent. There is a significant difference in morphology of mandibles in Males and Females. In our study a higher level of Metric Parameters was found in males than in females.

Anil Kumar et. al,[8] in their study found that the Mean Value and SD of the Maximum Ramus Breadth were 2.97 ± 1.09 cm in Males and 2.88 ± 1.04 cm in Females.

Ranganath et. al,[9] in their study found that the Mean Value and SD of Maximum Breadth of Ramus in males was 3.88 ± 0.52 cm and in females it was 4.07 ± 0.54 cm.

In our study we observed that the Mean value and SD of maximum ramus breadth in males were 2.97 ± 1.09 cm and in females were 2.88 ± 1.04 cm.

The p value was statistically significant.

Anil Kumar et al in their study reported that the mean coronoid breadth in males was 7.09±1.70 cm and in females was 6.24 ± 0.76cm.

Kumar and Loknadham,[10] reported the mean coronoid breadth in males was 9.53 cm & in females was 9.13 cm.

In our study we found that the mean coronoid breadth for males was 7.09 ± 1.70 cm. And in females it was 6.24 ± 0.76 cm. The 'p- value' we got was statistically significant.

Anil Kumar et. al. in their study reported that the mean bicondylar breadth in males was 11.29 ± 4.31cm. and in females it was 7.27 ± 1.69 cm.


ISSN (O): 2687-5365; ISSN (P): 2753-6556

Jaykaran et al,[11] it their study observed that the mean bicondylar breadth of males was 11.26 ± 0.53 cm.

In our study we found that the mean bicondylar breadth in males was 11.29 ± 4.31 cm and in females it was 7.27 ± 1.69 cm. The 'p- value' was found to be statistically significant.

Anil Kumar et. al. in their study reported that the mean body thickness in male was 1.28 ± 0.46cm and in female it was 1.08 ± 0.41 cm.

In their study Kumar and Loknatham found that the mean mandibular body thickness in both males and females was 14.60 ± 1.35 mm.

In our study we found that the mean body thickness in males was 1.28 ± 0.46 cm and in females it was 1.08 ± 0.41cm. We found the 'p-value' to be statistically significant.

Anil Kumar et. al. in their study reported that the mean mandibular index in males was 3.80±1.22 cm. And in females it was 3.92±1.68 cm.

Vinay et al,[7] in their study reported that the mean mandibular index for males was 66.52 ± 4.42 mm while in females it was 66.41 ± 5.69mm.

In our study we found that the mean Mandibular Index in males was 3.80 ± 1.22 cm and in females it was 3.92 ± 1.68 cm. In our study, the result of 'p-value' was not statistically significant.

The results of our study prompt us to believe that our data will be useful in medico legal and academic activities.

We visited different Govt. Centres in our region that are conducting the examination of the bones on behalf of Police or Courts for the purpose of aiding the police investigation or the trial in courts. The method that was being used was the examination of Morphological features of the mandible. It is only in rare cases that the Morphological features are classically following the textbook description. For example, males have a more obtuse gonial angle and females have a less obtuse gonial angle. Most of the doctors with whom we interacted were confused about when to label the gonial angle as 'more obtuse' and when as 'less obtuse'. Thus, with different examiners the same bone may be interpreted differently.

The advantage of Morphometric parameters is that, with every examiner the values of measurements will be the same.

As we know that Mandibles tend to have Morphological features that are dependent on different social habits and different genetic make-up, the morphological features in our region may vary from those of different parts of the world. As only a few studies have been conducted in our region we feel that more such studies should be conducted for more precise knowledge.

## CONCLUSION

Determination of sex from the available skeletal remains is of great importance in anthropology and medico legal cases. The conventional methods for determination of sex by observation of morphological features depend on the ability as well as the experience of the examiner. We think that more reliance on metrical parameters would be scientifically more accurate. As the morphology of mandible depends on diet, genetics and socio-environmental factors, studies at various different regions would be more prudent.

## REFERENCES


1. Yuwanati M, Karia A, Yuwanati M. Canine tooth dimorphism: An adjunct for establishing sex identity. J Forensic Dent Sci.2012;4:80-3.
2. Singh I. Text book of human osteology 3rd edition, Jay Pee Brothers Medical Publisher, New Delhi. 2009. p. 198-203.
3. Naira FD, Nilton A. Non-metrical sexual dimorphism in mandibles of Brazilian individuals. Biomed Res 2017;9:28.
4. Singh R, Mishra SR, Sushobhana K, Passey J, Kumar P, Singh S.Sexual dimorphism in the adult human mandible of North Indian origin. Forensic Med Anat Res 2015;3:82-8.
5. Zvando MD, Suazo GI, Smith RL. Sexual dimorphism determination from linear dimensions of skulls. Int J Morphol 2009;27:133-7.
6. Saini V, Srivastava R, Rai RK, Shamal SN, Singh TB, Tripathi SK. Mandibular ramus: An indicator for sex in fragmentary mandible. J Forensic Sci 2011;56 Suppl 1:S13-6.
7. Vinay G, Gowri SR, Anbalagan J. Sex determination of human mandible using metrical parameters. J Clin Diagn Res 2013;7:2671-3.
8. Anil Kumar, Penprapa S. Klinkhachorn, Ciraj Ali Mohammed. Measurement of Metric and Nonmetric Parameters for Determining the Gender of the Human Mandible. National Journal of Clinical Anatomy 2022;11:22-29.
9. Ranganath V, Yogitha R, Roopa R. Sexual dimorphism in mandibular morphology: A study on South Indian sample. South Asian Anthropol2008;8:9-11.
10. Kumar MP, Lokanadham S. Sex determination & morphometric parameters of the human mandible. Int J Res Med Sci 2017;1:93-6.
11. Jayakaran F, Rajangam S, Janakiram S, Thomas IM. Sexing of the mandible. Anat Karnataka 2000;1:11-6.




ISSN (O): 2687-5365; ISSN (P): 2753-6556