Estimation of Stature from Index Finger Length and Sexual Dimorphism in Adult Chakma Males and Females

Md. Mujibul Huq Talukdar[1*]   Md. Ashrafuzzaman[2]   Asma Mostafa[3]

ABSTRACT

Background: *Estimation of stature from index finger length in adult Chakma males and females and also to observe gender difference was the main purpose of this study.*

Materials and methods: *It was a cross-sectional analytical study conducted over 104 adult healthy Chakma males and females (52 males and 52 females) residents of Chattogram Hill Tracts area in the year 2016 and 2017. Subject selection was done by convenience sampling technique and stature and index finger length were measured and data were documented in SPSS version 19.*

Results: *A highly significant (p<0.001) gender difference was found in index fingers length. Mean Multiplication Factor (M.F.) to estimate stature in males was 25.1239 and 25.1149 for right and left index finger respectively and in female was 25.2505 and 25.2135 for right and left index finger respectively. A highly significant (p<0.001) positive correlation was found between stature and right index finger length 0.571 and left index finger length 0.576 in Chakma males. The stature and right index finger length 0.630 and left index finger length 0.679 in Chakma females respectively.*

Conclusion: *This study found multiplication factors for right and left index finger length to estimate stature in a correct way and found a linear correlation between stature and index fingers length. There was significant gender difference present between index fingers length in between adult Chakma males and females.*

Key words: Chakma population; Co-relation coefficient; Gender difference; index finger length; Stature.

Introduction

Anthropometry is the scientific study of the measurements and proportions of the human body. Height measurement is one of the important parts in the field of anthropometry. In case of complete or incomplete identification of individuals, height measurements are considered an important parameter.[1] Height measurements and other parts of the individual have a constant relationship and based on this principal, anthropologist and forensic experts use height parameter in identification purpose.[2] Charak and Sushruta, who were ancient time physician and surgeon also found the relationship between height and different body parts. Charak mentioned that the height of an average man should be 84 anguls, thigh 21 anguls, leg 19 anguls, forearm 15 anguls and arm 16 anguls.[3] Height measurements are used by the forensic pathologists for personal identification and they use linear regression models to predict the height.[4] Height estimation is done from long bones of the limbs by many researchers but very few researchers showed height estimation from fingers length and their study was also useful and effective.[5] Sex determination also an essential part of medico-legal investigations when an unknown body is found. Accurate sex determination has potent importance for giving sense of direction to the ongoing forensic investigation.[6] Stature of human being grows up to 20 – 25 years of age, and declines about 2.5 cm every 25 years, after the age of 30. So, a specific age group of adult population whose height is being steady and not changed should be come in consideration.[7] Digit length varies from person to person in the parameter of age, sex, races, occupation, environmental influences and also evolution and genetic arrangements. Variation in the digital lengths and their ratios was observed in different sexes and even in both hands of same individual.[8] The Chakma are the largest ethnic group in the Chattogram Hill Tract, making up more than half the tribal population in Bangladesh. They have their own religion, language and cultural systems.

1. Associate Professor of Anatomy
   BGC Trust Medical College, Chandanaish, Chattogram.

2. Professor of Anatomy
   Chittagong Medical College, Chattogram.

3. Professor of Anatomy
   Chattogram Maa-O-Shishu Hospital Medical College, Chattogram.

*Correspondence : **Md. Mujibul Huq Talukdar***
                 Cell : +88 01905 42 46 67
                 Email : mujibulhuq_talukdar@yahoo.com

Date of Submission   :   15th February 2022
Date of Acceptance   :   10th March 2022

Anthropometric knowledge will help in identification of this particular tribal population. This study was done to see the relation of height with index finger length on both side in both male and female of Chakma population and also to observe the sex difference, so that personal identification would be helpful in this tribal group of population.

