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Estimating Stature among Medical Students in Lalitpur, Tertiary Care Hospital, using Index and Ring Finger Length

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ABSTRACT

Introduction: Anthropometry refers to a group of systematic methods for quantitatively measuring the dimensions of the human body and skeleton. It is the fundamental tool for biological anthropology that is closely related to determining an individual's height based on the available information.

Objective: Medical and dental students in Nepal will use finger lengths to derive a regression equation to calculate an individual's height in a tertiary care hospital.in

Methods: A cross-sectional study included 250 healthy Nepali students from KISTMCTH (145 females and 105 men). Using SPSS software version 17, the index (2DL) and ring (4DL) finger lengths were measured in order to create a regression formula.

Results: Males outperform females in terms of Pearson's correlation, coefficient of determination, and regression equation. Linear regression analysis was used to estimate stature using the assessed factors that were statistically significant (p 0.05) for both genders.

Conclusions: Forensic professionals and anthropologists will find it useful to be able to estimate stature from the length of the finger when identifying a person from skeletal remains.

Keywords: Anthropometry; index finger; medico legal cases; regression equation; ring finger.

INTRODUCTION

The primary goal of a forensic investigation is to confirm the victims' identities using their remains,[1] in which specific body parts may have been severed from the body and only skeletal remains may have been recovered. Such human remains are frequently discovered at or near crime scenes and may have been discovered as a result of body mutilation, explosion remnants, or other major calamities. The investigation's primary goal is to create a biological profile for identifying human individuals by determining the age, gender, and size of the remains.[2, 3]

Since ancient times, various scientists around the world have proposed various equations to estimate the height of various groups of populations by using different parts of the skeleton. The formulae and equations proposed by various workers for estimating height using various anthropometric parameters have been discovered to be entirely population and region-specific.[4] According to Pearson Trotter and Glesser's published work, studies on the estimation of stature from skeletal remains or mutilated limbs, mostly of the long bones, have been reported. There have been very few studies that estimate a person's stature based on finger length. This study sought

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to discover a relationship between Index and Ring finger length and an individual's stature, as well as to develop a linear regression equation to calculate stature from Index and Ring finger length, allowing for an estimation of stature. This was done due to the scarcity of literature on estimating stature from index finger (2DL) and ring finger lengths (4DL).

METHODS

A total of 250 healthy Nepali students from KISTMCTH (145 females and 105 males) between the ages of 20 and 25 were assessed.

The Institutional Ethics Committee of KISTMCTH granted approval (ref. no. 2076/80/41). The participant was made aware of the study's objective. Each participant provided written informed consent in advance, and confidentiality was upheld at all times. The study did not include any participants who had a history of hand illness, injury, or deformity.

Measuring procedure

1. The patient was made to stand barefoot on the baseboard in the standard position with the head aligned with the Frankfurt Plane. The stadiometer was used to measure the subject's height from the crown to the heel in centimetres to the nearest millimetre.

2. Measuring digit (2DL and 4DL): After the subjects' hands were positioned on a flat surface with their palms facing up and their forearms aligned with their middle fingers, the measurement process began. The fingers were then maximally stretched while remaining close to one another. The length of each subject's left and right hands' fingers was then measured in millimetres using a sliding traceable calliper.

The measurement was performed six times using the same instrument and identical observers to avoid any intrapersonal variation and inter-observer errors.

Using SPSS 26.0 for Windows, version 12.0, the collected data were tabulated and statistically analyzed. The Independent Samples t test was used to examine the gender gap. The Pearson correlation coefficient was used to establish the relationship between stature and finger length. The length of the fingers was used to calculate the regression equation for reconstructing stature, and the regression equation is:

Y = BO +B1x Bo= Measuring height,

B1x = Calculated height

The male and female differences for the variable were used to observe by using Student's t-test at $p<0.05$ as a level of significance.

