

ANATOMICAL STUDY ON ANTHROPOMETRIC MEASUREMENTS OF STATURE  
AND ITS RELATIONSHIP WITH RIGHT UPPER LIMB

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## ABSTRACT

**Background:** It is a fact that in humans, no two persons have same characters. Anthropometry is commonly used technique for the measurements of bones in Anatomy. Stature and upper limb anthropometric measurements of an individual plays a vital role in determining the identity of unknown person. **Method:** This study has been conducted on 256 students of Maharishi Markandeshwar University having 122 females and 134 males between age group 18-25 years as participants. All the participants have been enrolled after their consent. Anthropometric Measurements made on 256 participants and data collected. Data (Frequency, percentages and Pearson coefficient of correlation) had been analyzed by using SPSS Version 16. **Results:** Mean stature, right arm length, Right Fore Arm Length(cm), Right Upper Extremity Length(cm), Right Palmar Length(cm), Right Third Finger Length(cm), Right Hand Width(cm), Right Wrist Width(cm), Right Wrist Circumference(cm) among total population 166.4, 33.9, 26.38, 72.28, 10.3, 7.83, 8.27, 6.17 and 15.77 respectively. **Conclusion:** There is significant positive correlation ( $p < 0.05$ ) between right upper limb and stature.

**KEYWORDS:** Stature and upper limb anthropometric measurements of an individual plays a vital role in determining the identity of unknown person.

## INTRODUCTION

"Identification is an individual's birth right". In cases of mass disasters such as explosions, railway and aviation accidents, where only body pieces may be accessible, identification becomes even more crucial. In addition to identification, stature measurement is necessary for evaluating children's growth, calculating nutritional indices, predicting and standardizing physiological parameters like resting metabolic rate, lung volumes, muscle strength, and glomerular filtration rate, and adjusting medication dosage. Measuring stature can be challenging or impossible in certain situations, though, because of lower limb amputations, abnormalities of the trunk or legs, fractures, contractures, or patients who are unable to stand.<sup>[1]</sup>

A long-standing area of interest for scientists, anatomists, and anthropologists has been the dimensional relationship between body segments and the entire body. Numerous regression equation sets have been produced for this purpose; the most well-known ones are those from western nations, such as Karl Pearson, Trotter, and Glessner, and Indian countries, such as Pan (1924), Singh and Sohal (1952), and Mehat and Thomas.<sup>[1]</sup>

Anthropometry is the quantitative expression of the dimensions of the human body and skeleton using a set

of systematized measuring techniques. To identify a person, a biological profile must be established by the estimation of age, race, sex, and stature. Also referred to as the "big four" forensic anthropological parameters. These comprise the attributes of provisional identity. We can create the deceased's biological profile with the use of anthropometry. The estimation of stature is one of the primary characteristics for personal identification among the "big four" parameters in forensic anthropology. Through this procedure, we can reduce the number of victims that must be matched, making it possible to subsequently employ more conclusive indicators, such as DNA, for the validation of the ultimate recognition.<sup>[2]</sup>

The estimation of stature is not a difficulty while studying intact bodies. However, it is extremely difficult to operate with human parts that have been severed. Most techniques use the fundamental comparison procedure. As a result, the availability and completeness of antemortem information are crucial for identification. Because there is a strong correlation between the size of body parts and height, assessing living stature when working with human remains can also aid in the identification of an unknown individual.

## MATERIAL AND METHODS

This study was conducted on 256 students of Maharishi Markandeshwar University having 122 females and 134 males between age group 18-25 years as participants.

## INCLUSION CRITERIA

18-25 years of age with informed consent and having no gross structural deformity.

## EXCLUSION CRITERIA

- Subject having genetic disorder
- Trauma/ surgery
- Subject having congenital anomalies affecting stature or upper limb dimensions
- Subject with endocrine causes
- Subjects with structural deformity

## METHODOLOGY

Following Instruments were used for Anthropometric Measurements of Stature and right upper limb.

