# ESTIMATION OF STATURE USING INTER-CANINE WIDTH AMONG UNDERGRADUATE STUDENTS AND INTERNS IN A TERTIARY CARE HOSPITAL: A CROSS-SECTIONAL STUDY

**Submitted by**

[redacted]

[redacted]

**Submitted to**

[redacted]

**M.D.**

**DEPARTMENT OF FORENSIC MEDICINE AND TOXICOLOGY**

[redacted]

[redacted]

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[redacted]

# LIST OF ABBREVIATIONS

- **ANOVA** – Analysis of Variance
- **B** – Unstandardized Regression Coefficient
- **Beta (β)** – Standardized Regression Coefficient
- **CBCT** – Cone Beam Computed Tomography
- **CI** – Confidence Interval
- **cm** – Centimeter(s)
- **df** – Degrees of Freedom
- **F** – F-statistic
- **ICW** – Inter-Canine Width
- **IQR** – Interquartile Range
- **MaxICW** – Maxillary Inter-Canine Width
- **ManICW** – Mandibular Inter-Canine Width
- **Max** – Maximum
- **Min** – Minimum
- **mm** – Millimeter(s)
- **n** – Number of participants (sample size)
- **p value** – Probability value (level of statistical significance)
- **R** – Correlation coefficient / Multiple correlation coefficient
- **r** – Pearson correlation coefficient
- **$R^2$** – Coefficient of determination
- **SD** – Standard Deviation
- **SE** – Standard Error

- **SEE** – Standard Error of Estimate
- **t** – t-statistic (t-test value)
- **VIF** – Variance Inflation Factor

# ABSTRACT

**Background:** Stature estimation is an important component of forensic identification, particularly when only partial remains or limited anatomical structures are available. Dental measurements are considered relatively stable and resistant to postmortem changes, making them useful in forensic and anthropological investigations. Inter-canine width is a simple odontometric parameter that may aid in stature estimation.

**Aim and Objective:** [redacted]

**Materials and Methods:** [redacted]

**Results:** [redacted]

**Conclusion** [redacted]

**Keywords:** Stature estimation; Inter-canine width; Mandibular inter-canine width; Maxillary inter-canine width; Odontometry; Forensic dentistry; Regression analysis; Anthropometry; Sexual dimorphism; Tertiary care hospital.

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# INTRODUCTION

# INTRODUCTION

Stature is one of the most essential anthropometric parameters used in the identification of an individual in Forensic Science. [redacted] Craniofacial measurements, especially dental parameters, offer promising alternatives due to their durability, resistance to postmortem degradation, and preservation against environmental factors [3].

[redacted]

[redacted]

[redacted]

The rationale for choosing undergraduate medical and dental students, along with interns, as the study population stems from their relatively narrow age range, healthy nutritional status, and accessibility for accurate clinical examination. [redacted]

[redacted] Having a dependable dental-based estimation method provides a significant advantage in such scenarios.

[redacted]

[redacted]

[redacted]The ultimate objective is to develop a method that is reliable, reproducible, and applicable in real-world forensic settings, particularly when other conventional methods are not viable.

## EPIDEMIOLOGY

### Global Scenario

Stature estimation has long been a cornerstone of Forensic identification worldwide. [redacted]

[redacted]

[redacted]Hence, each region needs its own data to improve accuracy in identification processes [15].

**Indian Scenario**

India, with its vast ethnic and cultural diversity, presents a unique challenge in forensic stature estimation. [redacted]

[redacted]

[redacted] This calls for more region-specific research, especially in young adult populations such as college students and interns.

**Karnataka Scenario**

In Karnataka, there is a noticeable paucity of published data on stature estimation using dental anthropometric parameters [1]. [redacted]

[redacted]

Additionally, tertiary care hospitals in Karnataka cater to a diverse group of patients and students from rural and urban areas alike. [redacted]

[redacted] This will not only contribute to local forensic databases but also support medicolegal practices across the state.

# AIMS AND OBJECTIVES

# AIMS AND OBJECTIVES

**OBJECTIVES:** [redacted]

# REVIEW OF LITERATURE

# REVIEW OF LITERATURE

## Stature

[redacted]

According to the World Health Organization (WHO), stature is a key anthropometric measurement used for assessing growth, nutritional status, and population health trends.

[redacted]

## Inter-Canine Width

[redacted]

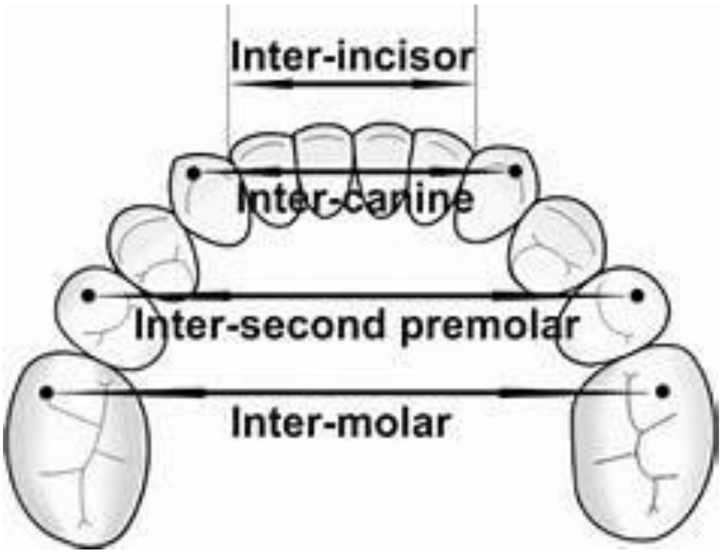



**Figure 1: Diagram of the upper arch showing the measurements of the inter-incisor, inter-canine, inter-premolar and inter-molar widths** (19)**.**

**Odontometry**

[redacted]

- [redacted]
- It is essential in applications such as stature estimation, sex determination, and forensic identification**.**

**Anthropometry**

[redacted]

[redacted]

- [redacted]

- [redacted]
- In the current study, anthropometry refers to the measurement of human stature and its correlation with dental metrics [20].

**Background of Stature Estimation in Forensic Medicine**

Stature plays a fundamental role in forensic identification, especially when dealing with unknown, decomposed, or fragmented human remains [2]. [redacted]

**Significance of Stature in Personal Identification**

Stature is often one of the first physical features noted when describing a person. [redacted]

[redacted]

When other features like facial recognition or fingerprints are unavailable due to decomposition or trauma, stature estimation becomes a critical investigative tool.

**Conventional Methods: Osteometric and Anthropometric Techniques**

Traditionally, stature is estimated using:

[redacted]

[redacted]

However, these methods assume that major skeletal structures are intact and accessible, which is not always the case in forensic settings.

**Challenges in Mutilated, Burned, or Skeletal Remains**

Despite their accuracy, conventional methods come with limitations in real-world forensic cases. [redacted]

[redacted]

This has led to growing interest in odontometric approaches, such as using inter-canine width, as a practical and reliable alternative for estimating stature in forensic practice.