RESULTS

Out of 250 individuals in our study, 105 were male with a mean age of 21.9 years and 145 were female with a mean age of 22 years. Males' statures varied from 152.4 cm to 185.42 cm, while female statures ranged from 144.78 cm to 175.26 cm. Male stature was taller than female stature on average (171.33cm) (158.63cm). Students' t-test determined that the result is significant at p 0.05 because the t-value is 16.85 of stature and the p-value is .00001. Males' mean 2DL on the right and left sides were 6.97 cm and 7.02 cm, respectively, while females' mean 2DL was 6.36 cm and 6.35 cm. In both males and females, RFL was larger than IFL, and the mean 4DL on the right and left sides, respectively, measured 7.16 cm and 7.15 cm.

For males, the Rt. 4DL and Lt. 4DL Pearson correlation coefficients were 0.49 and 0.46, respectively. For females, the Rt. 4DL and Lt. 4DL Pearson correlation coefficients were 0.28 and 0.29, respectively. Corresponding to this, for males, the Rt. 2DL and Lt. 2DL Pearson correlation coefficients (r) were 0.36 and 0.38, respectively. For females, the Rt. 2DL and Lt. 2DL Pearson correlation coefficients were 0.49 and 0.5, respectively. The coefficient of determination (R2) between stature and Rt. 4DL and between stature and Lt. 4DL in men was 0.24

and 0.22, respectively. Females' coefficients of determination (R2) between stature and Rt. 4DL and between stature and Lt. 4DL were both 0.08 and 0.09, respectively.

Table 1: Descriptive statistics of age, stature, 2DL and 4DL in males and females.

Variables	Males (n=105)				Females (n=145)			
	Min	Max	Mean	St.dev	Min	Max	Mean	St.dev
Age (years)	20	25	21.9	1.09	19	25	22	1.1
Stature (cm)	152.4	185.42	171.33	6.69	144.78	175.26	158.63	5.20
Left 2DL (cm)	5.94	7.83	7.02	0.38	5.14	7.39	6.35	0.42
Right 2DL (cm)	5.89	8	6.97	0.39	5.03	7.37	6.36	0.44
Left 4DL (cm)	6.07	7.94	7.15	0.46	5.2	7.48	6.44	0.46
Right 4DL (cm)	6.02	7.94	7.16	0.49	5.22	7.57	6.47	0.45

Table 2: Pearson's correlation coefficient, coefficient of determination, P-value and the regression equation derived in females.

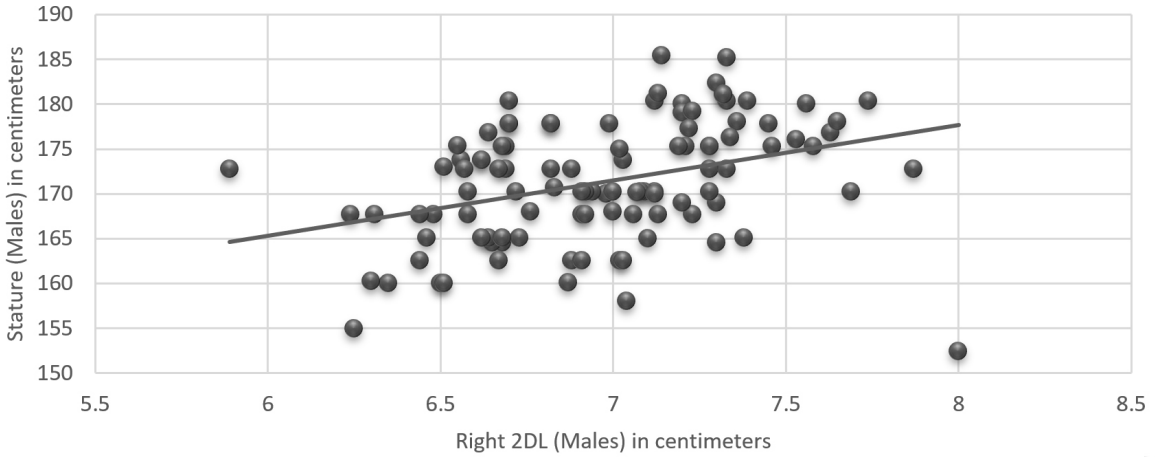
Parameter	Pearson correlation coefficient (r)	Coefficient of determination (R2)	P-value	Regression equation derived
Lt. 2DL vs Stature	0.5	0.25	< .00001*	$\hat{y} = 6.20564X + 119.23277$
Rt. 2DL vs Stature	0.49	0.24	< .00001*	$\hat{y} = 5.80667X + 121.69304$
Lt. 4DL vs Stature	0.29	0.64	0.00038*	$\hat{y} = 3.25379X + 137.72486$
Rt. 4DL vs Stature	0.28	0.08	0.00048*	$\hat{y} = 3.26307X + 137.50781$

