

ASSOCIATION OF HAND LENGTH WITH HEIGHT IN MEDICAL STUDENTS ENROLLED IN SKIMS MEDICAL COLLEGE, INDIA.

Sajad Hamid ^{*1}, Arsalaan F. Rashid ², Qazi Najeeb ³, Shahnawaz Hamid ⁴, Arif Makdoomi ⁵.

^{*1} Lecturer Anatomy, SKIMS Medical College, Bemina, India.

² Post-MD Demonstrator Forensic Medicine, SKIMS Medical College Bemina, India.

³ Post-MD Demonstrator Biochemistry, SKIMS Medical College Bemina, India.

⁴ Post-Graduate Hospital Administration, SKIMS, Soura, India.

⁵ Demonstrator Anatomy, GMC, Srinagar, India.

ABSTRACT

Introduction: Stature is considered as one of the important parameters for personal identification. So, Stature reconstruction is important as it provides forensic anthropological estimation of the height of a person in the living state which plays a vital role in the identification of individual remains.

Aim: The aim of the present study was to investigate the association of hand length with height and to show if height could be predicted using hand length measurements in students of SKIMS Medical college.

Methodology: The study of the anthropometric characteristics of 100 Medical College students of ages between 18-23 years of SKIMS Medical college, Bemina with no obvious deformities or previous history of trauma to the spine or hand was undertaken. The study of these medical students, males (n=50) & females (n=50) was investigated. The anthropometric characteristics of their height and hand length were measured, analysed statistically for any significant difference, and correlation between the parameters studied.

Results: The results show some significant differences between the anthropometric parameters, Pearson's correlation analysis was used and showed a strong positive correlation, which means that high X variable scores go with high Y variable scores. (R is 0.8229) and it is significant. Results from the present study show that there was a positive correlation between height and hand length indicating that height could be predicted using hand length.

Conclusion: As age groups increase the mean length of hand also increase, so there is direct relation between length of hand and age groups. Definite proportion also exists between the height and hand length in an individual at all ages, irrespective of the sex. Height of an individual is 9 times the height of hand length. Thus we can predict height from hand length when it is difficult or not possible to measure height directly.

KEY WORDS: Height, Hand Length, Anthropometry, Medical College.

Address for Correspondence: Dr. Sajad Hamid, Lecturer Anatomy, SKIMS Medical College, Bemina, India. **E-Mail:** drsajadk@rediffmail.com

Access this Article online

Quick Response code



DOI: 10.16965/ijar.2015.110

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 24 Jan 2015

Accepted: 16 Feb 2015

Peer Review: 24 Jan 2015

Published (O): 28 Feb 2015

Revised: None

Published (P): 31 Mar 2015

INTRODUCTION

The growth, nutritional status, body surface area and pulmonary function of children can be assessed by the estimation of the body size such as height and weight [1,2]. Measurement of height is important for determination of basic

energy requirement, standardization, and measures of physical capacity and for adjusting drug dosages [3] but various diseases where a patient cannot stand the exact height cannot be determined directly e.g deformities of axial skeleton such as kyphosis, lordosis, scoliosis, lost of lower limbs and in patients who have

undergone amputations [4,5]. For example in scoliosis patients, the predicted spirometric values were underestimated when the measured body was used and under such circumstances, an estimate of height has to be computed based on another body parameters [6,7].

The height achieved by the individuals is under the control of genes and environment. As the growth is measured by measuring the height of a person, which itself is a sum of the length of certain bones and appendages of the body. This relationship is very useful anthropologically to find racial differences and medico-legally, when only parts of the deceased body are available [8] Ascertaining sex and estimation of stature from incomplete skeletal and decomposing bodies is a recurring theme in physical anthropology and forensic science [9-12] as Stature is considered as one of the important parameters for personal identification [13,14]. The hand length was found to be the most reliable alternative that can be used as a basis for estimating age-related loss in height. The length of the body while alive is one of the key parameters established in the course of identification of unknown skeletal remains [15,16]. Amirshaybani et al (2000) found that hand length can be a good predictor of the body surface area independent of the sex of the individual [2].

The most important applications of anthropology at field level include biological anthropology, epidemiology, clinical application and in metabolic research [17,18]. The hand length could be used to predict body weight status and body surface area independent of the sex of the individual [18]. Thus a reliable and precise means in predicting the height of an individual is by knowing the hand length of the individual [19,20].

The dimensions of the hand and foot have been used in the determination of sex, age, stature of an individual by forensic experts in forensic examinations. Stature reconstruction is important as it provides forensic anthropological estimation of the height of a person in the living state which plays a vital role in the identification of individual remains [21,22]. Intact long limb bones have been used in the derivation of

regression equations for stature assessment in different population groups. Anthropologist observes and compared the relation between body and segments to highlight variations between and within groups. The major concern in forensic medicine and forensic anthropology is determination of a stature [23].