**Anthropometry and Its Role in Human Identification**

The science of anthropometry has been a foundational pillar in Forensic Medicine for over a century, dating back to the era of Alphonse Bertillon, who first systematized the use of body measurements for identification [redacted]. [redacted] It plays a crucial role in the preliminary stages of human identification when visual recognition, fingerprints, or DNA analysis are not possible or are delayed [redacted]

**Definition and Scope of Forensic Anthropometry**

The World Health Organization (WHO) defines anthropometry as "the measurement of the size, shape, and composition of the human body." [redacted]

[redacted]

- [redacted] Direct measurement of bones or body segments (e.g. [redacted]

[redacted]

[redacted] Its reliability and simplicity make it especially useful in the initial screening of unknown bodies before resorting to complex and time-consuming molecular methods (1,25).

**Applications in Mass Disasters and Unknown Bodies**

In situations where human bodies are damaged, dismembered, decomposed, or burned, identification becomes a complex challenge. [redacted]

[redacted]

[redacted]

- Matching physical profiles with missing person reports or ante-mortem data.

International guidelines, such as those issued by INTERPOL, emphasize the role of anthropometry as part of the Disaster Victim Identification (DVI) protocol (28). [redacted]

[redacted] Even small skeletal fragments can yield critical data if standardized measurement protocols are applied.

**Limitations in Resource-Poor or Fragmentary Situations**

[redacted]

**Some key limitations include:**

[redacted] **Incomplete or damaged skeletons**: [redacted]

[redacted] **Burned or charred remains**: [redacted]

[redacted] **Absence of population-specific reference data**: [redacted]

[redacted] **Lack of infrastructure**: [redacted]

[redacted] **Measurement errors**: [redacted]

These limitations underscore the importance of developing and validating alternative methods of stature estimation that are not solely reliant on long bones or complete skeletons.

[redacted]

In summary, Forensic Anthropometry remains a critical aspect of human identification, particularly in the early stages of forensic analysis [redacted]

**Emergence of Forensic Odontology**

Forensic odontology has emerged as a vital subspecialty within Forensic Medicine, bridging the gap between dentistry and medicolegal investigation. [redacted]

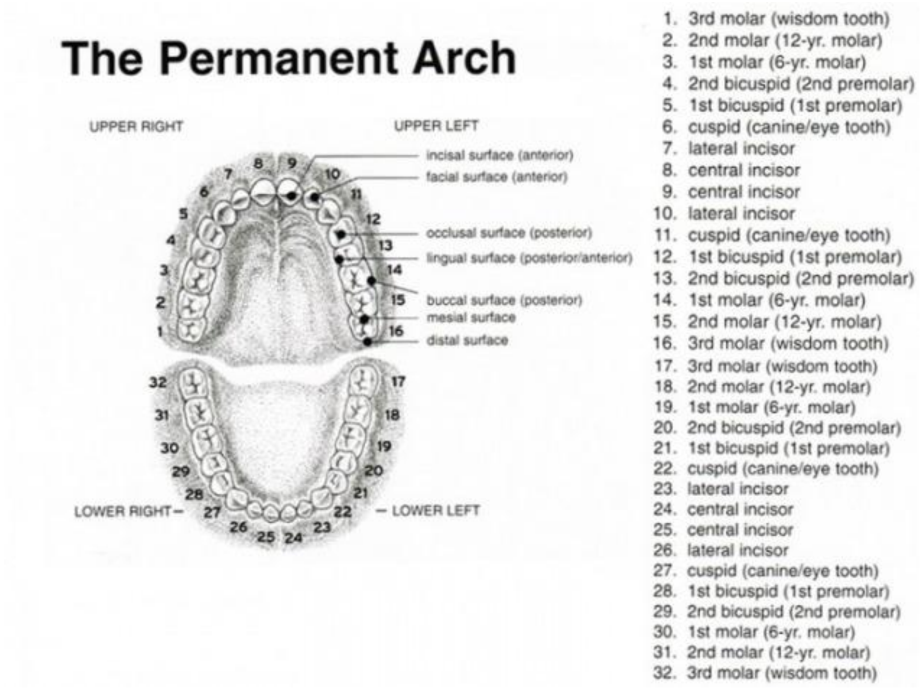



**Figure 2: The Permanent Arch** (32)

**Role of Dentition in Identification**

Dentition plays a critical role in establishing identity, both in the living and the deceased. [redacted]

[redacted]

[redacted] Unusual dental features such as rotated teeth, dental caries, restorations, crowns, prostheses, or orthodontic appliances can serve as identifying markers.

**Postmortem Resistance of Teeth to Destruction**

Teeth are among the most durable components of the human body. [redacted]

[redacted]

[redacted]

For instance, even in aviation accidents or house fires where victims are exposed to intense heat, dental structures particularly the maxillary and mandibular canines are often recoverable and usable for identification [38].

**Dental Records in Medicolegal Cases**

The use of dental records is a cornerstone of Forensic Odontology. [redacted]

[redacted]

- Digital scans and photographs showing dental alignments and aesthetics.

[redacted]

- [redacted]
- [redacted]

[redacted] Their findings often carry considerable weight in cases involving mass fatalities, unclaimed bodies, and criminal investigations.

Forensic Odontology offers a robust, reliable, and scientifically valid method of identification**,** especially when conventional approaches are limited or impossible. [redacted]

**Maxillary Canines and Inter-Canine Width**

Maxillary canines, often referred to as the “cornerstones” of the dental arch, hold significant anatomical and forensic value. [redacted]

**Anatomical Location and Eruption Pattern**

The maxillary canines are located in the upper jaw, lateral to the lateral incisors and mesial to the first premolars [redacted]. [redacted]

**Anatomical features include:**

- Prominent cusp tip with a single sharp point.
- [redacted]

[redacted]

They are:

[redacted]

This delayed eruption and deep positioning in the alveolar bone make them less susceptible to early childhood caries or mechanical trauma [redacted]

**Importance in Orthodontics and Anthropometry**

In orthodontics, maxillary canines play a central role due to their:

[redacted]

They are often used as reference points for:

[redacted]

In **a**nthropometry, the inter-canine width is:

[redacted]

[redacted]

Studies have shown moderate to strong correlation between inter-canine width and height, making it a suitable proxy in cases where long bones are unavailable [redacted]

**Stability in Adult Dentition and Minimal Alteration**

One of the strongest arguments for using maxillary canines in forensic applications is their remarkable stability in adult life. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

This approach, when validated by population-specific studies, can significantly aid identification in challenging medicolegal situations.

**Inter-Canine Width as a Predictor of Stature**

The search for alternative, reliable, and easily accessible parameters for stature estimation has led forensic researchers to explore craniofacial and dental dimensions. [redacted]

**Biometric Relationship Between Craniofacial and Body Proportions**

Human growth and development occur in a coordinated and proportionate manner. [redacted]

[redacted]

This biometric proportionality forms the basis for using inter-canine width as a proxy in estimating stature, especially when conventional long bones are unavailable.

