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Original Research Article

Anthropometric Measurement of Hand Dimension and Their Correlation with Height in Undergraduate Students of a Medical College in Nepal

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ABSTRACT

Introduction: Height is important for determination of basic energy requirement, standardization and identification. It is also useful for measuring physical capacity and adjusting drug dosages. Sometimes the exact height cannot be determined directly because the patient is unable to stand as a result of neuromuscular weakness, deformities of axial skeleton, loss of lower limbs and in case of amputation. Forensic investigations of skeletal remains also face the problems. Under such circumstances, height can be estimated by hand dimensions.**Methods**: Hand dimensions and height were measured on 239 medical students in the Department of Anatomy using standard instruments. Among them 120 were females and 119 were males. Correlation between height and hand dimensions was studied. Regression equation was derived for estimation of height from hand dimensions.**Results**: The correlations between height and hand dimension were statistically significant in both genders ($p<0.05$). The Pearson correlation between height and hand length was 0.616 and between height and hand breadth was 0.353 in males. Those coefficients for females were 0.706 and 0.198 respectively. Regression equations were formulated for height with hand length in males and females. **Conclusion**: Height can be predicted from hand length. Hand length showed moderate (males) to strong (females) positive correlation with statistical significance whereas hand breadth showed weak positive correlation with statistical significance.

Keywords: **Anthropometry, Hand dimensions, Height, Linear regression**

INTRODUCTION:

Height is the upright posture which is an important tool of physical identity. It establishes the identity of an individual from mutilated, decomposed and amputated body fragments which become an important necessity in recent times due to natural disasters like earthquakes, tsunamis, cyclones, floods and man-made disasters like terrorist attacks, bomb blasts, mass accidents, wars, plane crashes etc.[1]

The hand length was reliable alternative for estimating age-related loss in height. While alive the height is one of the key parameters established in the course of identification of unknown skeletal remains. Height helps to determine various features of a population including nutritional health and genetics. Height is considered as one of the important parameters for individual identification.[2]

For determination of height, anatomical and mathematical methods are generally applied. Mathematical methods that forensic anthropologists use for height reconstruction when complete skeletons are not available include regression equation and multiplication factor.[3] In 2018, the study conducted by Pandeya et al., calculated the estimation of height from hand length.[4] The present study aimed to investigate the association

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of hand dimensions (hand length and hand breadth) with height, and derive a linear regression equation between them to show if height could be predicted using hand dimensions.

METHODS:

An observational, cross sectional study was carried out from June 2019 to August 2019 among the first, second and third year students of Bachelor of Medicine and Bachelor of Surgery and first year students of Bachelor of Science,Nursing in the Department of Human Anatomy, Lumbini Medical College and Teaching Hospital, Pravas, Palpa, Nepal. The ethical clearance was obtained from Institutional Review Committee (IRC-LMC06-C/019). Informed consent was taken from each participant.

Sample size was calculated by using the formula,

$N = [(Z\alpha+Z\beta)/C]^2+3$

Where, N=desired sample size

$Z\alpha=1.96$(standard value at 95% confidence interval)

$Z\beta=0.80$

$C=0.5 \ln \{(1+r)/ (1-r)\}$

r =0.32(coefficient of correlation)[5]

The calculated minimum sample size was 75 for each gender. We enrolled a total of 119 males and 120 females in the study. For the selection of required participants the procedure was explained verbally and only the interested students were included. Those having deformities of axial skeleton and hand were excluded.

Standing height was measured to the nearest centimetres (cm) using a Stadiometer with the participant standing bare footed on a horizontal plane with eyes looking straight forward, the lower margins of the orbits and upper margins of external acoustic meatus lying in the same horizontal plane (Frankfurt plane). The height was measured from the sole of feet to the vertex of head.

Each participant was instructed to place his/her hands supine on a flat hard horizontal surface with fingers extended and adducted. Then the hand length (HL) of both hands, right and left, was measured by a metallic scale from the midpoint of the distal crease of wrist joint to the distal end of the most anterior projecting point that is tip of the middle finger.

Next, the participants were asked to place their hands in prone position on the flat hard horizontal surface with thumb extended and other fingers in extended and adducted position. Then the hand breadth (HB) of both hands was measured on a distance between the radial side of the 2nd metacarpo-phalangeal joint and the ulnar side of the 5th metacarpo-phalangeal joint.[6]

Data were entered in Statistical Package for Social Sciences software (SPSS™) version 20. Descriptive statistics were presented in terms of mean and standard deviation. Linear regression was used to determine relationship between height and hand dimensions. P value <0.05 was considered to be statistically significant.

RESULTS:

A total of 239 participants comprising 119 males and 120 females were taken. Their age ranged from 18 to 25 years. The mean (±SD)height, hand length and hand breadth of males and females are shown in Table 1. The mean height, hand length and hand breadth of males were found to be greater than those of females and the differences were statistically significant (p<0.001).