The bone area values at different sites strongly correlates to muscle strength and also correlate to body size; height, weight, lean mass, fat mass and body mass index (BMI) [23]. It is commonly accepted that standards for skeletal identification vary among different populations and the standard for one population may not be used for another [24,25].

Establishing personal identification of the victims is often required and the estimation of stature from extremities and their parts plays an important role in identifying the dead in forensic examinations (26). The reconstruction of body stature has been a subject of study since the beginning of the nineteenth century in the specialized areas of forensic anthropology which deals with the application of methods and techniques of analysing skeletal remains [27,25,28].

The aim of the present study was to investigate the association of hand length with height and to show if height could be predicted using hand length measurements in students of SKIMS Medical college.

MATERIALS AND METHODS

This study was carried out among first year students of SKIMS Medical college in Kashmir, india. The sample consists of 100(males=50, females=50) with no known physical deformities between the ages of 17-23 years. The inclusion criteria include that participants must be a first year medical student between the ages of 17-23 years of age without any known Physical or Mental deformity. The demographic data of the subjects collected include the age in years, name, place of birth, parental and grandparental origin were completed in the questionnaire. Standing height and hand length measurements were done.

Standing height was measured to the nearest metres (cms) using a Stadiometer with subject

standing erect on a horizontal resting plane bare footed having the palms of the hands turned inward and the finger pointing downwards and the height was then converted to the nearest meters (cms). The height was measured from the sole of the feet to the vertex of the head as recommended by International Biological Program [29,30].

The measurements were taken by the same person to avoid personal error in methodology.

The hand length was measured with a calibrated non stretch tape from distal flexion crease of wrist to the tip of the middle finger in extension after nails were trimmed as described by Amirshaybani et al. (2001)[6]. Data was expressed as mean \pm standard deviation (\pm SD). Pearson's correlation analysis was used to determine the strength of the relationship between the parameters studied. Students' T-test was used to test the significant levels between the body proportions studied. Differences were declared significant when P-value is less than 0.05 ($P \leq 0.05$) and correlation exist when $P \leq 0.001$.

RESULTS

The results from the present study show the mean and standard deviation of height in medical students was 164.95 ± 10.71 , while the mean and standard deviation of hand length are 18.56 ± 1.06 . In the present study shows that mean height of male medical students was 173.6 ± 5.0 and female medical students was 156.24 ± 7.1 cm. Mean height of first year medical students child was 164.95 ± 10.71 cm. Mean length of hand in male medical students was $19.24 \text{ cms} \pm 0.80 \text{ cm}$. and female medical students was 17.89 ± 0.85 cm. Mean hand length of all the first year medical students was 18.56 ± 1.06 . Our study reveals that mean height of case who belong to one year of age group were 8.55 times more than length of hand. As age increases the mean length of hand also increases. In our study age group the height is approximately 9 times more than length of hand. Pearson's correlation analysis was used to and shows a strong positive correlation, which means that high X variable scores go with high Y variable scores.

The results show that height and hand length was significantly increased with age of the medical students. ($P \leq 0.05$). This shows that there is a proportional relationship between age and the parameters studied and an age dependent increase in height and hand length.

The linear regression equation for estimation of height from age (years) with hand length shows there was a positive correlation ($p \leq 0.001$) between height and hand length.

The result shows the multiple regression equation for estimation of height and hand length. The multiple linear regressions show a positive correlation ($P \leq 0.001$) of height with the other parameters used.

Table 1: Statistical Data on Mean Height.

	MEAN HEIGHT	STANDARD DEVIATION
MALES	173.6 cms	(SD= 5.0)
FEMALES	156.24 cms	(SD= 7.1)
TOTAL	164.95 cms	(SD=10.71)

Table 2: Statistical Data on Mean Hand Length.

	MEAN HAND LENGTH	STANDARD DEVIATION
MALES	19.24cms	(SD=0.80)
FEMALES	17.89 cms	(SD=0.85)
TOTAL	18.56 cms	(SD=1.06)

Pearson Correlation coefficient	r=0.8229	
p-value <0.00001	The result is significant at $p < 0.05$	
STUDENT'S T TEST		
T-value = 135.87	p-value= <0.00001	The result is significant at $p < 0.05$

The value of R is 0.8229. This is a strong positive correlation, which means that high X variable scores go with high Y variable scores.