**Rationale for Using Dental Width Measurements**

Using dental dimensions for stature estimation is both scientifically logical and practically valuable in forensic situations. [redacted]

[redacted]

[redacted]

[redacted]

Thus, dental width offers a practical alternative when larger skeletal structures are unavailable or degraded.

**Advantages Over Long Bones in Fragmentary Remains**

In real-life forensic scenarios, especially in mass disasters, fire fatalities, or cases involving mutilation, long bones may not be retrievable or intact, making standard osteometric methods unusable. Here, inter-canine width presents distinct advantages:

[redacted] **Preservation**: [redacted]

[redacted] **Accessibility**: [redacted]

[redacted] **Minimal deformation**: [redacted]

[redacted] **Faster field application**: [redacted]

[redacted]

[redacted]Ongoing research and population-specific studies, such as the present one, aim to further validate its utility and establish standardized regression models for forensic application [redacted]

**Factors Influencing Dental and Stature Relationship**

While dental measurements such as inter-canine width have been proposed as practical alternatives for stature estimation, it is essential to acknowledge that this relationship is not universally fixed. [redacted]Understanding these influencing factors is critical when developing accurate, population-specific regression models for forensic application [redacted]

**Ethnicity, Gender, and Secular Changes**

One of the most significant factors affecting both stature and dental dimensions is ethnic variation. [redacted]

[redacted]

[redacted]

[redacted]

These trends must be considered in longitudinal forensic data sets [45,46].

**Impact of Age and Dental Attrition**

Age influences both stature and dental anatomy in different ways:

[redacted]

In forensic application, this factor is important because:

[redacted]

**Nutritional and Environmental Influences**

Nutrition during critical periods of growth (infancy, childhood, adolescence) plays a pivotal role in the development of both skeletal height and dental structures. [redacted]

[redacted]

[redacted]It also reinforces the importance of developing localized and demographically representative regression models to ensure accuracy and applicability [redacted]

**Sexual Dimorphism and Dental Parameters**

Sexual dimorphism refers to the systematic differences in form between individuals of different sex in the same species. [redacted]

[redacted] The inter-canine width, due to its anatomical stability and measurable precision, serves as a critical parameter in this regard (48).

**Male vs Female Differences in Inter-Canine Width**

One of the most consistently observed odontometric differences between sexes is the larger inter-canine width in males compared to females. [redacted]

[redacted]

[redacted]

[redacted]

These variations not only assist in determining sex but also influence stature estimation models, necessitating the separation of datasets based on gender.

**Implication in Sex-Specific Regression Models**

Due to the clear distinction in inter-canine width between males and females, combined regression models (using pooled data from both sexes) often result in reduced accuracy. [redacted]

[redacted]

Sexual dimorphism in dental width is particularly advantageous in partial remains, where long bones may not be available, but maxillary or mandibular arches are preserved. [redacted]

[redacted]

**Previous Findings on Dimorphism in Indian Population**

Several Indian studies have explored odontometric sexual dimorphism with consistent findings:

[redacted]

These findings not only support the importance of inter-canine width in stature estimation but also reinforce its dual utility in sex estimation, making it a powerful tool in Forensic Odontology.

Sexual dimorphism in dental parameters, especially inter-canine width, is a critical consideration in forensic stature estimation. [redacted] With supporting literature and measurable anatomical differences, inter-canine width stands out as a reliable dual-purpose marker in the reconstruction of both sex and stature from dental remains (49,51).

**Postmortem Identification Using Dental Remains**

Dental structures, particularly canines, play a pivotal role in postmortem identification, especially in scenarios where the body is mutilated, decomposed, incinerated, or reduced to skeletal remains[redacted].

**Durability of Canines After Decomposition and Incineration**

Maxillary and mandibular canines are among the most robust teeth in the human dentition, characterized by:

[redacted]

These anatomical features provide extraordinary resistance to physical, chemical, and environmental degradation.

**In decomposition:**

[redacted]

**In incineration:**

[redacted]

[redacted]

**Application in Mass Disasters, Burn Victims, Skeletal Remains**

In large-scale forensic scenarios such as:

[redacted]Mass disasters [redacted]
[redacted]Burn cases [redacted]
[redacted]Advanced decomposition [redacted]

[redacted]

Thus, the forensic value of dental remains, particularly canines, is underscored in extreme postmortem conditions where other tissues and bones fail to provide useful information.

**Integration in Forensic Workflow**

In a standard medicolegal workflow, dental identification is increasingly being integrated alongside other primary identifiers such as fingerprints and DNA. [redacted]

[redacted]

**In forensic case management:**

- Dental remains are examined in conjunction with anthropological and radiological assessments.

[redacted]

[redacted]

**Odontometric Tools and Techniques**

Accurate measurement of dental parameters such as inter-canine width is essential for reliable application in forensic identification and stature estimation. [redacted]

[redacted]

**Use of Vernier Caliper, Digital Caliper, and 3D Scanners**

**Vernier Caliper**: The traditional and most commonly used tool for measuring inter-canine width is the Vernier caliper, which provides millimetre-scale accuracy. It is:

[redacted]

**Digital Caliper**: [redacted]

[redacted]

**3D Scanners**: [redacted]

[redacted]

3D scanners also facilitate non-destructive analysis, especially valuable in handling fragile or charred remains.

**Calibration and Standard Operating Procedures**

[redacted]

**Calibration practices include**:

[redacted]

**Standard Operating Procedures (SOPs)** should define:

[redacted] The exact anatomical landmarks to be used [redacted]

[redacted]

### Minimizing Intra-Observer and Inter-Observer Error

Observer variation is a common source of error in odontometric studies and must be controlled through careful technique and documentation.

[redacted]

**To minimize these errors:**

- Examiners should undergo training and standardization exercises before data collection begins.

[redacted]

[redacted]

[redacted]

[redacted] Whether using simple tools like Vernier calipers or advanced digital scanners, proper calibration, procedural discipline, and error minimization are essential for generating valid forensic data that can withstand scrutiny in both scientific and legal contexts [58].

**Statistical Models in Stature Prediction**

The application of statistical models forms the foundation of any scientific attempt to predict stature using odontometric or anthropometric measurements. [redacted]

**Correlation and Regression Methods**

[redacted]

[redacted]

- [redacted].

[redacted]

[redacted]

**Linear regression analysis is then used to:**

Derive a predictive equation in the form:

[redacted]

[redacted]

**Reliability and Predictive Accuracy**

The reliability of a regression model depends on several key statistical indicators:

[redacted]

Other measures such as the mean absolute error (MAE) or root mean square error **(**RMSE) may also be reported to assess model performance. [redacted]

[redacted]

- [redacted]
- Measurement errors are minimized during data collection.

