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Indian Journal of Clinical Anatomy and Physiology

Journal homepage: www.innovativepublication.com

Original Research Article

Exploring the anatomical dimensions of hand and its correlation with height – An observational study in context of Indian population

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ARTICLE INFO

Article history:
Received 04-12-2019
Accepted 11-01-2020
Available online 14-03-2020

Keywords:
Anthropometry
Hand length
Height
Indian population.

ABSTRACT

Introduction: An inclusive study of relationship between lengths of hand and its correlation to height of person provides valuable help in generating biometric database. Limited research exists on morphometric assessment of hand dimensions in Indian population. The objective of the current study was to frame the morphometric database of hand measurements in context of its clinical implications. The generated data can be used in various anthropological studies.

Material and Methods: A Cross-sectional Indian population-based study was carried out among 500 male and female healthy students after excluding past history of trauma or illness after taking written, informed consent. Hand dimensions were measured by 'Rod Compass'. The data was processed and analysed in SPSS Version 20 (SPSS Inc., Chicago, IL, USA). Two tailed 'p' value of 0.05 was taken as statistically significant. Appropriate statistical tests of significance, correlation coefficients, and multiple regression correlations were computed to evaluate statistical differences.

Results: The mean hand length in the females was lower as compared to males who had significantly higher mean hand length in all age groups. The difference was found to be statistically significant ($p<0.001$). The study revealed positive relationship between hand length and height.

Conclusions: Hand dimensions provide good reliability in estimation of stature. This biometric data can be successfully utilized in management of various health ailments.

1. Introduction

Anthropometry is a series of systematized measuring techniques that express quantitatively the dimensions of human body and skeleton.[1] Anthropometric studies have multiple useful implications. They have instrumental role for defence personnel in pretext of designing aircrafts, uniforms as well as other specialized equipment.[2] Its utilization in industries and spaceship programmes is also well acknowledged in recent centuries.[3]

Anthropometry bears a vital role in forensic medicine as well, in the form of assisting the law enforcement agencies in ensuring the personal identity in case of unknown human remains.[4] In forensic anthropology, an assessment of stature from feet and hand measurements play a substantial role in creating personal identity. Despite the bilateral symmetry among humans, there seems to have asymmetry in various dimensions like arms, foot, hands etc. irrespective of gender or handedness.[1]

Comprehensive study of relationship between lengths of hand, feet and its correlation to height of an individual provides valuable help in creating biometric database. Such database can be useful in various corrective surgeries, development of prosthesis, management of burn patients etc.[3] There is limited research on morphometric assessment of hand dimensions in Indian population. The intent of the present study was to formulate the morphometric database of hand measurements in context of its clinical implications. The generated data can be utilized in further anthropological studies.

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https://doi.org/10.18231/j.ijcap.2020.005

2. Materials and Methods

An Institutional Ethics Committee (IEC) approval was obtained from the ethics committee of respective institute. The current Cross-sectional study was implemented at Bharati Vidyapeeth (Deemed to be University) Medical college, Pune, Maharashtra State. The enrolled study participants were 500 in total consisting of male and female healthy group between 18 to 23 years without any past history of trauma or illness. An informed consent was taken from the study participants.

Hand measurements were taken by using 'Rod Compass'. Styloid process of both radius and ulna were marked with a marker pen. Interstyloid line was drawn. Mid-point of this line was marked. The distance between midpoint of interstyloid line and tip of middle finger was taken as measurement of hand length. Both the lengths of right and left hands were measured. All measurements were done by same instrument and technician for three times and mean value taken to avoid intra-observer variations.

Entire data was processed and analysed in SPSS Version 20 (SPSS Inc., Chicago, IL, USA). Mean and Standard Deviation of all observations were determined. Two tailed p value of 0.05 was taken as statistically significant. Appropriate statistical tests of significance, correlation coefficients, and multiple regression correlations were computed to evaluate statistical differences.

3. Results

Table 1 depicts mean hand length (HL) of male and female participants of various age groups. Measurements shows mean hand length in the females was lower as compared to males who had significantly higher mean hand length in all age groups. The difference was found to be statistically significant ($p<0.001$) (Table 1).

Table 2 describes the details of height of study participants. It clearly shows that males in all age groups were taller than females. The difference was found to be statistically significant.

In males and females both, the correlation coefficient 'r' was statistically significant for almost all age groups ($p < 0.01$) (Table 3). This indicated the positive correlation between two variables, i.e. hand length and height. So, linear regression coefficients were found out, which again were statistically highly significant ($p < 0.01$) (Table 3). However, in the age group of 20-21 of both genders and 22-23 of male participants, the correlation coefficient and regression coefficient were not statistically significant. So, the regression equation could not give a good fit for these age groups.