### 1. Stadiometer



### 2. Sliding vernier caliper



### 3. Digital vernier caliper



### 4. Non-elastic thread/tape



## SOMATOMETRIC LANDMARKS

1. **Acromion process-** is the bony projection of scapula at the top of shoulder.
2. **Olecranon process-** is a bony prominence at the back of elbow on the upper end of ulna.
3. **Styloid process of Radius-** is present on lateral surface of the distal end of radius as a conical projection, lying 1 cm lower than ulnar styloid process. It is palpable in the upper part of anatomical snuff box.
4. **Styloid process of ulna-** is a bony prominence present at distal end of ulna in the forearm palpable in posteromedial aspect of wrist about 1cm proximal to radial styloid process.
5. **Wrist joint** –is formed proximally by distal end of radius and distally by articular disc of inferior radio ulnar joint, scaphoid, lunate and triquetral bones.

## MEASUREMENTS

All measurements will be taken from the right & left sides to the nearest 0.1 cm as under

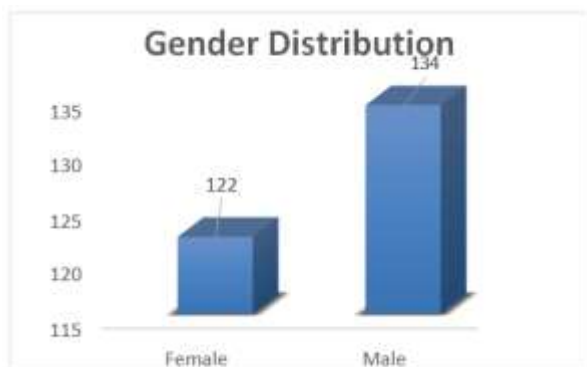
1. **Standing height (H):-** will be measured by using a portable stadiometer. Height will be measured from the vertex to the floor bare footed in anatomical position with the head in Frankfurt plane.
2. **Arm Length (Right arm length (RAL))** will be measured with sliding vernier caliper between the acromion process of scapula and olecranon process of ulna with elbow flexed at 90 degrees & shoulder fully adducted.
3. **Forearm Length (Right forearm length (RFAL))** will be measured between the olecranon process of ulna and radial styloid process with elbow flexed at 90 degrees by using sliding vernier caliper.
4. **Forearm Length (Right forearm length (RFAL))** will be measured between the olecranon process of ulna and radial styloid process with elbow flexed at 90 degrees by using sliding vernier caliper.
5. **Upper extremity (Right upper extremity (RUE))** will be measured from the acromion process of scapula to the most distal point of the third finger.
6. **Hand Length (Right hand length (RHL))** will be measured between the most distal point of third finger and midpoint of radial and ulnar styloid process with palm facing upwards and thumb abducted and other fingers adducted.
7. **Palmar length (Right palmar length (RPL))** will be measured as the shortest distance from the midpoint of proximal crease middle finger to midpoint of distal transverse flexion wrist crease.
8. **Third finger length (Right third finger length (RTFL))** - will be measured between the most distal point of third finger and proximal flexion line at base of third finger on palmar surface.
9. **Hand width (Right hand width (RHW))** - will be measured from the distal end of fifth and second metacarpal bone.
10. **Wrist width (Right wrist width (RWW))** – will be measured between the ulnar styloid process and radial styloid process by using digital vernier caliper

- 11. Wrist Circumference (Right wrist circumference (RWC))**–The wrist circumference will be measured around the wrist using non elastic tape.

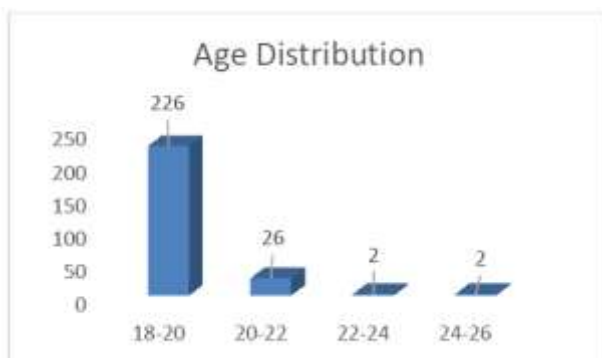
Parameters	Measurement unit
Standing height	Cm
Arm length (Right )	Cm
Forearm length (Right )	Cm
Upper extremity length (Right)	Cm
Palmar length (Right)	Cm
Third finger length (Right )	Cm
Hand width (Right)	Cm
Wrist width (Right )	Cm
Wrist circumference (Right)	Cm
Hand length (Right)	Cm