**Challenges in Model Validation and External Applicability**

Despite the promising results often seen in localized studies, several challenges exist when applying these models to broader forensic practice:

[redacted] **Population specificity**: [redacted]

[redacted] **Sample variability**: [redacted]

[redacted] **External validation** is [redacted]

[redacted] **Biological variation**: [redacted]

Moreover, in forensic casework, applying a model to a decedent without knowing their ethnic background or sex may reduce predictive confidence. [redacted]

[redacted]

Statistical modelling particularly through correlation and regression is essential for converting dental measurements into usable stature estimates. [redacted]

**Study Population: Rationale for Selecting Students and Interns**

[redacted]

**Healthy, Uniform Age Group (18–25 Years)**

[redacted]

- Full eruption of permanent dentition, including the maxillary canines, with little or no further change in arch width.
- [redacted]

By focusing on this specific age range, the study avoids confounding variables related to growth spurts (seen in adolescents) or height reduction (seen in older adults), thus providing accurate baseline data for stature estimation.

**Cooperative and Accessible in Institutional Settings**

Undergraduate students and medical/dental interns are:

- [redacted]

[redacted]

This logistical convenience enables consistent measurement protocols, fewer drop outs, and better data quality, particularly when multiple observations or re-measurements are required.

**Minimal Dental Pathology or Orthodontic Intervention**

One of the crucial criteria for using inter-canine width in stature estimation is that the measurement must be taken from unaltered natural dentition. [redacted]

[redacted]

[redacted]

[redacted]

[redacted] This approach not only enhances the accuracy of the study but also lays the foundation for future research on population-specific forensic applications.

**Medico-Legal and Identification Applications**

The ultimate goal of any anthropometric or odontometric method in Forensic Medicine is to aid in the identification of unknown individuals, particularly when routine means like visual recognition or fingerprinting are not feasible. [redacted]

**Complement to Skeletal-Based Estimation Methods**

Stature estimation has traditionally relied on long bones (femur, tibia, humerus) due to their strong correlation with height (64). [redacted]

In such situations, dental measurements especially inter-canine width can serve as an effective complement to skeletal methods (12). [redacted]

**Use in Unrecognizable and Skeletonized Bodies**

One of the biggest challenges in forensic casework is dealing with unrecognizable remains due to:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Teeth are also less prone to environmental degradation, and measurements can still be obtained from cast impressions or 3D scanned models, making them highly useful in both field and lab-based forensic identification (63).

**Legal Admissibility and Documentation Standards**

For any method used in forensic investigations to be legally accepted, it must be:

[redacted]

[redacted]

- Standard operating procedures are followed.
- Measurements are reproducible and clearly recorded.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] Its integration into the forensic workflow and increasing legal recognition make it a vital component of modern forensic practice [56,65].

**Conceptual Framework**

The conceptual framework for this study is built upon the premise that certain odontometric parameters particularly inter-canine width exhibits a biologically proportionate relationship with overall body stature. [redacted]

**Visual Model: Link Between Inter-Canine Width and Stature**

[redacted]

**This relationship can be visually conceptualized as:**

Genetic & Hormonal Factors
[redacted]

[redacted]This concept provides the scientific foundation for using inter-canine width as a predictor of stature when traditional skeletal remains are unavailable.

**Influencing Variables and Confounders**

[redacted]

**Key influencing variables include:**

- **Sex**: [redacted]
- **Ethnicity**: [redacted]
[redacted]**Age**: [redacted]
- **Dental anomalies**: [redacted]

[redacted] **Nutritional status**: [redacted]

[redacted]

[redacted]

Controlling these variables helps ensure that the derived regression models reflect biological correlation, rather than external influences or anomalies.

**Predictive Potential in Forensic Casework**

[redacted]

[redacted] **Stature estimation from partial remains**: [redacted]

[redacted] **Disaster victim identification (DVI)**: [redacted]

[redacted] **Biological profiling**: [redacted]

[redacted] **Supporting evidence**: [redacted]

[redacted]

[redacted]

[redacted]

**Expected Forensic Applications**

The application of dental measurements, specifically inter-canine width in stature estimation is not only a valuable academic exercise but also holds significant practical utility in forensic casework. [redacted]

**Use in Unidentified Dead Bodies and Skeletonized Remains**

In real-world forensic scenarios, unidentified bodies are frequently encountered, especially in the context of:

- Train accidents
- [redacted]

[redacted] However, teeth especially maxillary canines are often preserved, even when the rest of the skeleton is compromised.

**This study will provide:**

- Validated regression models to estimate stature using inter-canine width in such cases.
- [redacted]

The findings thus directly support the reconstruction of a biological profile in scenarios where identification would otherwise be delayed or impossible.

**Practicality in Resource-Limited Rural Forensic Centers**

[redacted]

- Advanced radiographic equipment
- [redacted]

[redacted]

- Requires minimal equipment (e.g., digital caliper)
- [redacted]

[redacted]

[redacted]

**Addition to Regional Anthropometric Reference Databases**

[redacted]

- [redacted]

- Assist forensic institutes and teaching departments in developing modules, training, and case-based learning tools.

[redacted]

[redacted] Inter-canine width, as a measurable and durable parameter, presents a practical solution to one of the persistent challenges in Forensic Medicine: accurate and accessible stature estimation.

**Research Studies**

[redacted]**. (2004)** conducted a seminal study aimed at assessing the sexual dimorphism of mandibular canines in the North Indian population using the Mandibular Canine Index (MCI). [redacted]

[redacted] **(2010)** investigated the relationship between nasal width and inter-canine distance across different maxillary arch forms to evaluate the use of facial measurements in prosthodontic tooth selection. [redacted]

[redacted] **(2013)** assessed the reliability of mandibular canine indices in predicting gender in an Indian population. [redacted], [redacted]

[redacted] **(2014)** explored sexual dimorphism using the mesiodistal width and inter-canine distance of maxillary canines in 120 dental students (60 males and 60 females). [redacted]

[redacted] **(2015)** investigated the correlation of intercanthal and interalar widths with inter-canine width in 200 individuals (100 males, 100 females) from Central India. [redacted]

[redacted] **(2015)** aimed to validate the use of inter-canine width in forensic facial reconstruction. [redacted]

[redacted]

[redacted] **(2015)** evaluated the Mandibular Canine Index (MCI) for gender estimation in a group of 150 dental students aged 18–25 years. [redacted]

[redacted] **(2017)** investigated the morphometric characteristics of the maxillary arch for determining sexual dimorphism in a sample of 200 adults (100 males, 100 females) from North India. [redacted]

[redacted] **(2021)** evaluated the use of odontometric parameters, including inter-canine and inter-molar widths, in stature estimation. [redacted]

[redacted]

[redacted] **(2021)** examined the reliability of multiple odontometric parameters, including inter-canine width, in estimating stature among 150 Indian adults aged 20–35 years. [redacted]

[redacted] **(2021)** assessed the correlation between inter-canine width and the basal plane angle in orthodontic patients. [redacted]

[redacted] **(2021)** investigated the correlation between cephalic index (CI), facial index (FI), and dental parameters like inter-canine width for reconstructive and forensic applications. [redacted]

[redacted] **(2022)** directly addressing stature prediction from dental metrics in an Indian subpopulation. [redacted]