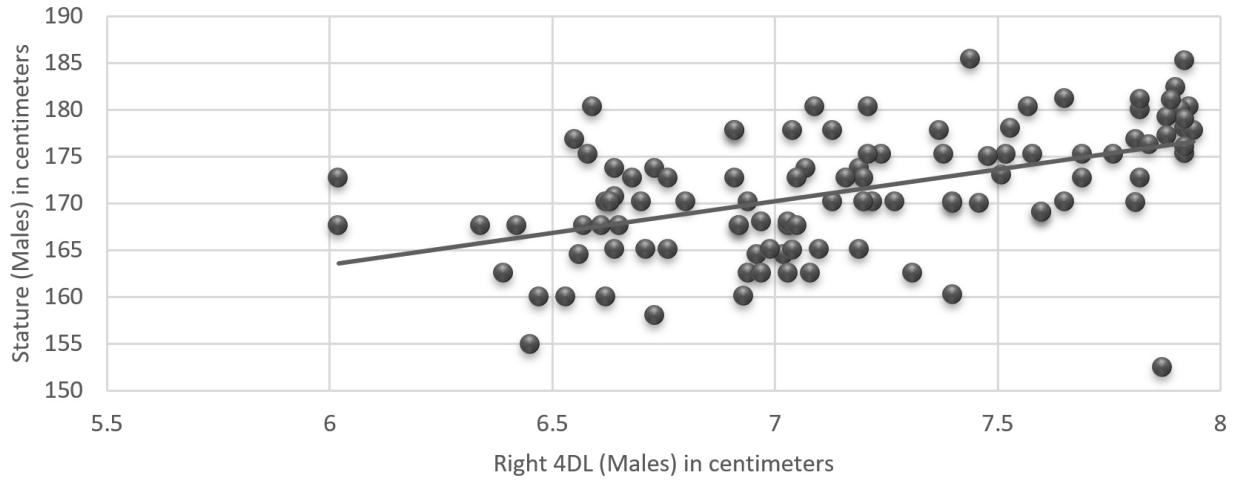
*The result is significant at $p < 0.05$.