DISCUSSION

The result of the present study showed that the dimension of hand length can be associated with height and can be used in the estimation of height. The parameters studied, showed a significant correlation with height, hence these could be used by law enforcement agents and forensic scientists in the identification of the fragmentary dismembered human remains. Since it has been established that long bones are the most appropriate specimen for height evaluation and estimation [25,31], hand length was chosen for this study as it is part of the long bones of the body.

It has been shown in this study that there was a significant correlation between height and hand length.

The use of anthropometric methods is available in case of athletes in which the bone area values at different sites of the body are strongly related to muscle strength and parameters related to body size such as height, weight, lean mass, fat mass and body mass index according to Ruff, (2000) and Jasuga et al., (2004)[32,31].

Thus morphometric estimation of height from skeletal size appears to work reasonably well in both normal and highly athletic modern humans [32,31]. Estimation of height using various physical measurements has been attempted by many researchers but the one variable that proves to be consistently reliable in the estimation of height is the hand length [33,34]. The result from the present study shows that hand length can be used to predict height. The present study shows the parameters used to determine height can also be used to determine hand length because there was a 2-tailed significant correlation between hand length and height. In the age group 19-23 years the height is approximately 9 times more than length of hand. This shows that height of any age group is 9 times more than the length of hand. Danborn found that the relationship between hand and foot length and height is strongly significant ($P < 0.001$). When hand and foot were correlated the relationship between hand and foot length was higher in the females than the males, but when hand and foot lengths were compared to height the relationship was stronger in the males than in the females. Multivariate analysis was conducted to see if the height of subjects could be predicted from the lengths of right and left hands and feet. This proved to be effective and provided valuable predictive equations that enable the prediction of height for both males and females, with higher prediction ability in the females than the males [35]. This finding is in agreement with reports from Turkish sample [35, 36] and Indian sample [13].

CONCLUSION

The results from the present study indicated that among the 17 – 23 year age group, male had

more height than female. As age groups increase the mean length of hand also increase, there is direct relation between length of hand and age groups. Definite proportion also exists between the height and hand length in an individual at all ages, irrespective of the sex. Height of an individual is 9 times the height of hand length. Hand length is a proxy indicator for height when it is difficult or not possible to measure height directly, thus stand as indicator for predicting height among medical students of SKIMS Medical college

Conflicts of Interests: None

REFERENCES

- [1]. Gauld R. F., & Rakhir S. M. The nutritional status of disabled children: a cross-sectional survey. *Eur. J Clin Nutr.* 2004;53(12):915-919.
- [2]. Amirshaybani H. R., Creceilius G. M., Timothy N. H., Pfeiffer M., Saggars G. C., & Manders E.K. The natural history of growth of hand. Part I: Hand area as a percentage of body surface area. *Plastic and Reconstructive Surgery* 2000;107(3):726-733.
- [3]. Jalzem, P. F., & Gledhill R. B. Predicting height from limb measurement. *Journal of Paediatrics and Orthopaedics* 1993;13(6):761-65.
- [4]. Duyar I. & Pelin C. Body height estimation based on tibia length in different stature groups. *American Journal of Physical Anthropology* 2003;122:23-27.
- [5]. Duyar I., Pelin C., & Zagyapan R. (2006). A new method of stature estimation for forensic anthropological application. *Anthropological Science International* 2006;114:23-27.
- [6]. Amirshaybani H. R., Creceilius G. M., Timothy N. H., Pfeiffer M., Saggars G. C., & Manders E.K. The natural history of growth of hand. Part II: Hand length as a treatment guide in paediatric trauma patients. *Journal of trauma* 2001;49:457-460.
- [7]. De Mendonca, M. C. Estimation of height from lengths of long bones in a Portuguese adult population. *American Journal of Physical Anthropology* 2000;112:39-48.
- [8]. Patel SM, Shah GV, Patel SV. Estimation of height from measurements of foot length in Gujarat region. *J Anat Soc India.* 2007; 56:25-25
- [9]. Agnihotri AK, Shukla S, Purwar B. Determination of sex from the foot measurements. *The Internet J Forensic Sci.* 2007; 2:1.
- [10]. El-Meligy MMS, Abdel-Hady RH, Abdel-Maaboud RM, Mohamed ZT. Estimation of human body built in Egyptians. *Forensic Sci Int.* 2006;159:27-31.
- [11]. Ozaslan A, Iscan MY, Ozaslan I, Tugcu H, Koc S. Estimation of stature from body parts. *Forensic Sci Int.* 2003; 132:40-5.
- [12]. Ozden H, Balci Y, Demirustu C, Turgut A, Ertugrul M. Stature and sex estimate using foot and shoe dimensions. *Forensic Sci Int.* 2005; 147:181-4.