Materials and methods
Total 104 Chakma adult Buddhist people in the age between 25 to 45 years were underwent direct physical measurement. Among them 52 males and 52 females. The subjects were chosen by convenience sampling technique from Rangamati and Khagrachori district of greater hill tract area of Chattogram. To eliminate the discrepancies of diurnal variation the measurements and the photographs were taken in day time between 9 a.m. to 3-4 p.m.

Procedure for Measurement of Stature (Height of the Body in a Standing Position)

The subject stood on bare-footed with feet together on a level concrete floor, with his/her upper backs, buttocks and heels touching the wall. The participant's head in the Frankfort plane. The arms were hung freely by the sides with the palm facing the thighs. After asking the subject to take a deep breath and holding it, a measuring scale was placed against the head and wall to determine maximum height on the wall and this was marked. The subject was then told to breath and to step away from the wall. The height was then measured from the floor to the mark on the wall with steel tape which represents stature in centimeters to the nearest 0.1 centimeters. The average of the two measurement was considered for the height of that person.[10]

Procedure for Measuring the Length of Index Finger
The subject was asked to place his / her hand on a table with the fingers together and thumb abducted and the hand and fingers as straight as possible. Measurement of length of index finger was taken from the tip of the finger to the midpoint of proximal / basal crease of the index finger with the help of sliding caliper[11].

Measurement of Index Finger Length Using Sliding Caliper
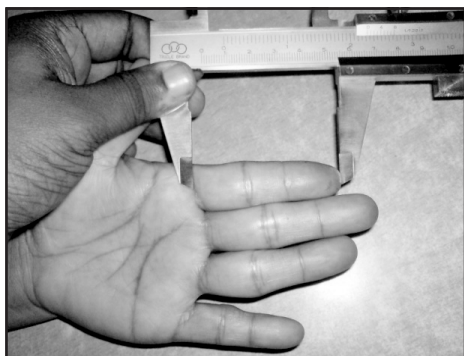

Figure 1 Measurement of index finger length

Formula for measurement of any length by sliding caliper.
Length = Reading of the main scale + Vernier coincidence × Vernier constant-(±Mechanical error).[12,13]

Procedure of Calculation of Multiplication Factor
Multiplication factor was obtained by dividing the stature with the respective upper limb variable (Length of index finger). Then the mean multiplication factor was calculated.
Multiplication factor = Stature ÷ upper limb variable (Index finger length).[10]

Software SPSS version 19 was used for analysis of data. Their mean, minimum, maximum, standard deviation, mean multiplication factor were calculated. Frequency distribution and regression analysis were done. Measured and estimated statures by using multiplication factor were tested by paired sample t-test. Gender differences in each variable were tested by using independent sample t-test. The Pearson correlation coefficient (r), probability (p) value, coefficient of determination (r^2) were calculated. The significance level was set at $p < 0.05$.

Results
In the present study, descriptive statistics and Multiplication Factor (MF) to estimate stature of Chakma adult males and females was shown in Table I. A highly significant positive ($p<0.001$) correlation between index finger length with stature found in males and females shown in table II. In Table III showed that there was no significant ($p>0.05$) difference present in measured and estimated stature in males and females respectively. Unpaired t test also done to see gender difference between index finger length, which showed at 102 degree of freedom t value was 6.021 and sig. (2-tailed) value was 0.000 ($p<0.001$) for right index finger length and t value was 6.276 and sig. (2-tailed) value was 0.000 ($p<0.001$) for left index finger length which expresses there was highly significant ($p<0.001$) gender difference present in right and left index finger length in Chakma adult population.