[redacted] **(2023)** assessed whether specific dental measurements, inter-canine arch width, intermolar arch width, and canine fossa width, could reliably predict gender. [redacted]

[redacted]

[redacted] **(2023)** focused on estimating human soma types (ectomorph, mesomorph, endomorph) using dental metrics such as maxillary inter-canine and inter-premolar widths. [redacted]

[redacted] **(2024)** aimed at correlating odontometric data especially inter-canine widthwith stature. [redacted]

[redacted] **(2024)** evaluated the effectiveness of clinical versus experimental methods (digital casts and radiographs) in estimating sex using mandibular canine dimensions among the Himachal population. The sample included 80 males and 80 females aged 18–30 years. [redacted]

[redacted]

[redacted] **(2025)** aimed at directly predicting height using odontometric indices, especially inter-canine width. Conducted on 150 medical students aged 18–30 years, the researchers measured inter-canine distance using study casts and height with stadiometers. [redacted]

[redacted] **(2022)** focused on assessing sexual dimorphism through the odontometric evaluation of maxillary canines in a North Central Indian population. [redacted]

[redacted]

[redacted] **(2023)** explored the relationship between intercondylar distance and mandibular inter-canine distance using orthopantomograms (OPG) of 120 adult subjects. [redacted]

**Research Gap and Need for the Present Study**

[redacted]

**A critical analysis of existing literature reveals the following** research gaps**:**

[redacted]

[redacted]

[redacted] However, for such methods to be effective and legally admissible, they must be supported by locally derived and statistically validated data (17,72).

**Need for the Present Study**

This study addresses these gaps by focusing on a healthy, region-specific sample (undergraduate students and interns from Karnataka), with an emphasis on:

[redacted]

[redacted]

# MATERIALS AND METHODS

# MATERIALS AND METHODS

**Source of Data:** [redacted]

**Study Design:** Cross sectional Study

**Study Period:** [redacted]

**Sample Size:**

[redacted]

**Sample size =** [redacted]

**Sampling Technique:** [redacted]

**Inclusion Criteria:** [redacted]

**Exclusion Criteria:** [redacted]

**Study protocol: Consort flow chart for RCTs** : [redacted]

**Data collection procedure:** [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

**Data processing and analysis/statistical analysis:**

[redacted]

[redacted]

[redacted]

[redacted]

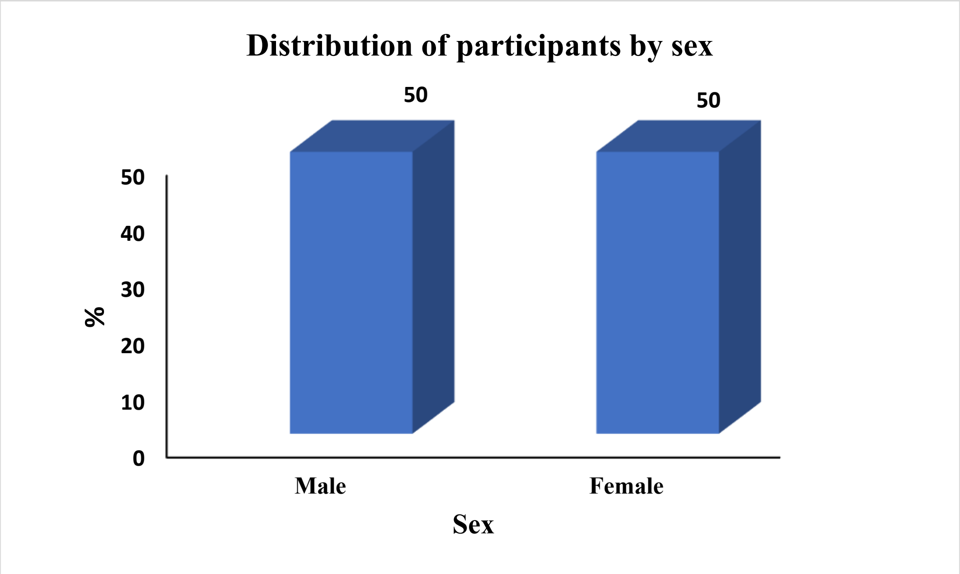
# RESULTS

# RESULTS

**Table 1. Distribution of participants by sex (n = 106)**

| Sex | n | % |
|---|---|---|
| **Male** | 53 | 50.0 |
| **Female** | 53 | 50.0 |
| **Total** | 106 | 100.0 |

**Graph 1: Distribution of participants by sex**




In the present study, I included 106 participants, with an equal distribution of males (n=53; 50.0%) and females (n=53; 50.0%). This balanced sex distribution strengthens comparisons between groups and improves the interpretability of sex-stratified analyses.

**Table 2. Age distribution by sex (Descriptive statistics)**

| Sex | n | Mean ± SD (years) | Median (IQR) | Min–Max |
|---|---|---|---|---|
| [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 3. Stature distribution by sex (Descriptive statistics)**

| Sex | n | Mean ± SD (cm) | Median (IQR) | Min–Max |
|---|---|---|---|---|
| Male | [redacted] | [redacted] | [redacted] | [redacted] |
| Female | [redacted] | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 4. Maxillary inter-canine width distribution by sex (Descriptive statistics)**

| Sex | n | Mean ± SD (mm) | Median (IQR) | Min–Max (mm) |
|---|---|---|---|---|
| **Male** | [redacted] | [redacted] | [redacted] | [redacted] |
| **Female** | [redacted] | [redacted] | [redacted] | [redacted] |

[redacted]

.

**Table 5. Mandibular inter-canine width distribution by sex (Descriptive statistics)**

| Sex | n | Mean ± SD (mm) | Median (IQR) | Min–Max (mm) |
|---|---|---|---|---|
| Male | [redacted] | [redacted] | [redacted] | [redacted] |
| Female | [redacted] | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 6. Normality assessment by sex (Shapiro–Wilk test)**

| Variable | Sex | Shapiro–Wilk Statistic | df | p value |
|---|---|---|---|---|
| **Stature (cm)** | Male | [redacted] | [redacted] | [redacted] |
| **Stature (cm)** | Female | [redacted] | [redacted] | [redacted] |
| **Maxillary ICW (mm)** | Male | [redacted] | [redacted] | [redacted] |
| **Maxillary ICW (mm)** | Female | [redacted] | [redacted] | [redacted] |
| **Mandibular ICW (mm)** | Male | [redacted] | [redacted] | [redacted] |
| **Mandibular ICW (mm)** | Female | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 7. Comparison of males and females: stature and inter-canine widths (Independent samples t-test)**

| Outcome | Levene F | Levene p | t | df | p (2-tailed) | Mean difference (M−F) | 95% CI Lower | 95% CI Upper |
|---|---|---|---|---|---|---|---|---|
| Stature (cm) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Maxillary ICW (mm) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Mandibular ICW (mm) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 8. Sex difference in stature (Independent samples t-test)**

