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Estimation Of Adult Human Stature By Anthropometric Measurements Of Inter Anterior Superior Iliac Spinal Distance – A Cross Sectional Pilot Study.

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ABSTRACT

Background

Estimation of stature forms a part of examination of an unidentified corpse, especially a dismembered one, for a forensic pathologist while aiming to establish its identity. It can be accomplished accurately by anatomical reconstruction, followed by Type I regression equations using long bones of lower limbs. Skeletal remains presented to forensic pathologists are often incomplete; one has to rely on other elements too. As no existing equations are clearly appropriate, new sample specific regression equations formulation has been attempted. **Aim:** To formulate regression equation to establish relationship between stature and inter anterior superior iliac spinal distance of living individuals. **Methodology:** Measurements were taken from 100 randomly selected medical students above 20 years of age, native of Gujarat, Indian using spreading calliper

[least count being 1 mm]. The data was analysed using SPSS Software version 11. **Results:** Three sets of regression equations were derived. It revealed that predictive value from the equations was unsatisfactory. **Conclusion:** Inter- anterior superior iliac spinal distance is not a good parameter for stature estimation. Further detailed studies are recommended to support or negate the findings.

Keywords: Inter- anterior superior iliac spinal distance, stature correlation, regression equation

Declaration

Approval from Institutional Ethics Committee was obtained prior to start of the study.

INTRODUCTION

The establishment of identity of an individual is of immense medico legal significance both in the living and dead. Forensic medicine specialists are very often faced with the problem of fixing the individuality of an unknown human body. It is easy when the remains are complete. But the real task lies when only parts of the body are recovered. Such bodies are encountered in homicides [to conceal evidence], in railway accidents, plane crashes, bomb explosions etc. Here estimation of sex, age and stature from the available skeletal remains help in identifying an individual.[1]

The most common method employed for stature estimation is use of regression equations developed from length of long bones. Such formulae, like the Karl-Pearson, Dupertius & Hadden and Trotter & Glesser, have been derived from predominantly Western populations.[2] Some studies have been conducted in India also but are few and far between, e.g., Siddiqui & Shah, Singh& Soha and Mehta & Thomas.[3]

It is necessary to have different formulae for determination of stature from the measurements of different body parts. Cases are common where only parts of the long bones are available along with an intact pelvis. There have been only few studies done to find out formulae for estimation of stature without long bones.[4] Absence of an intact long bone in such cases makes it difficult for approximate estimation of stature. As no existing equations are clearly appropriate, new sample-specific regression equations formulation is always recommended. An approach is utilized in this study to establish the relationship between statures of western Indian population and their inter-anterior superior iliac spinal distance; to develop regression equation formulae from these two variables by simple regression analysis. The formula thus obtained could be used for the determination of stature of individuals of this region.

METHODOLOGY

The study sample comprised of 100 medical students, randomly selected at a tertiary health care institute with attached medical college. The participants were aged between 20 – 22 years with mean age of 20.5 years [by this age pelvic growth is presumed to be complete]. M: F ratio of participants was 50:50. The participants constituted mixed population of Western India. Cases of stunted or enhanced bone growth or with history of skeletal injury were excluded from the study. The participants were explained about the purpose and procedure of the study and informed consent was obtained.

Data collection and anthropometry

The data collected for the study were stature and inter anterior superior iliac spinal distance. The measurements were taken with procedures and landmarks as by Krogman.[2]

Stature

Participants were asked to stand up erect against the wall with hands hanging down, feet axes parallel or slightly divergent, and head in the Frankfurt horizontal plane, without any headgear or footwear being worn; and stature recorded using an anthropometer rod set. No pressure was exerted since this was a contact measurement.

Inter anterior superior iliac spinal distance

Inter-anterior superior iliac spinal distance is the distance between two bony landmarks i.e. anterior superior iliac spine on each side. Anterior superior iliac spine is the end point of the front end of iliac crest easily palpable on both sides with subject standing in normal position with his arms hanging by the sides.

The measurement from the vertex of head to the ground was taken after bringing down the adjustable cross-bar to the head and the measurement was read from the vertical scale. Next, keeping point of one static arm of the anthropometer rod on right anterior superior iliac spine, the tip of adjustable arm of the anthropometer rod was brought to the left anterior superior iliac spine to measure the inter anterior superior iliac spinal distance in centimeters with the person in the same erect position.