Table I Descriptive statistics and Multiplication Factor (MF) in males (n=52) and females (n=52)

Measurement		Minimum(cm)	Maximum(cm)	Mean±SD	M.F.
Stature	Male	150.85	189.05	162.5327± 6.85381	
	Female	137.90	165.95	150.7500±5.82519	
Right index finger	Male	5.42	7.40	6.4851±0.40670	25.1239
	Female	4.93	6.83	5.9909±0.43013	25.2505
Left index finger	Male	5.63	7.40	6.4854±0.39039	25.1149
	Female	5.08	6.82	5.9955±0.40547	25.2135

Table II Pearson correlation coefficient (r) and coefficient of derermination (r²) of variables measurements with stature and p value – males and females

Variable		Right side			Left side		
		r	r²	p value	r	r²	p value
Index finger	Males	0.571	0.326	p=0.000	0.576	0.332	p=0.000
length	Females	0.630	0.396	p=0.000	0.679	0.461	p=0.000

Table III Comparison between the measured stature and the stature estimated from different physically measured variables – males & females

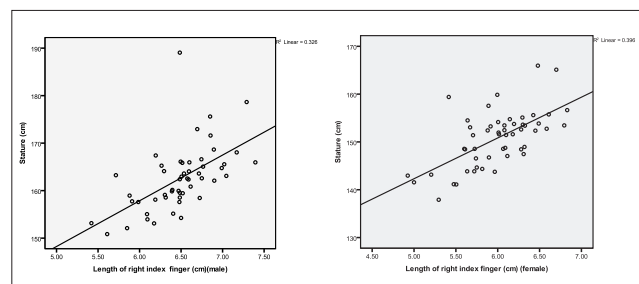|	Measurement from which the stature estimated	Measured stature (cm)	Estimated stature (cm)		p value
		Mean ± SD	Range	Mean ± SD	
Male	Right index finger length	162.53 ± 6.85	136.17 – 185.79	162.93 ± 10.21	0.735
	Left index finger length		141.27 – 185.72	162.87 ± 9.80	0.759
Female	Right index finger length	150.75 ± 5.82	124.36 – 172.46	151.27 ± 10.86	0.659
	Left index finger length		128.08 – 171.96	151.16 ± 10.22	0.693

Figure 2 Scatter diagram with regression analysis showing significant positive correlation (r=0.571, p<0.001) between the stature and length of right index finger of the Chakma adult males (n=52) and (r=0.630, p<0.001) between the stature and length of right index finger of the Chakma adult females (n=52)
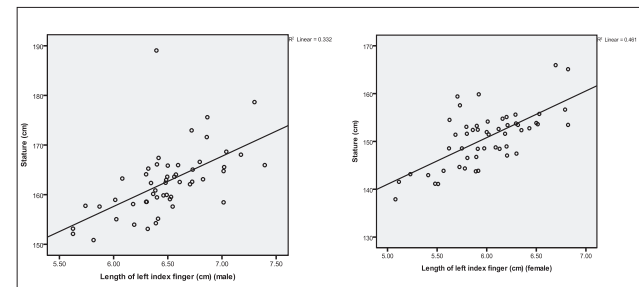

Figure 3 Scatter diagram with regression analysis showing significant positive correlation (r=0.576, p<0.001) between the stature and length of left index finger of the Chakma adult males (n=52) and (r=0.679, p<0.001) between the stature and length of left index finger of the Chakma adult females (n=52)

