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# CORRELATION BETWEEN TOTAL BODY HEIGHT AND PERCUTANEOUS TIBIAL LENGTH IN JHANSI REGION (U.P.,INDIA)

Anatomy

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## ABSTRACT

Stature is natural height of a person in upright position. Stature or body height is very important anthropometric parameter by which physical identity of an individual can be done when where is an unknown dead body found or dead body with destroyed face or a mummified/ putrefied body in which face is unrecognizable. Aim – Human body height is marked from long bones humerus , radius , ulna, femur and tibia. If total body height is more, then long bone of that human body also have more length .So there is a relation between length of human body and length of bones. So by this relation if single bone or extremity is found after any natural disaster , we can get some identity of an individual. Material and method- 204 individual (102 male and 102 female) were material of this study, we estimated total body height and length of individual bone (in this study, tibia) and relation between these two measurements was found and we derived a formula ,regression equation formula specific for a population found in particular area or region . For this a regression equation derived by this study in Jhansi (U.P. ,INDIA) can be helpful. Stastistical analysis was done. . It was observed that although standing height of two individuals were found same but there PCTL differ. Knowledge of limb bone length and total body height relation is important.this study will be help for forensic experts, anthropologists and anatomists

## KEYWORDS

Anthropometry, Total Body Height , Percutaneous Tibial Length, Regression Equation Formula

### INTRODUCTION :

Humans have erect posture and his /her height get contribution from long bones. Lower limb bones get direct contribution that is from femur, tibia and fibula . In any disaster, either natural or man-made (bomb-blast, train accident road traffic accident, air plane crash) or in any criminal case where only separate bones / incomplete skeleton/ ruminant of skeleton or mummified limb or macerated part of body is found , then for identity of that individual, anatomist or forensic expert is needed . For this purpose knowledge of relation between limb bone length and total body height is important . Contribution of upper limb bones in individual's total body height is very important (especially in adult individual in which height and length of bone gain is maximum[1,2]). For this a regression equation derived by this study can be helpful.

The estimated height calculated from this formula is found in close approximation with exact height of an individual (within a range of error)[3]. Body stature (total height) and individual bone length is anthropometric measurement. Tibial bone length is easy to measure in living human[4]. So from percutaneous tibial length we estimate total body height in this study.

However , formula is population / region specific because stature is influenced by race geographical climate, genetic, nutritional factors. Hence this correlation cannot be applied for other population.

### MATERIAL & METHOD :

In present study 204 living adult individual (102 male and 102 female) of age 22 to 42 years are measured for there percutaneous tibial bone length (PCTL) and standing body height as after 20 year union of epiphysis and diaphysis has occurred in Indian population and no height further increase which had been studied by several workers[5,6] .

**PCTL is measured by spreading calipers having blunt end.**

Position for measuring PCTL – we asked each individual to sit on a stool with knee is fixed at 90 degree with thigh and foot kept inverted. Because in this position soft tissue relaxes in bony point become more prominent. Upper bony point - most prominent upper palpable bony part of tibia at medial side of leg and lower bony point – where maximum convexity of medial mallelous found.

Standing height is measured by a stadiometer. Horizontal sliding bar is foot on vertex. Subject stand bare footed with both feet in contact with each-other. Eye looking straight forward, arms keep along side of trunk.

SPSS software for statistical analysis was used .Also ANOVA software was used . Linear regression was found out.

We calculate regression equation formula (y=a+bx) for both male and female separately to estimate total body height by using PCTL. Left PCTL was approximately similar to right PCTL in both gender. No significant difference ( p>0.05) found in PCTL both side We observed difference between actual (measured by a stadiometer ) and estimated body height by regression formula.

Since past regression formula of Trotter and Gleser[7,8] for long bone were used to estimate stature of an individual.

### OBSERVATION –

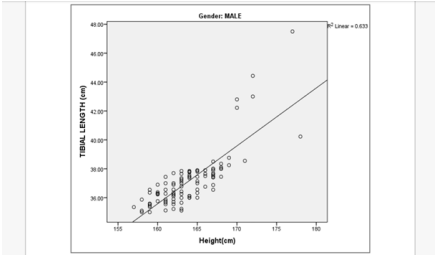
**Table-1 Average tibial lenth (in cm)**

| | Range | Mean | Standard Deviation | number |
|---|---|---|---|---|
| Male | 44.43 -35.35 | 37.15 | 1.91 | 102 |
| Female | 38.55-31 | 33.165 | 1.39 | 102 |