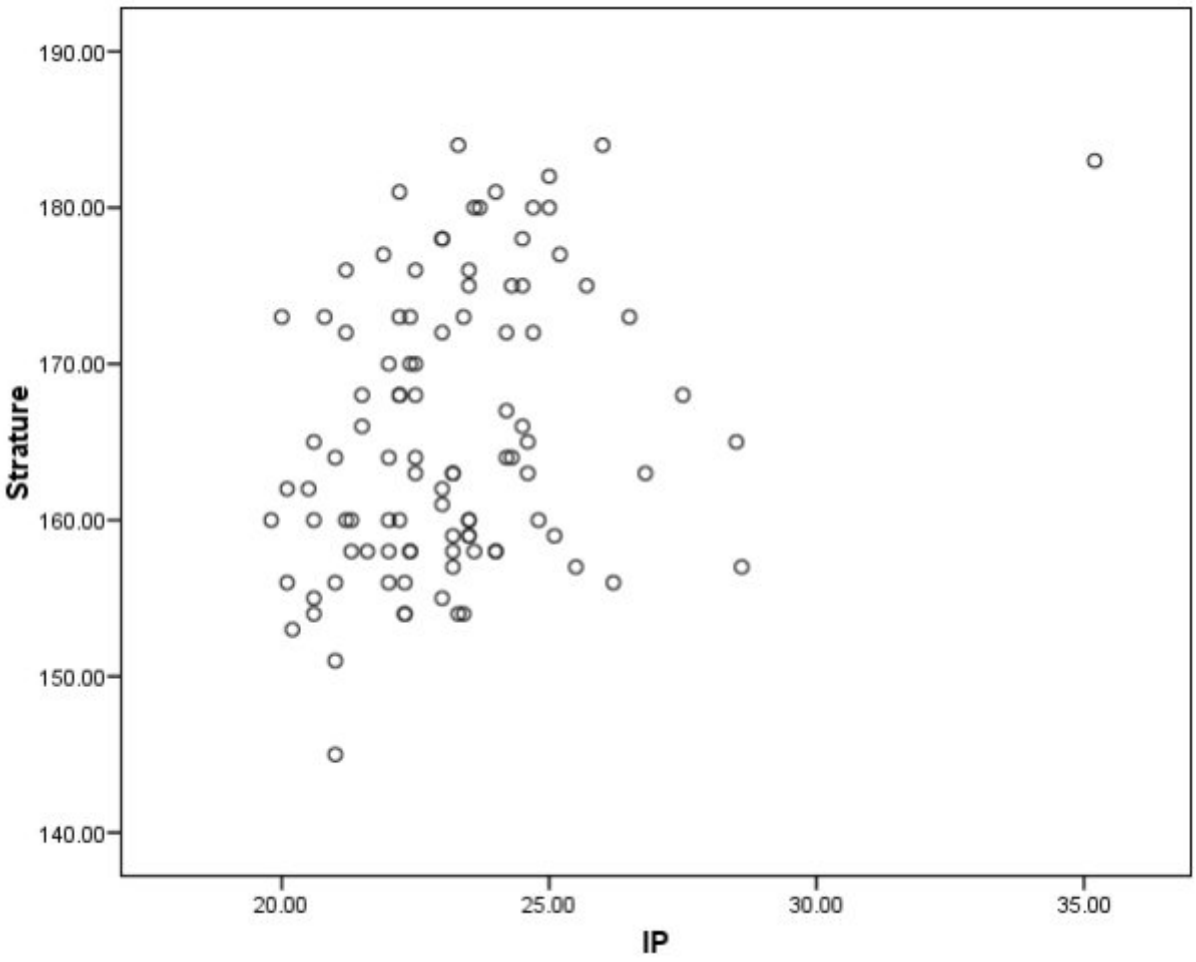
Technical/Measurement error

The data were analyzed statistically (using basic bivariate statistics and simple and multiple regression analyses) by SPSS software, version 11 to formulate regression equation. The observer bias was reduced as they underwent training for measurement of the parameters. Then 5 cases were measured in presence of the 6^{th} author and the findings were confirmed by 5^{th} author and the observer. The degree of measurement error [< + 0.2 cms] and reliability were well within accepted standards.