Table 1: Comparison of the findings of male and female participants.

Variables	Males (n=119) mean ± SD	Females (n=120) mean ± SD	Statistics
Age (years)	20.50 ± 1.51	19.78 ± 1.12	t (237) = 4.136, p<0.001
Height (cm)	170.52 ± 5.78	158.78 ± 6.93	t (237) = 14.207, p<0.001
Hand length (cm)	18.54 ± 0.98	16.85 ± 0.94	t (237) = 13.519, p<0.001
Hand breadth (cm)	8.32 ± 0.44	7.07 ± 0.63	t (237) = 17.819, p<0.001

Table 2 shows moderate positive correlation between hand length and height of males which was statistically significant (r=0.616, p<0.001). Similarly, correlation between hand length and height of females was strongly positive and statistically significant (r= 0.706, p<0.001).

Table 2: Correlation coefficient of height with hand length and hand breadth

Hand dimension	Height			
	Male		Female	
	r	p value	r	p value
Hand length	0.616	<0.001	0.706	<0.001
Hand breadth	0.353	<0.001	0.198	0.030

r= Coefficient of correlation

There was a weak positive correlation between height and hand breadth of males which was statistically significant (r=0.353, p<0.001). In females there was a weak positive correlation between height and hand breadth which was statistically significant (r=0.198, p=0.03).

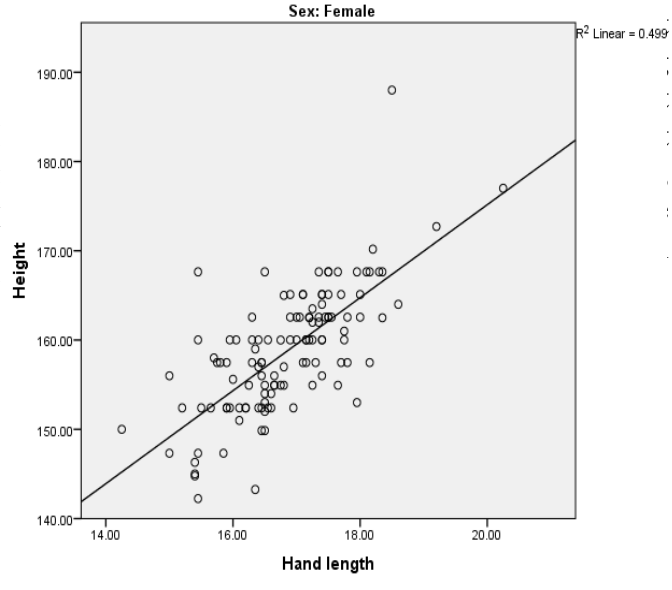

Fig 1: Relationship between height and hand length in females

Fig. 2 shows the relationship between height and hand length of males and the linear regression equation obtained was to predict height (cm) based on hand length (cm). A significant regression equation was found F(1,117)=71.62,p<0.001 with R^2 of 0.38, standard error of the estimate=4.56. Male participant's height is equal to

Height = 103.394+3.621× HL

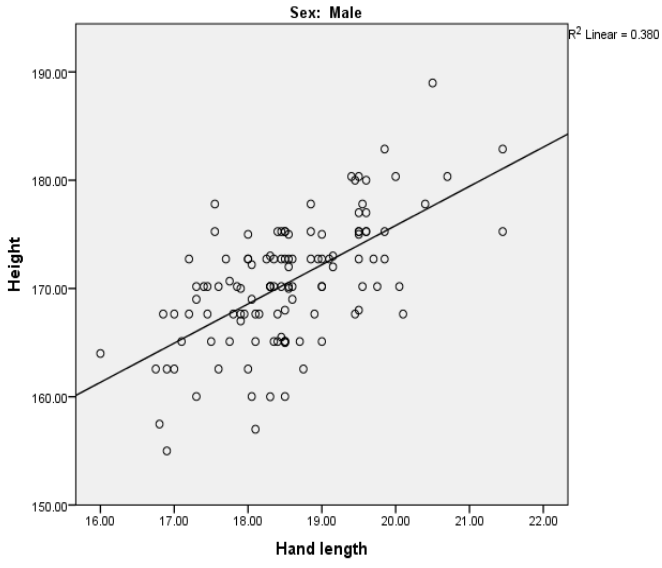

Fig 2: Relationship between height and hand length in males

Similarly, the following linear regression equations were obtained to predict height (cm) based on hand breadth (HB in cm) in females and males respectively.

For females, A significant regression equation was found F(1,118)=4.83, p = 0.03 with R^2 of 0.039, standard error of the estimate=6.82. Participant's height is equal to

Height = 143.28+2.19×HB

Male participant's height is equal to

Height = 132.21+4.60×HB.

Where, F(1,117)=16.66, p<0.001 with R^2 of 0.125, standard error of the estimate=5.43.

