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Relationship Between the Height of the Person with the Length of the Radius in Undergraduate Students of Gandaki Medical College Pokhara

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ABSTRACT

INTRODUCTION: Stature estimation from skeletal remains is a critical component in forensic anthropology and medical examinations. Traditional methods often require a nearly complete skeleton, which may not be available in cases of dismembered or decomposed bodies. This study explores the connotation between the height of individuals and the radius' length as a potentially practical and accessible method for stature estimation.**MATERIALS AND METHODS:** The study involved 125 asymptomatic, healthy undergraduate medical students, aged 18-25 years, from Gandaki Medical College. Height measurements were obtained using a stadiometer, while radius length was measured by marking two specific points on the radius and measuring the distance between them with a spreading caliper. Statistical exploration was carried out with $p<0.05$ significance rate.**RESULTS:** The investigation revealed a strong and statistically significant positive correlation between height and radius length for all participants ($p < 0.001$). Gender-specific analyses showed a slightly higher correlation for males compared to females. These findings suggest that radius length can be a reliable predictor of stature, with potential gender-specific equations.**CONCLUSION:** The study highlights the potential utility of radius length as a practical and accessible method for stature estimation in forensic anthropology and medical assessments. The strong correlation observed between height and radius length, along with gender-specific differences, supports the development of gender-specific regression equations for more accurate predictions of stature. This research contributes to the development of simplified and efficient tools for estimating stature from skeletal measurements, reducing reliance on complete skeletons and complex mathematical models.

Keywords: Forensic anthropology, gender-specific equations. radius length, skeletal measurements, stature estimation.

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INTRODUCTION

The calculation of a person's height from skeletal remains is crucial for both medical and forensic anthropology studies [1]. Precise calculation of stature is essential for the identification of human remains in forensic cases and for several medical uses, including as evaluating living people and tracking anatomical growth [2-3]. Historically, these approximations have been dependent on intricate mathematical and anatomical techniques, frequently necessitating a virtually whole skeleton. These methods, however, can be unfeasible, particularly in situations involving dismembered or decayed bodies or when only partial skeleton remains are available [4,5].

The quest for more accessible and alternative techniques to estimate stature has prompted studies examining the correlation between particular bone dimensions and a person's height. The radius, or lateral forearm bone, is one such bone of interest in this context. The radius is a fascinating topic for research because of its accessibility and the possibility of correlations with height [4–9].

To estimate stature from skeletal remains, two primary methods have been used historically: the mathematical method [6] and the anatomical method [7]. By adding the heights of each component of the skeleton that contributes to stature, the anatomical technique calculates the total skeletal height. Nevertheless, this method requires adjustment variables to take into consideration the soft tissue that is absent from skeletal remains. Because of this constraint, almost whole skeletons are necessary for precise calculations [6–10].

Conversely, the mathematical approach uses regression formulas to predict stature based on one or more bone lengths. This approach is more flexible because it doesn't need a nearly full skeleton; in fact, measurements of just one bone can yield important information. Over the years, researchers have created a large number of

regression equations for stature estimate using different bone measurements; however, these equations frequently do not apply to specific populations. Therefore, when creating stature estimate algorithms, it is crucial to take population-specific characteristics into account [7–12].

Through this research, we hope to offer a useful and approachable substitute for current methods of estimating stature, which can be applied in forensic anthropology, medical examinations, and other relevant domains. The study's materials and procedures, current findings, and ramifications for the field of skeletal measurements and stature estimation are all covered in detail in the parts that follow.

The association between the height and radius length of healthy undergraduate students is the main topic of this investigation. The research was piloted to determine if the radius length can accurately predict stature in people between the ages of 18 and 25. By doing this, the study hopes to further the creation of useful and effective techniques for stature estimate that are applicable to both standard medical examinations and forensic anthropology.

MATERIALS AND METHODS

Study design and setting:

This quantitative cross sectional research was carried out in the practical Anatomy class of Gandaki Medical College. The study was conducted from November 2022 to October 2023.

Participants, sample size and sampling technique:

The study focused on 125 asymptomatic and healthy undergraduate medical students, aged between 18 and 25, who were enrolled in the academic year 2021/22. The sample size of 125 individuals was determined through a census approach, ensuring the inclusion of all eligible students meeting the specified criteria. Following formula is used for sample size estimation,

$N = Z^2 \times p \times (1\text{-}p) / e^2$ where n is the sample size Z is the z-score for the desired confidence level p is the estimated prevalence of the connection between height and radius [11]and e is the desired margin error. Therefore, the sample size was 125 participants.

Inclusion Criteria:

First and second-year undergraduate medical science students of the academic year 2021/22.

Participants consenting to take part in the study.

Exclusion Criteria:

Individuals with self-reported physical illness or any muscular defect.

Data collection procedure and study variables:

Height of the individuals and length of the radius are the main areas for analysis of this study. Hence, we used both the parameters. For height measurement we used a stadiometer to record the heights. The participants were instructed to stand in an automatically correct position. with their back straight, heels together, and arms at their sides. Height was recorded in centimeters (cm) to the nearest millimeter. For radius length measurement, the investigators asked the participants to flex their elbow joint so that the flexor surfaces of their arm and forearm formed a 90-degree angle, the length of the radius was noted. During this position, a skin marking pencil was used to mark two precise points: the tip of the radius styloid process and the top margin of the radius head. Because these locations have unique anatomical markers, precise measurements may be made because they were carefully chosen. After marking the two points, the distance in the middle of them was calculated using a spreading caliper. This instrument allowed for precise measurements of the radius length, and measurements were taken on both the right and left sides to account for any potential bilateral variations. 10% of the participants who were not included in the final study sample took a pretest to ensure the validity and accuracy of the data collection instruments. This pretesting phase aimed to identify any potential issues or sources of error in the measurement process. Data obtained from the pretest participants were not included in the final analysis. The dependent variable in this study is the height of individuals. The independent variable is the length of the radius. Height is measured using a stadiometer in centimeters (cm) to the nearest millimeters.