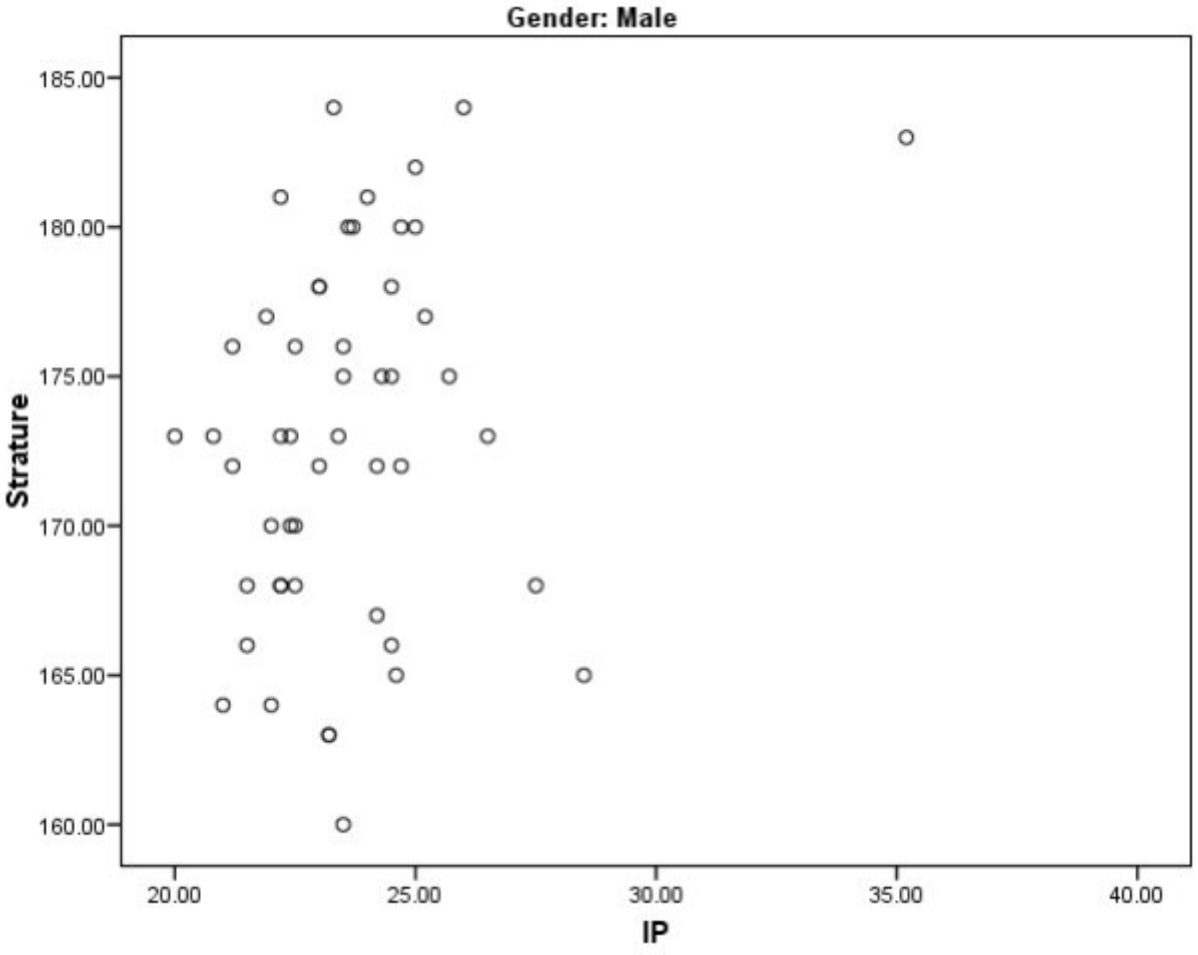
OBSERVATIONS AND ANALYSIS

Two variables were taken into consideration i.e. stature and inter anterior superior iliac spinal distance [IASIS]. Basic bivariate statistics and linear regression analyses was applied to find out correlation between the variables. Three regression equation formulae were obtained by statistical analysis from the relationship between statures inter anterior superior iliac spinal distance for females only, males only and males and females combined (Table 1). As all the subjects were of approximately same age, correlation between age and inter-acromial length was not sought. When combined data was used, no positive correlation between statures and inter anterior superior iliac spinal distance was found (Scatter plot 1). Similarly, there was insignificant correlations found between statures and inter anterior superior iliac spinal distance in either of the sexes (Scatter plots 2 & 3).

Scatter plot 1 shows insignificant correlation between stature and inter-anterior superior iliac spinal distance. Also, there was no correlation found between stature and inter-anterior superior iliac spinal distance sex wise, as shown in Scatter plots 2 & 3.