Discussion

The purpose of the study was to find out Multiplication Factor (MF) for index finger to estimate stature for the specific tribal Chakma population whose resident's was in the Chattogram hill tract area of Bangladesh and also to see whether there was gender variation present or not. The mean length of right index finger in male was 6.4851(±0.4067) cm, in female was 5.9909 (±0.43013) cm, left index finger in male was 6.4854 (±0.39039) cm, in female was 5.9955 (±0.40547) cm. Higher value of index finger length was found in comparison to Chakma population in other geographical area and ethnic group seen in different studies whose nutritional status, culture, environment are different such as Moradabad India studied by Kumar R et al.[1] Dakshina Kannada region of India studied by Balachandran M and Vaswani V R, adult eastern population of india studied by Sen J et al, Irainian population studied by Mojaverrostami S et al, Nepalese population left index finger length studied by Acharya J, Shrestha R and Pandey N, Nigerian adult population studied by Danborno B et al. and also Korean adolescents index finger length studied by Rhiu I and Kim W.[5,6,7,14,15,16]. Multiplication factor for estimation of stature for right and left index finger for both male and female was different and specific for that finger and tribe and with the multiplication factor, almost accurately the stature of that person of the Chakma adult population which is shown in Table I can be determined. Pearson correlation coefficient (r) in male was 0.571 for right index finger and 0.576 for left index finger and in female was 0.630 for right index finger and 0.679 for left index finger and all showed p value for correlation was <0.001. So, highest correlation with stature found in left index finger in both male and female. Our study also showed coefficient of determination (r²) in case of male was for right index finger 0.326 and SE of estimation 5.681 and for left index finger 0.332 and SE of estimation 5.659. Coefficient of determination (r²) in case of females was for right index finger 0.396 and SE of estimation 4.571 and for left index finger 0.461 and SE of estimation 4.318. Other researchers also found positive and significant correlation with stature and index finger length in different population such as Kumar R et al. study on Moradabad, Uttar Pradesh India, Balachandran M and Vaswani V R study on Dakshina Kannada, India, Mojaverrostami S et al. study in Iranian population, Nepalese population left index finger length studied by Acharya J, Shrestha R and Pandey N, Nigerian adult population studied by Danborno B et al. Korean adolescents index finger length studied by Rhiu I and Kim W, Raju G M et al. in

Davangere district, Karnataka, India, Bardale R V et al in Maharashtra population in India.[1,5,7,14-18] Gender difference in index finger length in this study also showed highly significant (p<0.001) and male index finger length was longer than female index finger length. Balachandran M and Vaswani V R study on Dakshina Kannada, India, Jaydip Sen et al study on eastern Indian population, Mojaverrostami S et al. study in Iranian population, Danborno B et al. study on Nigerian adult population, Dennis E. O. study on Nigerian population, Rhiu I and Kim W study on Korean adolescents, Suseelamma D et al. study on Narketpally, Telangana, India population, Bardale R V et al. in Maharashtra population in India, Ozlem Uzun et al. study on Turkish population, have established that there was statistically significant gender difference present in index finger length and sex can be determined from index finger length.[5-7, 15,16,18-21]

Conclusion

Highly significant (p<0.001) positive correlation was established between stature and right and left index finger length in adult Chakma tribal population and also regression analysis was done and found very effective in stature estimation was seen in this study. The multiplication factor showed the accuracy in determining the height of the person and the highly significant gender difference was also seen in our study. So, our study will be helpful in personal identification of the adult Chakma population.

Acknowledgement

Disclosure

References

1. Kumar R, Sharma N, Jain S K, Budhiraja V, Rastogi R, Garg R, et al. Morphometric Study of Estimation of Stature from Index Finger Length in Indian Population. Annals of International Medical and Dental Research 2016; 2(4): 232 – 236.
DOI:10.21276/aimdr.2016.2.4.57

2. Ahuja P, Manve P, Christal G, Dahiya MS. Estimation of Stature from Finger Length. J Forensic Sci & Criminal Inves. 2018; 7(2): 1-4.

3. Mondal, M.K., Jana, T.K., Das, J., Biswas, S., Use of Length of Ulna for Estimation of Stature in Living Adult Male in Burdwan District and Adjacent Areas of West Bengal. Journal of the Anatomical Society of India. 2009;58(1): 16-18.

4. Agnihotri A K, Kachhwaha S, Jowaheer V, Singh A P. Estimating Stature from Percutaneous Length of Tibia and Ulnan in Indo-Mauritian Population. Forensic Science International. 2009; 187: 109.e1 – 109.e3.

5. Balachandran M, Vaswani V R. Estimation of Stature from the Length of the Right Index Finger in a Population in an Area in Dakshina Kannada and Sexual Dimorphism Exhibition. Journal of Forensic Sciences And Criminal Investigation. 2017; 5(2): 001 – 008.
DOI: 10. 19080/JFSCI.2017.05.555659.