- [13]. Krishan K., & Sharma, A. (2007). Estimation of stature from dimension of hands and feet in North Indian Population. *Journal of forensic and Legal Medicine* 2007;14:327-332.
- [14]. Anitie H. *Worldwide variation in human growth*. 2007;4:67– 68. Cambridge University Press.
- [15]. Hauser R., Smolinski J., & Gos T. The estimation of stature on the basis of measurements of femur. *Forensic Science International* 2005;147:181-184.
- [16]. Auerbach B. M., & Ruff C. B. Human body mass estimation: a comparison of morphometric and mechanical methods. *American Journal of physical anthropology* 2004;125: 331-342.
- [17]. Bidmos, M. A. A staturer reconstruction from the calcaneus of south Africans of European descent. *Journal of clinical and forensic medicine* 2006;13:247-252.
- [18]. Bidmos, M. A. Evaluation of accuracy of direct and indirect methods in stature reconstruction. *Journal of clinical and forensic medicine* 2009.
- [19]. Gauld, R. F. & Rakhir S. M. The prediction of stature from handlength. *Journal of crime and criminalistic* 1996;8:79-81.
- [20]. Ebite M. N., S. T., & Frisher K. R. Predicting stature through hand length. *Journal of crime and criminalistic* 2000;52:23-27.
- [21]. Bhatnagar, D., Thapar, S., & British, M. Identification of personal height from the somatometry of the hands in Punjabi males. *Forensic Science International* 1984;24:137-141.
- [22]. Boldsen, J. A statistical evaluation of the basis for predicting stature from lengths of long bones in European populations. *American Journal of physical Anthropology* 1984;65:305-311.
- [23]. Fessler D. M T, Haley K. J., & Lai R.D. Sexual dimorphism in hand length proportionate to stature. *Ann Hum Biol.* 2005; 32(1): 44-59.
- [24]. Thakur SD., & Rai KS. Determination of stature from hand measurement. *Medicine Science and Law* 1987;78:25-28.
- [25]. Iscan M. Y. Rise of forensic anthropology. *Year Book of Physical Anthropology* 1988;31:203-230.
- [26]. Nath, S., Dayal, N. & Chandara, N. S. Reconstruction of stature using percutaneous lengths of forearm bones among Mundas of Midnapore district. *Journal of West Bengal Human Biology* 1998;37:170-175.
- [27]. Trotter, M. & Glesser, G. C. Are evaluations of estimation of stature based on measurements of stature taken during life and of long bones after death, *American Journal of Physical Anthropology* 1958; 16(1):79-123.
- [28]. Iscan, M. Y. Editorial: Global Forensic anthropology in the 21st century. *Forensic Science International* 2001;117:1-6.
- [29]. Mauthausen K., & Gusen, Y. R. Estimation of actual individual height during the exhumation of the remains of the former concentration camps. *Journal of Forensic Science* 1959;3:533-537.
- [30]. WHO. Physical status, the use and interpretation of anthropometrics. Report of a WHO Expert Committee Technical Report Series No 854, Geneva, 1995.
- [31]. Jasuga O. P, Singh J, & Jain M. Estimation of stature from hand, foot and shoe measurement by multiplication factors: A reviewed attempt. *Forensic Science International* 2004;50:203-215.
- [32]. Ruff C. B. Body mass prediction from skeletal frame size in elite athletes. *American Journal of Physical Anthropology* 2000;113(4):507-517.
- [33]. Shintaku K., & Furuyay. Estimation of stature based on the proximal phalangeal length of Japanese women's hand. *JUEOH.* 1990; 12(2): 215-219.
- [34]. Kanchan T., Krishan K, Sharma A, & Menezes RG. A study of correlation of hand and foot dimensions for personal identification in mass disasters. *Forensic Science International* 2010; 199: 112-116.
- [35]. Danborn B, Elukpo A: Sexual Dimorphism in Hand and Foot Length, Indices, Stature-ratio and Relationship to Height in Nigerians. *The Internet Journal of Forensic Science.* 2008;3(1).
- [36]. Sanli SG, Kizilkanat ED, Boyan Ozsahin NE, M. Bozkir MG, Soames R, Erol H, and Oguz O. Stature Estimation Based on Hand Length and Foot Length. *Clin Anat* 2005; 18:589-596.

How to cite this article:

Sajad Hamid, Arsalaan F. Rashid, Qazi Najeeb, Shahnawaz Hamid, Arif Makdoomi. ASSOCIATION OF HAND LENGTH WITH HEIGHT IN MEDICAL STUDENTS ENROLLED IN SKIMS MEDICAL COLLEGE, INDIA. *Int J Anat Res* 2015;3(1):884-888. DOI: 10.16965/ijar.2015.110