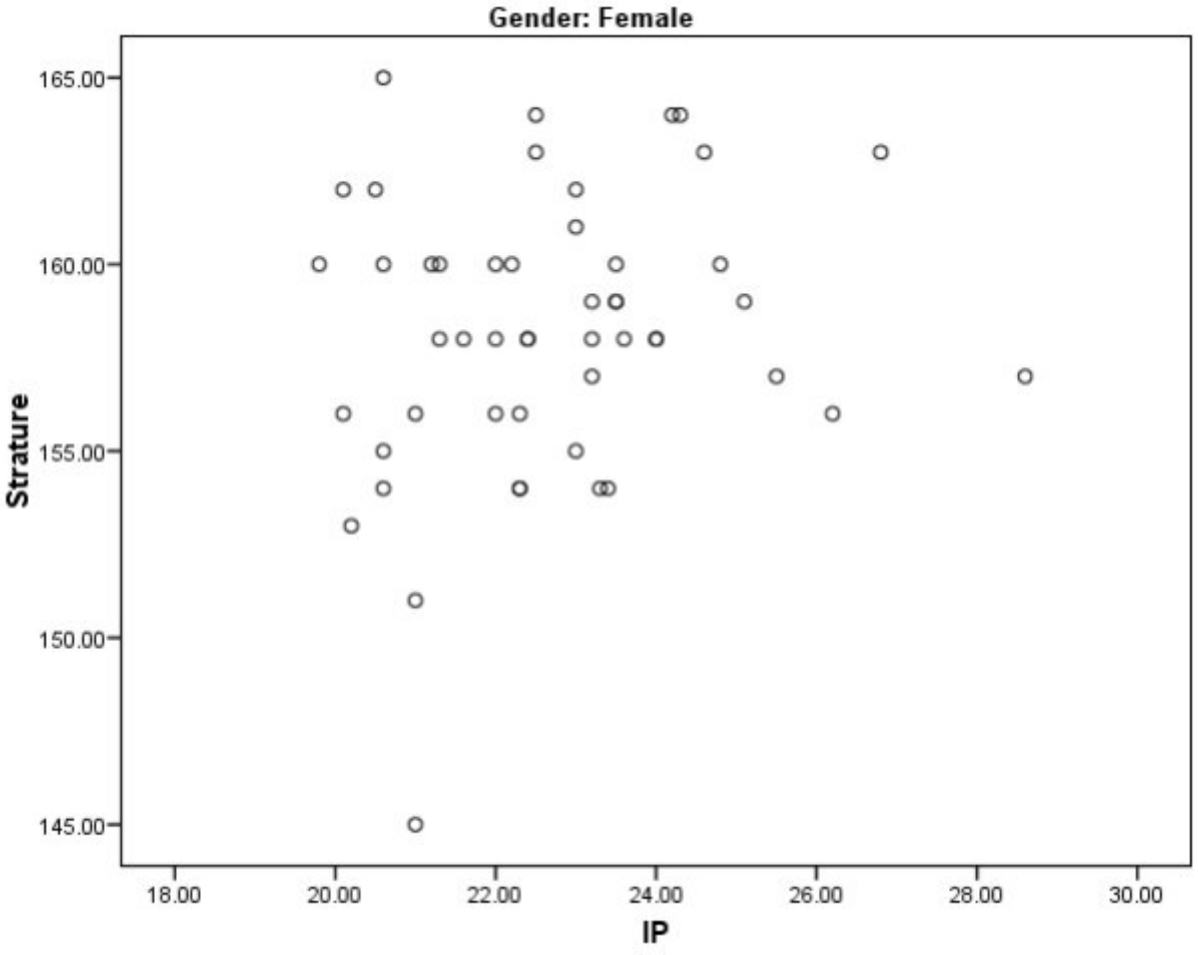


Scatter plot 1 [combined] shows that there is not much association between the two variables. Regression analysis further confirms the fact.



Scatter plot 2 [for males] shows that there is some positive association. But the p value is insignificant.

Scatter plot 3 [for females] shows that there is no/ or very little association. The regression analysis confirms the same.



In our study, all variables were quantitative; thus linear regression was applied to assess the prediction of stature from inter anterior superior iliac spinal distance.

Table 1

Variable	Regression formula for stature (y) =	Correlation coefficient	R^2
Females	150.11 + 0.357x	0.177	0.031
Males	157.28 + 0.665x	0.258	0.066
Combined	135.66 + 1.29x	0.313	0.098

Where x = IASIS distance

DISCUSSION

Population variations in anthropometric dimensions always exist and are attributed to genetic, dietary habits, environmental and other factors. This indicates that specific formulae or regression equations used in prediction of stature are only applicable to the population from which the data were collected.[4]

Various researchers with variable degree of success have attempted the estimation of stature from long bones, by using different statistical methods such as regression equations and multiplication

factors with variable degrees of success. The availability of adequate quantities of bones, choice of bones, and trained personnel has always been limitations in conducting such studies. Nevertheless, no study could be found on the use of these statistical methods to calculate stature from inter anterior superior iliac spinal distance.

The above results show that there was insignificant correlation found between stature of a person and inter-anterior superior iliac spinal distance. Though it is a fixed landmark, there might exist some errors in measurements thus giving an insignificant correlation. It can be ruled out by further similar studies and on a larger sample size. References regarding it could not be found in literature. So it might be possible that similar studies have been conducted in past but because of negative result, they haven't been reported.

CONCLUSION

The present study concluded that inter anterior superior iliac spinal distance has no forensic value in estimating stature in living individuals. This was a pilot study hence it is aspired that the results may be viewed more as indicative of the feasibility of the technique. Similar studies in other geographical areas and racial groups with larger sample size may validate or negate our observations.

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