| Variable | Male Mean ± SD | Female Mean ± SD | Levene p | t | df | p (2-tailed) | Mean diff (M−F) | 95% CI |
|---|---|---|---|---|---|---|---|---|
| Stature (cm) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 9. Sex difference in maxillary inter-canine width (Independent samples t-test)**

| Variable | Male Mean ± SD | Female Mean ± SD | Levene p | t | df | p (2-tailed) | Mean diff (M−F) | 95% CI |
|---|---|---|---|---|---|---|---|---|
| Maxillary ICW (mm) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 10. Sex difference in mandibular inter-canine width (Independent samples t-test)**

| Variable | Male Mean ± SD (mm) | Female Mean ± SD (mm) | Levene F | Levene p | t | df | p (2-tailed) | Mean diff (M−F) | 95% CI Lower | 95% CI Upper |
|---|---|---|---|---|---|---|---|---|---|---|
| Mandibular inter-canine width | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Table 11. Pearson correlation matrix (overall, n = 106)**

| Pair of variables | Pearson r | p (2-tailed) | N |
|---|---|---|---|
| Stature vs Maxillary inter-canine width | [redacted] | [redacted] | [redacted] |
| Stature vs Mandibular inter-canine width | [redacted] | [redacted] | [redacted] |
| Stature vs Age | [redacted] | [redacted] | [redacted] |
| Maxillary inter-canine width vs Mandibular inter-canine width | [redacted] | [redacted] | [redacted] |
| Maxillary inter-canine width vs Age | [redacted] | [redacted] | [redacted] |
| Mandibular inter-canine width vs Age | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 12. Pearson correlations among variables in males (n = 53)**

| Pair of variables (males) | Pearson r | p (2-tailed) | N |
|---|---|---|---|
| Stature vs Maxillary inter-canine width | [redacted] | [redacted] | [redacted] |
| Stature vs Mandibular inter-canine width | [redacted] | [redacted] | [redacted] |
| Stature vs Age | [redacted] | [redacted] | [redacted] |
| Maxillary inter-canine width vs Mandibular inter-canine width | [redacted] | [redacted] | [redacted] |
| Maxillary inter-canine width vs Age | [redacted] | [redacted] | [redacted] |
| Mandibular inter-canine width vs Age | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 13. Pearson correlations among variables in females (n = 53)**

| Pair of variables (females) | Pearson r | p (2-tailed) | N |
|---|---|---|---|
| Stature vs Maxillary inter-canine width | [redacted] | [redacted] | [redacted] |
| Stature vs Mandibular inter-canine width | [redacted] | [redacted] | [redacted] |
| Stature vs Age | [redacted] | [redacted] | [redacted] |
| Maxillary inter-canine width vs Mandibular inter-canine width | [redacted] | [redacted] | [redacted] |
| Maxillary inter-canine width vs Age | [redacted] | [redacted] | [redacted] |
| Mandibular inter-canine width vs Age | [redacted] | [redacted] | [redacted] |

[redacted]

**Table 14. Simple linear regression (overall): Prediction of stature using maxillary inter-canine width**

**Table 14A. Model summary (overall)**

| Model | R | $R^2$ | Adjusted $R^2$ | Std. Error of Estimate |
|---|---|---|---|---|
| 1 | [redacted] | [redacted] | [redacted] | [redacted] |

**Table 14B. ANOVA for regression model (overall)**

| Model | Sum of Squares | df | Mean Square | F | p value |
|---|---|---|---|---|---|
| Regression | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Residual | [redacted] | [redacted] | [redacted] | | |
| Total | [redacted] | [redacted] | | | |

**Table 14C. Regression coefficients (overall)**

| Predictor | B (Unstandardized) | SE | Beta (Standardized) | t | p value | 95% CI (Lower) | 95% CI (Upper) |
|---|---|---|---|---|---|---|---|
| Constant | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |
| Maxillary inter-canine width (mm) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Regression equation (overall)**

[redacted]

[redacted]

**Table 15. Simple linear regression (overall): Prediction of stature using mandibular inter-canine width**

**Table 15A. Model summary (overall)**

| Model | R | $R^2$ | Adjusted $R^2$ | Std. Error of Estimate |
|---|---|---|---|---|
| [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Table 15B. ANOVA for regression model (overall)**

| Model | Sum of Squares | df | Mean Square | F | p value |
|---|---|---|---|---|---|
| Regression | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Residual | [redacted] | [redacted] | [redacted] | | |
| Total | [redacted] | [redacted] | | | |

**Table 15C. Regression coefficients (overall)**

| Predictor | B (Unstandardized) | SE | Beta (Standardized) | t | p value | 95% CI (Lower) | 95% CI (Upper) |
|---|---|---|---|---|---|---|---|
| Constant | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |
| Mandibular inter-canine width (mm) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Regression equation (overall)**

[redacted]

[redacted]

[redacted]

**Table 16. Multiple linear regression (overall): Prediction of stature using maxillary ICW, mandibular ICW, age, and sex**

**Table 17A. Model summary (overall)**

| Model | R | R² | Adjusted R² | Std. Error of Estimate |
|---|---|---|---|---|
| 1 | [redacted] | [redacted] | [redacted] | [redacted] |

**Table 16B. ANOVA for regression model (overall)**

| Model | Sum of Squares | df | Mean Square | F | p value |
|---|---|---|---|---|---|
| Regression | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Residual | [redacted] | [redacted] | [redacted] | | |
| Total | [redacted] | [redacted] | | | |

**Table 16C. Regression coefficients with collinearity statistics (overall)**

| Predictor | B | SE | Beta | t | p value | 95% CI (Lower) | 95% CI (Upper) | Tolerance | VIF |
|---|---|---|---|---|---|---|---|---|---|
| Constant | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] | | |
| Maxillary ICW (mm) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Mandibular ICW (mm) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Age (years) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Sex (1=Male, 2=Female) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Regression equation (overall)**

[redacted]

[redacted]

**Table 17. Sex-wise regression equations: Prediction of stature using inter-canine widths (separate models in males and females)**

**Table 17A. Regression models by sex: Stature predicted by maxillary inter-canine width**

| Sex | R | $R^2$ | Adjusted $R^2$ | SEE | F (df1, df2) | p value |
|---|---|---|---|---|---|---|
| **Male** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **Female** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Table 17B. Coefficients (sex-wise): Stature predicted by maxillary inter-canine width**

| Sex | Predictor | B | SE | Beta | t | p value | 95% CI Lower | 95% CI Upper |
|---|---|---|---|---|---|---|---|---|
| **Male** | [redacted] | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |
| **Male** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **Female** | [redacted] | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |
| **Female** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Sex-wise equations (Maxillary ICW):**

[redacted]

[redacted]

**Table 17C. Regression models by sex: Stature predicted by mandibular inter-canine width**

| Sex | R | $R^2$ | Adjusted $R^2$ | SEE | F (df1, df2) | p value |
|---|---|---|---|---|---|---|
| **Male** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **Female** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Table 17D. Coefficients (sex-wise): Stature predicted by mandibular inter-canine width**

| Sex | Predictor | B | SE | Beta | t | p value | 95% CI Lower | 95% CI Upper |
|---|---|---|---|---|---|---|---|---|
| **Male** | [redacted] | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |
| **Male** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **Female** | [redacted] | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |
| **Female** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Sex-wise equations (Mandibular ICW):**

[redacted]

[redacted]

# DISCUSSION

# DISCUSSION

**Distribution of participants by sex**

In the present study, a total of 106 participants were included with an equal distribution of males [redacted] and females [redacted] (2005) have emphasized that demographic balance (including sex) strengthens identification models and improves applicability across populations (21,54).

