

Estimation of Stature from Percutaneous Inter-acromial Length in Tamil Population

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Abstract: Stature is one of the important parameters to identify unknown dead bodies. When the whole body or whole skeletal is available then there are not many problems. The difficulty arises when bodies are fragmented or mutilated. Forensic anthropologists have developed many methods for stature calculation in such cases. One such method is the estimation by using inter-acromial length. Different studies were conducted in different regions to develop a more suitable equation for stature estimation. These different regional studies are required because the stature of a person is influenced by many factors such as ethnicity, hormonal changes, food habits, environments, etc. For this reason, the present study was conducted amongst the Tamil population of South India.

Key Words: —Stature, Inter-acromial length, Regression equation, Forensic anthropology, Tamil population.

I. INTRODUCTION

The vertical height of a person in an erect posture is known as the stature of the person. Establishing stature is an important job in cases of an unknown mutilated body in forensic anthropology. For more than 100 years forensic scientists follow the different anthropometric techniques commonly used by anthropologists to estimate the stature of an unknown person (1). Anthropologists have observed that there is an established relationship between stature and different body parts (2). This basic principle allows forensic anthropologists to estimate stature by analyzing various body parts such as hands, legs, head, trunks, etc. The inter-acromial length is the distance between two bony landmarks formed by the acromial processes of the scapulae.

Many studies have been conducted for stature estimation by using inter-acromial length (3). However, stature is an inherent characteristic of an individual and this may also be affected by ethnicity and geographical influences. Further, it may also be affected by nutrition, hormonal changes, injuries, diseases, congenital defects of bones and muscles, etc. (4). So, there is a necessity of conducting a separate study for the Tamil population.

II. MATERIALS AND METHOD

The present study was conducted in the Department of Forensic Medicine & Toxicology, SRM Medical College & Research Centre, Potheri, Tamil Nadu by selecting suitable medical, paramedical students, and non-teaching staff in the age range of 22 to 44 years of Tamil Origin (both mother-father and grandparents of Tamil ethnicity). Any individual having physical deformity, dwarfism, gigantism, and injuries was excluded from the present study. Those persons who were reluctant about the procedure were also excluded. In total, we examined 100 male and 100 female participants.

The reason for fixing the minimum age at 22 years is that by this age almost all the epiphyses of the shoulder joint

Manuscript revised June 28, 2022; accepted June 29, 2022. Date of publication June 30, 2022.

This paper available online at www.ijprse.com

ISSN (Online): 2582-7898; SJIF: 5.59

including clavicles are fused. The upper age is fixed at 44 years because by this year the decrease in growth due to degeneration is insignificant enough to affect the regression equation.

Each and every participant was explained details about the present study and written informed consent was obtained before the starting of the research work. The stature was recorded by asking the participant to stand erect barefooted with the head in the Frankfurt plane tocks and heels pressed against the upright position of the instrument. Both the palms of the hands of the participants must turn inwards and the fingers point downwards. Then the participant was asked to sit straight on a chair. We asked the participant to hold his breath for a while so that the lateral border of the acromial bone may be palpated distinctly. We then placed the arms of the spreading caliper directly on the skin next to the outer borders of the acromial processes. Then the inter-acromial distance was measured twice one with the help of a spreading caliper and another with a retractable measuring tape.

All the measurements were done between 9 to 11 am by using the same types of equipment to minimize the diurnal variation and human error. For the stature measurement, we used a stadiometer, and for inter-acromial distance measurement, we used a spreading caliper & a self-retracting measuring tape. For female participants, measurements were conducted by female staff. Thus, collected data were analyzed by using the statistical package SPSS version 20.0.

III. RESULT

Measurements of all the 200 participants were noted separately. The below-given Table No.1 showed the maximum, minimum, and average stature of the 200 participants. All the values were noted in centimeters.

Table No.1. Stature in centimeters

| Sr. No. | Stature in cm | Male | Female |
|---------|---------------|--------|--------|
| 1 | Maximum | 181.5 | 169.5 |
| 2 | Minimum | 155 | 143.5 |
| 3 | Average | 168.25 | 156.5 |

The maximum, minimum, and average values of the inter-acromial lengths were tabulated in the below-given Table No.2.

Table No.2. Inter-acromial length in centimeters

| Sr. No. | Inter-acromial length in cm | Male | Female |
|---------|-----------------------------|------|--------|
| 1 | Maximum | 53 | 47.5 |
| 2 | Minimum | 37 | 32.5 |
| 3 | Average | 45 | 40 |

The collected data were analyzed by using statistical methods (statistical package SPSS version 20.0) presuming X as an independent variable and Y as a dependent variable as shown in table No.3.

Table No.3. Statistical value of inter-acromial length

| Study | Regression formula | Standard error | Standard deviation | Coefficient of correlation |
|---------------|--------------------|----------------|--------------------|----------------------------|
| Male & Female | $Y=X+115$ | ± 6.0 | 7.5 | 0.61 |
| Male only | $Y=2X+69$ | ± 8.0 | 6 | 0.38 |
| Female only | $Y=1.7X+84$ | ± 5.0 | 4.9 | 0.45 |

Statistical Equations:

$$(i) \sum Y = Na + b \sum X$$

$$(ii) \sum XY = a \sum X + b \sum X^2$$

Where,

- \sum = Sum value
- Y = Value of stature
- X = Value of the length of body part
- N = Number of cases studied
- a = Unit greater than X value by Y value,
- b = Constant value of co-efficient i.e multiple of X for determination of Y
- Regression Equation Formula: $Y = a + bX$

- Standard Error = $\sqrt{\sum(Y - Y_c)^2 / N}$
- Co-efficient of correlation = $\frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$
- Standard Deviation = $\sqrt{y^2 / N}$
- Regression Equation Formula: $Y = a + bX$
- Standard Error = $\sqrt{\sum(Y - Y_c)^2 / N}$
- Co-efficient of correlation = $\frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$
- Standard Deviation = $\sqrt{y^2 / N}$

IV. DISCUSSION

In the present study, for males and females together, we observed the standard error of ± 6.0 . The standard of error was more for male participants. Our present finding is in agreement with the studies conducted by Momonchand A., Devi T.M (5), and Vishal Veerbasu Koulapu et al (6). B. Vasant Nayak and Nishat Ahmed Sheikh (7) conducted a similar study on the South Indian population and their findings were consistent with the present study. They reported that "Stature of Male is highly correlated to Inter-Acromial length (i.e., Correlation coefficient = 0.827) with p-value is 0.000000". Similarly, for females too, Stature was found to be highly correlated to Inter-Acromial length (i.e., Correlation coefficient = 0.70) with a p-value is 0.0000.

Sweta Patel et al (8) conducted a similar stature estimation from the measurement of the inter-acromial lengths and they also observed that there is a strong correlation between the stature and inter-acromial length in both sexes. They reported the standard of errors for males and females as ± 6 and ± 5 respectively. These findings are also consistent with the present study. However, the study conducted by Koulapur VV et (9) al reported a standard error of ± 4 in cases of females.

The coefficient of co-relation in males and females is 0.61, in males only 0.38 and females only 0.48 respectively. So far, the co-efficient of co-relation is concerned the present study is in agreement with the previous studies (9,10,11). We don't see any remarkable difference between measured and estimated stature.

V. CONCLUSION

Stature is very important in the biological profiling of an unknown body when parts are mutilated or dismembered. There are different methods to estimate stature in such situations and one such method is the present study. The inter-acromial length can be positively used to establish the height

of a person. Due to ethnic and regional variability, we need different studies for creating more accurate equations for correct stature estimation.

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