4. Discussion

Over many years, an adjacent relationship between stature and dimensions of various body segments is documented and the results are recurrently used in the medico-legal investigations. In this Indian population-based study, an attempt was undertaken to estimate stature of person by using the length of hand. The study also tried to establish the correlation between hand length (HL) and height (Ht).

The emerging results of the study showed that the hand dimensions can be effectively used for the assessment of stature by forensic experts. The fact which needs to be considered is that these measurements may be applicable to Indian population only, as there might be inherent variations in the dimensions of other population due to genetic and environmental factors.

In the current study, the mean HL was observed to be more among male participants than females. The difference was statistically significant ($P <0.001$). It indicates a clear pattern of sexual dimorphism among female participants with reduced HL and Ht as compared to males. This corroborated with study finding of Khan M et al.[5] Numan et al.[6] and Jethva et al.[7] These gender differences could be attributed to early pubertal growth spurt in females due to hormonal influences which stimulates early fusion of epiphyses. However, in males, there is delay in growth spurts which help them to grow for longer period due to sustained testosterone effect.

It was seen in the present study that the mean height ranged from 167 cm to 173 cm in males and 155 cm to 159 cm in females. The males were having more height than females and the difference was observed to be statistically significant ($p<0.001$). Krishnan et al.[8] and Jasuja et al.[9] also reported similar findings in their studies. The studies in other Indian settings found differences in mean height among the subjects. Nutrition, genetic composition and environmental aspects may be the possible predisposing factors for such variations.

One of the major limitations of study was limited sample size as large sample size is essential to generalize the study results. Therefore, the current study recommends to carry out multiple anthropometric studies with larger sample size for better generalization of results and to avoid wider standard deviations.

Table 1: Distribution of Mean Hand Length in Males and Females (n= 500)

Age group	Males			Females			t value	P value
	Number	Mean	SD	Number	Mean	SD		
18 – 19	43	20.033	1.207	113	18.181	0.742	11.569	0.000
19 – 20	68	20.092	1.098	55	18.155	1.030	9.994	0.000
20 – 21	84	19.830	1.250	55	18.006	1.344	8.097	0.000
21 – 22	43	20.018	1.084	17	17.755	0.878	7.654	0.000
22 – 23	06	19.558	1.145	16	18.146	0.760	3.379	0.003

SD – Standard Deviation, $p<0.001$ was considered as statistically significant

Table 2: Distribution of Height in Males and Females (n= 500)

	Males			Females			't' value	'p' value
Age group	**Number**	**Mean**	**SD**	**Number**	**Mean**	**SD**		
18 – 19	43	171.2	7.2	113	158.4	5.8	11.506	0.000
19 – 20	68	172.2	7.4	55	158.2	6.7	10.842	0.000
20 – 21	84	170.04	17.01	55	158.05	6.5	4.945	0.000
21 – 22	43	172.1	6.9	17	155.7	3.6	9.345	0.000
22 – 23	6	167.22	3.914	16	157.69	5.9	3.652	0.002

SD – Standard Deviation, $p<0.001$ was considered as statistically significant

Table 3: Correlation between Hand Length and Height (n=500)

Age Group	Males			Females		
	r - square	Regression Equation		r - square	Regression Equation	
		Constant	'b'		Constant	'b'
18 – 19	0.205	7.043	0.076	0.474	4.214	0.088
19 – 20	0.482	2.356	0.103	0.643	- 1.367	0.123
20 – 21	NS			NS		
21 – 22	0.553	- 0.119	0.117	0.566	- 10.923	0.184
22 – 23	NS			0.444	4.545	0.086

NS – Not significant

5. Conclusion

It is concluded that hand dimensions provide good reliability in estimation of stature. The study also revealed higher hand dimensions in males as compared to females. The positive correlation was noted between hand length and height. This biometric data can be successfully utilized in management of various health ailments.

6. Acknowledgements

Authors are thankful to staff members of Department of Anatomy, Bharati Vidyapeeth Deemed to Be University Medical College, Pune for their valuable help and support for successful implementation of this study.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Cite this article: Joshi A, Khemnar G, Puranik M. **Exploring the anatomical dimensions of hand and its correlation with height – An observational study in context of Indian population**. *Indian J Clin Anat Physiol* 2020;7(1):19-22.