**Age distribution by sex**

In the present study, participants belonged to a narrow young adult age range of [redacted] years in both sexes. [redacted]

[redacted] (2020) emphasized that regression models for stature estimation should be derived from populations with stable anatomical measurements, which is strengthened in the present study by the limited age range and comparable distribution between sexes (2).

**Stature distribution by sex**

In the present study, a clear sex-wise difference in stature was observed. [redacted]

[redacted](2018) demonstrated that height prediction from tooth size showed variation between sexes, and that sex differences in stature must be considered while interpreting odontometric predictors (43).

**Maxillary inter-canine width distribution by sex**

In the present study, the mean maxillary inter-canine width (ICW) was [redacted] mm in males and [redacted] mm in females, with closely similar median and range values. [redacted]

[redacted] (2015) found that maxillary inter-canine width showed limited sex variation when compared with other craniofacial parameters (62).

**Mandibular inter-canine width distribution by sex**

In the present study, mandibular inter-canine width (ICW) showed a clear sex-wise difference. [redacted]

[redacted] (2021) also reported sex differences in odontometric measurements, reinforcing the broader pattern of male predominance in mandibular dental dimensions (52).

**Normality assessment by sex (Shapiro–Wilk test)**

In the present study, the Shapiro–Wilk test was used to evaluate whether the distribution of stature and inter-canine width variables followed a normal distribution separately in males and females. [redacted] The present findings, showing normality in most odontometric variables, therefore support the appropriateness of applying Pearson correlation and linear regression models in subsequent analyses.

**Comparison of males and females: stature and inter-canine widths (Independent samples t-test)**

In the present study, independent samples t-test demonstrated a highly significant sex difference in stature, with males being taller than females (mean difference = [redacted] cm; [redacted]). [redacted] Additionally, Hosmani et al. (2013) reinforced that mandibular canine measurements are reliable indicators of sexual dichotomy, aligning with the significant mandibular ICW difference observed in the present study (51).

**Sex difference in stature (Independent samples t-test)**

In the present study, stature showed a marked and statistically significant sex difference. [redacted]

[redacted] Furthermore, Bidmos and Brits (2025) highlighted that population-specific regression equations often perform better when demographic variables such as sex are considered, supporting the importance of sex-wise stature reporting as done in the present study (30).

**Sex difference in maxillary inter-canine width (Independent samples t-test)**

In the present study, maxillary inter-canine width (ICW) did not differ significantly between sexes ([redacted]). [redacted]

[redacted]

Likewise, broader odontometric dimorphism work (e.g. [redacted] Soundarya et al., 2021) supports that sex differences may exist in dental dimensions, but not necessarily uniformly across every parameter or population (52).

**Sex difference in mandibular inter-canine width (Independent samples t-test)**

In the present study, mandibular inter-canine width (ICW) demonstrated a statistically significant sex difference. [redacted]

[redacted] Soundarya et al. (2021) support that males typically exhibit larger odontometric values than females, particularly in mandibular measurements (52).

**Pearson correlation matrix**

In the present study, Pearson correlation analysis demonstrated that stature showed a significant positive correlation with mandibular inter-canine width ([redacted], [redacted]), indicating that individuals with greater mandibular inter-canine width tended to have greater stature. [redacted]

[redacted] Khatri et al. (2024) highlighted that odontometric correlations with stature can differ depending on the parameter measured and population characteristics, which supports the present finding of non-significance for maxillary ICW (46).

**Pearson correlations among variables in males**

In the present study, Pearson correlation analysis in males ([redacted]) showed that stature had no significant correlation with maxillary inter-canine width [redacted]). [redacted]

[redacted](2015) demonstrated that odontometric predictors may show differing levels of association with stature, reinforcing the importance of evaluating parameters separately by sex (12).

**Pearson correlations among variables in females**

In the present study, Pearson correlation analysis in females ([redacted]) showed that stature had a statistically significant positive correlation with mandibular inter-canine width ([redacted]). [redacted](2020) emphasized that regression-based stature estimation models may require subgroup-specific interpretation, and predictors that are weak in one sex may be stronger in another, supporting the present female-specific correlation outcome (2).

**Maxillary inter-canine width predicting stature (Simple linear regression)**

In the present study, the simple linear regression model using maxillary inter-canine width (ICW) as the sole predictor of stature showed an extremely weak relationship ([redacted]) and explained only [redacted] of the variance in stature ([redacted]; adjusted [redacted]), with a relatively large standard error of estimate (SEE) = [redacted] cm. [redacted](2023) showed improved stature estimation when odontometric parameters were combined with additional anthropometric/skull variables, supporting the inference that maxillary ICW may be more useful as part of a multivariable model rather than as a standalone predictor (66).

**Maxillary inter-canine width predicting stature: ANOVA for regression model (overall)**

In the present study, the ANOVA table for the simple linear regression model evaluating maxillary inter-canine width (ICW) as a predictor of stature demonstrated that the overall model was not statistically significant ([redacted]). [redacted]

[redacted](2023) reported improved predictive accuracy when odontometric measures were combined with other anthropometric variables, reinforcing that a single weak predictor may fail to generate a significant model (66).

**Maxillary inter-canine width predicting stature: Regression coefficients (overall)**

In the present study, the regression coefficient table confirms that maxillary inter-canine width (ICW) is not a significant predictor of stature. [redacted]

[redacted]

[redacted](2023) showed improved predictive performance when odontometric variables were combined with other craniofacial or anthropometric measurements, supporting the inference that maxillary ICW may only contribute in multivariable contexts rather than as a single predictor (66).

**Mandibular inter-canine width predicting stature (Simple linear regression): Model summary (overall)**

In the present study, the simple linear regression model using mandibular inter-canine width (ICW) as the predictor showed a moderate positive relationship with stature [redacted] and explained [redacted] of the variance in stature [redacted]

[redacted] (2023) supported improved stature estimation when odontometric predictors are combined with other measurements, which is consistent with the moderate explanatory power seen in this single-predictor model (66).

**Mandibular inter-canine width predicting stature: ANOVA for regression model (overall)**

In the present study, the ANOVA for the simple linear regression model using mandibular inter-canine width (ICW) as a predictor of stature showed that the model was highly statistically significant ([redacted]). [redacted]

[redacted]
(2024) highlighted that odontometric parameters may demonstrate significant predictive relationships with stature, but results vary by population, which reinforces the importance of validating such regression models in specific cohorts as done in the present study (46).