Linear regression models for estimating height from hand breadth had poor predictability explaining only 3.9 % of the variance in case of females and 12.5 % of the variance in case of males. Hence, hand length was more reliable than hand breadth to predict the height.

DISCUSSION:

Height is one of the important parameters to insight various features of population including nutritional health and genetics. However, under certain circumstances height cannot be exactly measured and in such conditions hand dimensions can be one of the reliable alternatives.[7] So the

present study was an attempt to find out the relation between height and hand dimensions. From this study we found that correlation of height with hand length was stronger than that with hand breadth in both males and females. Various studies had been carried out on assessment of height and its correlation with hand length. Mean height of both sexes and the correlation coefficients (r) =0.6 (for males) and 0.7 (for females) between height and hand length of our sample were similar to the previous study conducted in Delhi population.[8] Despite having almost similar heights in population of Sri Lanka,[9] the correlation coefficients (r=0.5 and 0.5) were slightly smaller.

The calculated mean hand length of males in the present study was almost same to the North Indian male population, but it was dissimilar in case of female.[10] In the present study the mean height was 170.52 ±5.78 and 158.78 ±6.93 cm in males and females respectively, while a study conducted in North Acrot district Tamilnadu,[11] mentioned different mean heights. Previously the study conducted by Pandeya et al., calculated the estimation of height from hand length only and their linear regression equation in male and female respectively were height=95.86+3.76×HL and height=79.41+4.46×HL.[4]

There are certain limitations of this study. It was conducted in one of the medical colleges of Nepal in a small population. The result obtained from this study might not represent all medical students. Further studies have to be carried out to develop the regression formula for the Nepalese population with larger sample size. The linear regression equation could have been derived from right and left hand dimension in relation to height.

CONCLUSION:

Linear regression equations were derived in relation of height with hand dimensions. We found that prediction of height can be done more accurately from the hand length than the hand breadth.

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REFERENCES

1. Mansur DI, Haque MK, Sharma K, Karki RK, Khanal K, Karna R. Estimation of stature from foot length in adult Nepalese population and its clinical relevance. Kathmandu Univ Med J. 2012;10(37):16-9. PMID: 22971855. DOI: https://doi.org/10.3126/kumj.v10i1.6907

2. Krishan K, Kanchan T, Sharma A. Multiplication factor versus regression analysis in stature estimation from hand and foot dimensions. J Forensic Legal Med. 2012;19(4):211-4. PMID: 22520373. DOI:https://doi.org/10.1016/j.jflm.2011.12.024

3. Venkatachalam KSM, Felix AJW. Comparison of Regression Equation with Multiplication Factor inDetermination of Stature from Hand Length in Adults. Journal of Medical Science and Clinical Research. 2019;7(1):188-92. DOI: https://dx.doi.org/10.18535/jmscr/v7i1.33

4. Pandeya A, Atreya A. Estimation of Stature from Percutaneous Hand Length Among the Students of A Medical College. J Nepal Med Assosc. 2018;56(211):687-690. PMID: 30381766. DOI: https://doi.org/10.31729/jnma.3624

5. Supare MS, Pandit SV, Bagul AS. Estimation of stature from hand length and hand breadth in medical students of Maharastra, India. International Journal of Health & Allied Sciences. 2015;4(3):154-9. Available from:http://www.ijhas.in/text.asp?2015/4/3/154/160875

6. Numan AI, Idris MO, Zirahei JV, Amaza DS, Dalori MB. Prediction of Stature from Hand Anthropometry: A Comparative Study in the Three Major Ethnic Groups in Nigeria. British Journal of Medicine & Research. 2013;3(4):1062-73. DOI: https://doi.org/10.9734/BJMMR/2013/1932

7. Krishan K, Sharma A. Estimation of stature from dimensions of hands and feet in North Indian Population. J Forensic Leg Med. 2007;14(6):327-32. PMID: 17239650. DOI: https://doi.org/10.1016/j.jcfm.2006.10.008

8. Sunil, Dikshit PC, Aggarwal A, Rani M. Estimation of stature from Hand length. Journal of Indian Academy of ForensicMedicine. 2005;27(4):219-21. Available from: http://medind.nic.in/jal/t05/i4/jalt05i4p219.pdf

9. Ilayperuma I, Nanayakkara G, Palahepitiya N. Prediction of personal stature based on the hand length. Galle Medical Journal. 2009;14(1):15-8. DOI: http://doi.org/10.4038/gmj.v14i1.1165

10. Kaur M, Singh B, Mahajan A, Khurana BS, Kaur A, Batra APS, et al. Anthropometric measurements of hand length for estimation of stature in North Indians. International Journal of Applied Biology and Pharmaceutical Technology. 2013;4(2):251-55. Available from: http://www.ijabpt.com/volume-4-issue-2.php

11. Karthick S, Elangovan M. Estimation of stature using hand length in the population of North Arcot District Tamilnadu. Global Journal for Research Analysis. 2018;7(5):49-50. DOI: https://www.doi.org/10.36106/gjra