**Table -2 Total body height (in cm)**

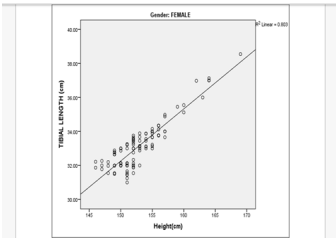
| | Range | Mean | Standard Deviation | number |
|---|---|---|---|---|
| Male | 178 - 158 | 163.94 | 3.81 | 102 |
| Female | 169-147 | 152.94 | 4.085 | 102 |

**Graph 1**




A positive correlation in between percutaneous length of tibia on x –axis and height of male subject Y –axis (show in Graph 1). This significant correlation further interpreted by linear regression .

**Graph 2**



A positive correlation in between per cutaneous length of tibia on x –axis and height of female subject Y –axis (show in Graph 2). This significant correlation further interpreted by linear regression .

( Height) Y =INTERCEPT (a) + (Tibial Length) X Regression coefficient (b)Regression formula derivation for calculating stature from length of Tibia-

| Regression Statics of Tibia | Male | Female |
|---|---|---|
| Intercept (a) | 105.23 | 65.98 |
| Regression coefficient (b) | 1.580 | 2.62 |
| Independent Variable (x)- Tibial Length | 37.15 | 33.165 |

Regression Equation for Male- Height = 105.23 +(Tibial Length) x1.580 Regression Equation for Female- Height = 65.98 +(Tibial Length) x2.62

**Table-3** Comparison of Actual height and estimated height from regression equation (in present study ) to check validity of results .

| Gender | Mean PCTL (in c.m.) | Actual height (in c.m.) | Estimated height (in c.m.) | Difference (in c.m.) |
|---|---|---|---|---|
| Male | 37 | 162 | 163.69 | +1.69 |
| Male | 43 | 172 | 173.17 | +1.17 |
| Male | 38 | 167 | 165.27 | +1.73 |
| Female | 37 | 164 | 162.92 | +1.08 |
| Female | 34 | 155 | 155.06 | +0.06 |
| Female | 33 | 152 | 152.14 | +0.14 |

## DISCUSSION –

Use of anthropometry in the field of forensic science done by 1883 when Alphonge Beritiffon , a French police expert invented a system of 'criminal identification' hence it is necessary to identify recovered remains and then by relevant measurement stature should be reconstructed.

In our study right and tibial length are very very similar. Our findings are similar to that of Yayim yili[9] , Chavan aet al,[10] Bhawna and Surinder Nath[11] and many others who observed that there was no statistically significant difference in the length of right and left tibia in both males and females.

Allbrook[12] in 1961, compared both estimated stature derived from length of dried tibia and from average PCTL. There was no difference in stature estimated from two different sets of tibia. The average stature was 170.06 cm for british male population.

Mukta rani *et al* [13]estimated the stature in students of delhi to be 169.5 cm in male and 159.5 cm in female. It means in delhi region height of peoples is more than the Jhansi region.

Akhilesh trivedi, S. saxena[14] estimated stature of student of Gwalior to be height is 164.5 cm in PCTL 38.24 cm in male and in female 155.3 cm & 36.64 cm in females. Which is slightly more in comparison to Jhansi population .

Pertovecki et al [15]test a new radiographic approach to stature prediction that could be used in adult cadaver were measured 24 hours death and considered equal to living stature. Anterio-posterior radiograph of all limbs were taken and maximum length of 6 long bone measured from radiograph. He stated that correlation between height and maximum length of long bone was best for tibia in male and best for humerus in female in a study of Croatian population .

According to Kate & Mazumdar[16] after comparing derived regression equation for maharastrian and punjabies with that of Pearson's (English scientist) regression formula derived from English bone, concluded that pearson's regreesion equation does not give exacts result in Indian population. Same view of Karore[17] et al , They suggested that the regression formula derived by Albrook for estimating the stature in the British population is not suitable to estimate the stature in Indian population.

**CONCLUSION** : Estimated height by using regression equation formula never be accepted as the accurate value. Variations are always there. To avoid this difficulty slandered error of estimation also always calculated. although standing height of two individuals were found same but there PCTL differ was observed . And if PCTL of two individual were found same yet there total body height different. There was very - very slightly difference in the right and left tibia in both genders total body height of body by regression formula is very -very similar to actual measured to body height. Mean calculated body height were similar to measured body height.

So conclusion is it is possible to determine stature of a deceased person (whose only remains found) accurately to some extent. But this formula is population specific.

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