**Mandibular inter-canine width predicting stature: Regression coefficients (overall)**

In the present study, the regression coefficient analysis demonstrated that mandibular inter-canine width (ICW) is a statistically significant predictor of stature. [redacted]

[redacted](2024) reported odontometric correlation with stature and emphasized population-specific applicability, supporting the need for local regression equations such as the one derived in the present study (46).

**Multiple linear regression predicting stature: Model summary (overall)**

In the present study, the multiple linear regression model predicting stature using maxillary inter-canine width, mandibular inter-canine width, age, and sex demonstrated a strong overall relationship with stature ([redacted]) and explained a substantial proportion of variance [redacted]). [redacted] Broader forensic stature estimation studies such as Kamal and Yadav (2016) also support multivariable prediction models for improved explanatory power, particularly when demographic factors like sex are included (10).

**Multiple linear regression predicting stature: ANOVA for regression model (overall)**

In the present study, the ANOVA for the multiple linear regression model predicting stature using maxillary inter-canine width, mandibular inter-canine width, age, and sex showed that the overall regression model was highly statistically significant ([redacted]). [redacted] (2024) also supported that odontometric parameters can contribute to stature estimation and that predictive performance improves when relevant variables are integrated into the model, which is consistent with the present highly significant ANOVA result (46).

**Regression coefficients with collinearity statistics (overall)**

In the present study, the multiple linear regression model showed that sex and age were significant predictors of stature, while odontometric predictors contributed less strongly after adjustment. [redacted] (2024), who noted that odontometric predictors may show moderate associations in isolation but can become weaker after adjustment for other variables, reinforcing the need for population-specific multivariable validation (42,46).

**Sex-wise regression models: Stature predicted by maxillary inter-canine width**

In the present study, sex-stratified simple linear regression showed that maxillary inter-canine width (MaxICW) had negligible predictive value for stature in both males and females. [redacted] (2024) illustrate that odontometric predictors can be explored for stature estimation, but the strength and significance can vary by population, sex, and measurement protocol (43,46).

**Sex-wise regression coefficients: Stature predicted by maxillary inter-canine width**

In the present study, sex-wise regression coefficients further confirm that maxillary inter-canine width (MaxICW) is not a significant predictor of stature in either sex. [redacted]

[redacted] In the present study, the wide confidence intervals and non-significant p-values clearly indicate that MaxICW-based equations should not be applied for stature prediction.

**Sex-wise regression models: Stature predicted by mandibular inter-canine width**

In the present study, sex-wise regression analysis demonstrated a clear difference in predictive performance of mandibular inter-canine width (ManICW) between males and females. [redacted]

[redacted](2024) also emphasized that odontometric predictors of stature are population-dependent and can show variable predictive performance, supporting the present observation that ManICW is significant only in females (46).

**Sex-wise regression coefficients: Stature predicted by mandibular inter-canine width**

In the present study, sex-wise regression coefficients demonstrate that mandibular inter-canine width (ManICW) has different predictive value in males and females. [redacted]

[redacted]

[redacted] (2024) similarly emphasized population-specific variability in odontometric–stature relationships, reinforcing the need for sex-wise validation as performed in the present study (46).

# STRENGTHS AND LIMITATIONS

# STRENGTHS OF THE STUDY

1. Equal sex distribution (53 males and 53 females), improving reliability of sex-wise comparisons.

[redacted]

9. Collinearity was minimal, suggesting stable and reliable regression estimates.

# LIMITATIONS OF THE STUDY

1. Single-center study, limiting generalizability to other regions/populations.

[redacted]

8. Cross-sectional design, so causal inference cannot be made only association can be reported.

# CONCLUSION

# CONCLUSION

In the present cross-sectional study conducted among 106 undergraduate students and interns in a tertiary care hospital, an equal number of males ([redacted]) and females ([redacted]) were included. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]Overall, the study concludes that mandibular inter-canine width has greater potential than maxillary inter-canine width for stature estimation, and the most accurate prediction is achieved when odontometric variables are used along with demographic factors such as age and sex.

# SUMMARY

# SUMMARY

The present cross-sectional study was conducted to determine the stature from inter-canine width among undergraduate students and interns in a tertiary care hospital. [redacted]

[redacted]

[redacted]

Multiple regression analysis including maxillary inter-canine width, mandibular inter-canine width, age, and sex demonstrated strong predictive performance ([redacted]), with sex and age emerging as significant predictors of stature. [redacted]

# BIBLIOGRAPHY

# BIBLIOGRAPHY

1. Yadav AB, Kale AD, Mane DR, Yadav SK, Hallikerimath S. Stature estimation from regression analysis of facial anthropometry in Indian population. 2019;23(2):311. doi:10.4103/jomfp.JOMFP_140_19
2. Verma R, Krishan K, Rani D, Kumar A, Sharma V. Stature estimation in forensic examinations using regression analysis: A likelihood ratio perspective. Forensic Sci Int Rep. 2020;2:100069. doi:10.1016/j.fsir.2020.100069

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[redacted]

[redacted]

[redacted]

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[redacted]

72. Sudele, D. K. ., & Gajbhiye, V. (2022). Role of mandibular canines in sex determination in northern central region of India. *International Journal of Health Sciences*, *6*(S1), 1410–1418. https://doi.org/10.53730/ijhs.v6nS1.4892

73. Prabhakar P, Mahendra Raj RR, Saravanan T, Ramalingam S. Assessing the relationship between the intercondylar distance and mandibular intercanine distance in orthopantomogram – A retrospective study. SRM J Res Dent Sci. 2023;14(1):6.

# ANNEXURES

# ANNEXURE I – INFORMED CONSENT

[redacted]

**Name of Student/Principal Investigator:** [redacted]

**Introduction:** [redacted]

**Explanation of procedure:** [redacted]

**Withdrawal from participation in the study:** [redacted]

**Possible benefits from participating in the study:** [redacted]

**Possible risks from participating in the study:** [redacted]

**Privacy and confidentiality:** [redacted]

**Financial incentives:** [redacted]

**Authorization for publication of aggregated data:** [redacted]

**Questions:** [redacted]

**Legal rights:** [redacted]

## CONSENT STATEMENT

I am making a voluntary decision to participate in the study: [redacted]

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

# ANNEXURE II – IMAGES

**Image 1.**

[redacted]

**Image 2.**

[redacted]

**Image 3.**

# MASTERCHART

| Record ID | Participant Code | Date of Examination | Age years | Sex | Group | Stature cm | Maxillary Inter Canine Width mm | Mandibular _Inter _Canine Width mm |
|---|---|---|---|---|---|---|---|---|
| 1 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 2 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 3 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 4 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 5 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 6 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 7 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 8 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 9 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 10 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 11 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 12 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 13 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 14 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 15 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 16 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 17 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
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| 19 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 20 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 21 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 22 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 23 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 24 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 25 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
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| 27 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 28 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 29 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 30 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 31 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

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