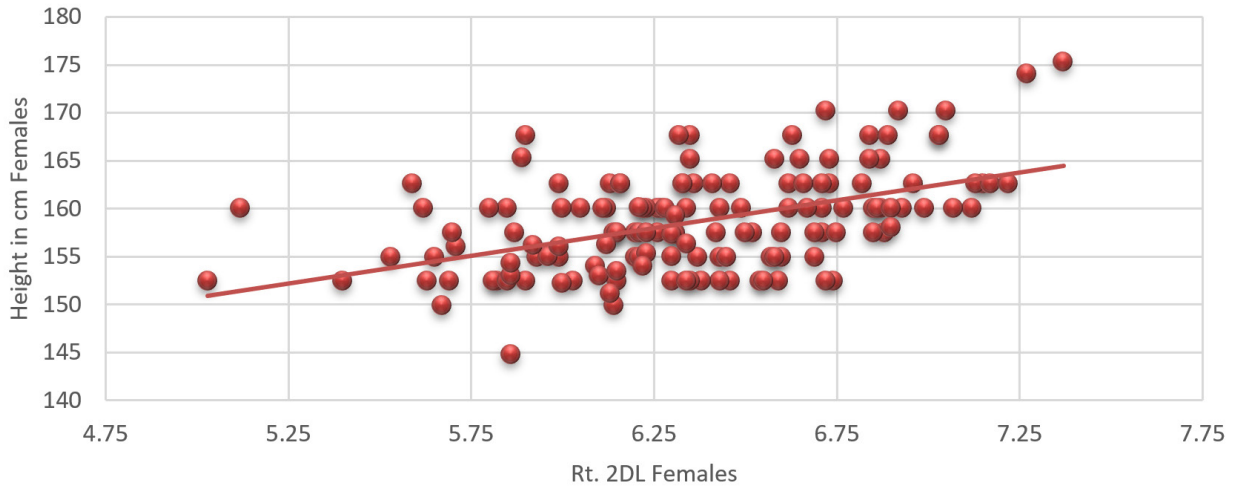
Table 3: Pearson's correlation coefficient, coefficient of determination, P-value and the regression equation derived in males.

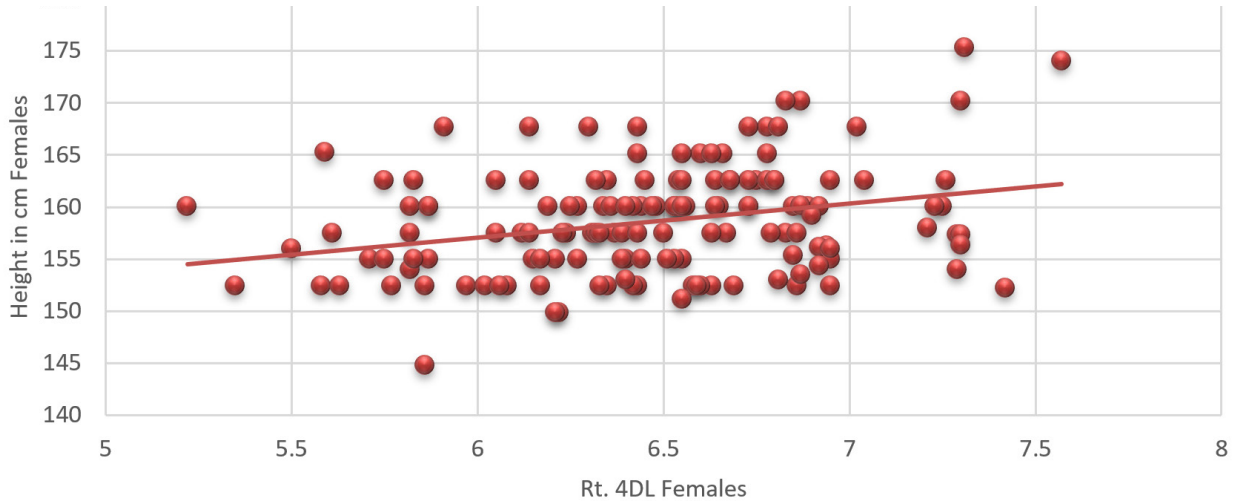
Parameter	Pearson correlation coefficient (r)	Coefficient of determination (R2)	P-value	Regression equation derived
Lt. 2DL vs Stature	0.38	0.14	0.00006*	$\hat{y} = 6.68862X + 124.32045$
Rt. 2DL vs Stature	0.36	0.13	0.00015*	$\hat{y} = 6.17904X + 128.25471$
Lt. 4DL vs Stature	0.47	0.22	< .00001*	$\hat{y} = 6.76851X + 122.90336$
Rt. 4DL vs Stature	0.49	0.24	< .00001*	$\hat{y} = 6.77295X + 122.80271$

*The result is significant at $p < 0.05$.