6. Sen J, Kanchan T, Ghosh A, Mondal N, Krishan K. Estimation of Sex From Index and Ring Finger Lengths in An Indigenous Population of Eastern India. Journal of Clinical and Diagnostic Research. 2015; 9(11): HC01 – HC05.
DOI:10.7860/JCDR/2015/14940.6846.

7. Mojaverrostami S, Mokhtari T, Malekzadeh M, Noori L, Kazemzadeh S, Ijaz S et al. Stature Estimation Based on Fingers Anthropometry in Iranian Population. Anatomical Sciences. 2017; 14(4): 163 – 168.

8. Hasan K R, Ara S, Banna F A M H. Correlation of Index Finger Length (2D) with Height, Weight and BMI in Adult Bangladeshi Male. Journal of Enam Medical College. 2017; 7(2): 90 – 94.

9. Athawale M C. Estimation of Height from Lengths of Forearm Bones. A Study of One Hundred Maharashtrian Male Adults of Ages between Twenty-Five and Thirty Years. American Journal of Physical Anthropology. 1963; 21(2): 105-112.

10. Hossain S, Begum J A, Akhter Z. Measurement of Stature from Arm-span – An Anthropometric Study on Garo Tribal Bangladeshi Females. Bangladesh Journal of Anatomy. 2011; 9(1): 5-9.

11. Shivakumar A H, Raju G M, Vijaynath V. Prediction of Stature by Right Middle Finger Length of Males among South Indian Population. Journal of Pharmaceutical and Scientific Innovation. 2013; 2(1): 31-33.

12. Tapan S, Hasan M A, Chowdhury R. Higher Secondary Physics: First Paper. Dhaka: Hasan Book House. 1998.

13. Laila S Z H, Ferdousi R, Nurunnobi A B M, Islam A T M S, Holy S Z H, Yesmin F. Anthropometric Measurements of the Hand Length and their Correlation with the Stature of Bengali Adult Muslim Females. Bangladesh Journal of Anatomy. 2009; 7(1): 10-13.

14. Acharya J, Shrestha R, Pandey N. Estimation of Stature Using Length of Fingers of Recessive Left Hand in Nepalese Population. Nepal Medical College Journal. 2016; 18(3-4): 132 – 136.

15. Danborno B, Adebisi S, Adelaiye A and Ojo S. Estimation of Height and Weight from the Lengths of Second and Fourth Digits in Nigerians. The Internet Journal of Forensic Science. 2008; 3(2): 1-4.

16. Rhiu I and Kim W. Estimation of stature from finger and phalange lengths in a Korean adolescent. Journal of Physiological Anthropology. 2019; 38(13): 1-8. DOI:10.1186/s40101-019-0206-1.

17. Raju G M, Shahina, Dubey S, Vijayanath V. Estimation of stature from index and ring finger length in Davangere district. International Journal of Clinical Trials. 2014; 1(1): 18-21. DOI:10.5455/2349-3259.ijct20140505.

18. Bardale R V, Dahodwala T M, Sonar V D. Estimation of Stature from Index and Ring Finger Length. J Indian Acad Forensic Med. 2013; 35(4): 353-357.

19. Eboh D. E. O. Sex Discrimination Using the Index and Ring Finger Lengths in Ukwuani People of Nigeria. Korean Journal of Legal Medicine. 2019; 43: 144 – 152.

20. Suseelamma D, Gyathri P, Deepthi S, Mohan C M, Kumar U M, Amarnath. Study of Correlation between Stature and Length of Fingers. Scholars Journal of Applied Medical Sciences. 2014; 2(2D): 773 – 784.

21. Uzun O, Oksuz C E, Zihni N B, Ozdemir T and Kalkisim S N. Sex Estimation from Index and Ring Finger Lengths in Turkish Population. Journal of Clinical and Diagnostic Research. 2019; 13(3): AC01 – AC06. DOI: 10.7860/JCDR/2019/40163.12673.