Statistical analysis and data management:

The data collected from the 125 study participants were noted into a computer's excel-sheet. Statistical valuation was achieved using the "Statistical Package for Social Science (SPSS)" version 21.0. Statistical tests, including correlation analysis, were applied to assess the correlation between height and radius length.

Ethical consideration:

Ethical clearance for this study was obtained from Institutional Review Committee (IRC) of Gandaki Medical College and Teaching Hospital, prior to start of study (Ref. No.146/079/080). Written consent was taken from the school before data collection.

RESULTS

This study centers on investigating the associations between participants' height and the length of their radius. To explore these correlations, we examined a sample consisting of male and female participants aged 18 to 25.

Table 1 provides an overview of the correlations between height and radius length for all participants. The mean height for the entire sample was 165.4 ± 6.2 cm while the mean radius length was 25.6 cm, with a standard deviation of 1.3. The correlation coefficient between height and radius length was 0.758, indicating a strong and statistically significant connection ($p < 0.001$).

For male participants, Table 2 illustrates the correlations

Table 1: Correlation of Height and Radius Length (All Participants)

Parameter	Mean	Standard Deviation	Correlation Coefficient	p-value
Height (cm)	165.4	6.2	0.758	<0.001
Radius Length (cm)	25.6	1.3	-	-

Table 2: Correlation in Males

Parameter	Mean	Standard Deviation	Correlation Coefficient	p-value
Height (cm)	172.1	5.4	0.782	<0.001
Radius Length (cm)	26.3	1.2		

Table 3: Correlation in Females

Parameter	Mean	Standard Deviation	Correlation Coefficient	p-value
Height (cm)	158.8	4.9	0.716	<0.001
Radius Length (cm)	24.9	1.1	-	-

Table 4| Comparison of the correlations between height and radius length for male and female participants

Parameter	Male Participants	Female Participants
Correlation Coefficient	0.782	0.716
p-value	<0.001	<0.001

between height and radius length. Males had a mean height of 172.1 cm (SD = 5.4) and a mean radius length of 26.3 cm (SD = 1.2). The correlation coefficient for males was 0.782, signifying a robust and statistically significant correlation ($p < 0.001$).

Table 3 focuses on the height and radius length correlations for female participants. The mean height for females was 158.8 cm (SD = 4.9), and the mean radius length was 24.9 cm (SD = 1.1). The correlation coefficient between height and radius length for females was 0.716, demonstrating a substantial and statistically significant correlation ($p < 0.001$).

Table 4 enables a comparison of the correlations between height and radius length for male and female participants. The correlation coefficient for males was 0.782, and for females, it was 0.716. Both correlations were statistically significant ($p < 0.001$), with males exhibiting a slightly stronger association between height and radius length.

DISCUSSION

Significant correlations are found in the data, and their modification are examined in a variety of settings.

This study's main goal was to examine the association between height and radius length as a possible means of determining a person's stature. For each individual, the results showed a substantial and statistically significant positive connection between these two variables (Table 1). This finding, which is consistent with other forensic anthropology research and bone measuring studies, supports the concept that the radius length can be utilized as predictor of stature [10-17]. The correlation value of 0.758 ($p < 0.001$) suggests that there is a statistically significant between a person's height and radius length.

The Gender-Specific Correlations for both sexes, different correlations between height and radius length were found using gender-specific analysis. The correlation value was 0.716 ($p < 0.001$) for females and 0.782 ($p < 0.001$) for males. Males showed a greater correlation than females, indicating that the association between height and radius length may be more prominent in males, even though both correlations were strong and statistically significant (Tables 2 and 3). These results highlight the significance of taking into account gender-specific equations for stature estimate in forensic and medical contexts and are consistent with the known sexual dimorphism in bone structure [13-17].

For implications for height estimation in the domains of forensic anthropology and medicine, the findings of this study have a substantial impact on height estimation [13-17]. Radius length provides a more useful and approachable substitute for the whole skeletons or intricate mathematical models used in standard techniques of stature estimation. This is especially helpful in cases involving mutilated corpses, fragmentary skeletal remains, or people whose physical conditions make it impossible to measure long bones accurately [13-17].

Given the significant connection that exists between height and radius length, it is possible to use radius length to accurately estimate stature in both males and females [11,12]. This provides a more straightforward and approachable approach that can be used in forensic investigations, medical exams, and physical development monitoring, among other contexts. The dissimilar correlations for boys and females suggest that gender-specific regression models should be developed in order to improve the accuracy of stature forecasts [13-17].

Although this study's results are encouraging, it is important to recognize its limits. The study concentrated on undergraduate medical students in the age range of 18 to 25, which may have limited the data' applicability to other demographics. Future studies should investigate a wider variety of ages in order to determine the generalizability

of the approach to various demographic groups.

Furthermore, the association between height and radius length was the only one studied in this study. Including more bone measurements in the analysis could lead to more accurate techniques of estimating stature. Additionally, the methodology's application and dependability would be improved by validating it on a larger and more diverse population, including people with varying degrees of physical fitness and health.

CONCLUSIONS

In conclusion, this study provides valuable insights into the potential use of radius length as a predictor of stature. The positive observed between height and radius length, along with the gender-specific differences, emphasize the method's potential application in stature estimation. This research contribute to the development of practical and accessible tools for forensic anthropology, medical assessments, and related fields, potentially simplifying the process of estimating stature from skeletal measurements.

ADDITIONAL INFORMATION AND DECLARATION

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