Stature (Males) in centimeters
190
185
180
175
170
165
160
155
150
5.5
6
6.5
7
7.5
8
Right 4DL (Males) in centimeters


Height in cm Females
180
175
170
165
160
155
150
145
140
4.75
5.25
5.75
6.25
6.75
7.25
7.75
Rt. 2DL Females


Height in cm Females
175
170
165
160
155
150
145
140
5
5.5
6
6.5
7
7.5
8
Rt. 4DL Females

DISCUSSION

In medicolegal situations where only the full hand or finger is available, estimating stature from finger length can be of crucial consequence. Predicting a person's height from their bone remains, amputated limbs, or other body parts has unique significance in cases of natural disasters, accidents, or murder.[5]

The goal of the current work was to create an equation for measuring stature from finger length that might be applied in situations where it is not possible to measure stature directly.

Similar to other investigations, the current study found a substantial Pearson connection between the length of the ring fingers on both hands, measuring 0.29 in the left 4DL stature and 0.28 in the right 4DL stature. [6,7,8,9,10,11] (Table 4)

Comparing the stature estimation regression models developed for this study, it was found that for 2DL, the accuracy of predicted stature estimation regression models was higher for males than for females, whereas for 4DL, the accuracy of predicted stature estimation regression models was higher in females than in males.

Regression equations were developed in earlier investigations by Jasuja O.P., and they once again demonstrated that both parameters are effective at providing estimates that can be used to estimate stature. [12]

Earlier studies on hand dimensions in different adult populations such as Turkish, North and South Indian populations report larger hand dimensions in males than females, which is similar to the findings of this study as the mean left 2DL and 4DL is 7.02cm and 7.15cm in male and 6.35cm and 6.44cm in female and for and for right 2DLand 4DL it is 6.97cm and 7.16cm for male whereas it is 6.36cm and 6.47cm in female. [13,14,15,16,17,18]

The purpose of this study piece is to fill a gap in the literature regarding the Nepalese population because statistically significant correlations between the length of the index and ring fingers and the height of males and females have been found. The index and ring fingers can also be used to measure stature, which is one of the key contributions to forensic anthropology needed for identification, according to a simple regression equation.

Table 4: Pearson's correlation Coefficient (r) determined by various researchers.

Author	Stature (mean) (c. m)		Pearson's correlation Coefficient (r)							
			Right hand				Left hand			
	Male	Female	Male		Female		Male		female	
			2DL	4DL	2DL	4DL	2DL	4DL	2DL	4DL
Rhui and Kim (6)	171.8	160.2	0.77	0.73	0.54	0.49	NA*	NA*	NA*	NA*
Mohan Prasad et al (7)	168	161	0.7	0.61	0.62	0.62	NA*	NA*	NA*	NA*
Yadav et al (8)	170	156	0.64	0.59	0.58	0.47	0.58	0.6	0.53	0.45
Ahuja P et al (9)	NA	NA	0.55	0.58	0.57	0.57	0.38	0.56	0.66	0.58
Abhishek Karn *et* al(10)	171.1	160.7	0.64	0.56	0.78	0.8	0.7	0.62	0.77	0.8
Krishna et al (11)	161.7	153.1	0.71	0.67	0.53	0.45	0.75	0.67	0.49	0.37
Present study	171.3	158.6	0.36	0.49	0.49	0.28	0.38	0.47	0.5	0.29

*Note: study done only on right hand

**Mean height was not available.

CONCLUSIONS

The findings of the current study show a statistically significant correlation between young adults' stature and their finger lengths (2DL and 4DL). The current preliminary investigation demonstrates that the living stature can be reasonably predicted from the lengths of the index and ring fingers. Other more techniques are used for identification, but since stature offers a strong starting point, calculating stature using a regression equation derived from finger length is crucial in forensic anthropology. The study can be furthered by conducting across a broader population with respect to a specific segment, as evidenced by the research conducted in Nepalese young adults, which has contributed to the field.

Conflict of interest: None

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