**Statistical analysis:** The collected data were analyzed by SPSS version 16. The mean and standard deviation were calculated for Stature, Right Arm length, Right forearm length, Right forearm length, Right upper Extremity length, Right Plamar length, Right third finger length, Right hand width, Right wrist width, Right wrist circumference, Right hand length. The relationship between Stature and right upper limb by using Pearson's correlation coefficient. Statistical significance set at  $p < 0.01$ .

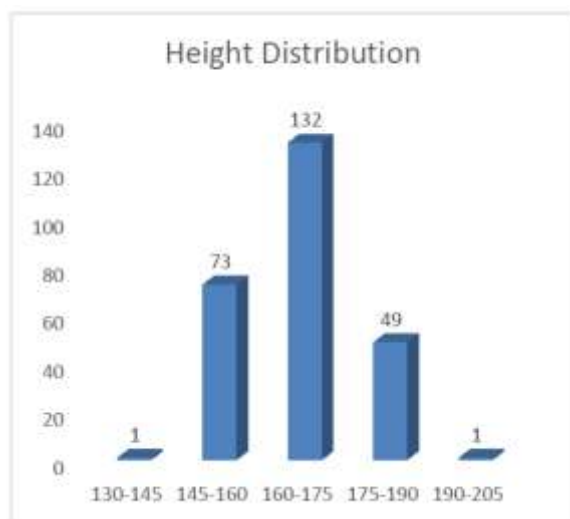
**Results and Outcomes:** Total 256 subjects were studied, out of them female (122, 47.7%) and male (134, 52.3%). The age of the recruited subjects ranged from 18-25 years with mean 19.33 and SD 1.146.



Gender	Frequency	Percent
Female	122	47.7
Male	134	52.3
Total	256	100.0



Age	Frequency	Percent
18-20	226	88.3
20-22	26	10.2
22-24	2	.8
24-26	2	.8
Total	256	100



	Frequency	Percent
130-145	1	.4
145-160	73	28.5
160-175	132	51.6
175-190	49	19.1
190-205	1	.4
Total	256	100.0

## Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Standing Heights(cm)	256	51.6	140.4	192.0	166.425	.5984	9.5752	91.684
Valid N (listwise)	256							

## Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
AGE	256	7.00	18.00	25.00	19.3359	1.14637

	Min	Max	Mean±SD
Standing height	140.4	192.0	166.42 ±9.572
Arm length (Right)	24	43	33.90 ± 3.93
Forearm length (Right)	20	38.5	26.3 ± 2.75
Upper extremity length (Right)	17.30	87.4	72.28 ± 7.079
Palmar length (Right)	8.30	18	10.30 ± 1.21
Third finger length (Right)	3.6	11.6	7.83 ± 1.04
Hand width (Right)	5.40	19.5	8.27 ±1.82
Wrist Width(Right)	3.80	18	6.17 ±1.88
Wrist Circumference(Right)	4.8	21	15.77 ± 1.70
RHL	8.5	48.50	17.99 ±2.44

Descriptive statistics for study group in table above. values obtained from respondents showing standing height range from 140.4 cm to 192 cm with mean±SD i.e 166.42 ±9.572, Arm length ranged from 24 to 43 with mean±SD i.e 33.90 ± 3.93, forearm length ranged from 20 to 38.5 with mean±SD i.e 26.3 ± 2.75, Upper extremity length ranged from 17.30 to 87.4 with mean±SD i.e 72.28 ± 7.079, Palmar length ranged from

8.30 to 18 with mean±SD i.e 10.30 ± 1.21, Third finger length ranged from 3.6 to 11.6 with mean±SD i.e 7.83 ± 1.04, Hand width ranged from 5.40 to 19.5 with mean±SD i.e 8.27 ±1.82, Wrist width ranged from 3.80 to 18 with mean±SD i.e 6.17 ±1.88, Wrist circumference ranged from 4.8 to 21 with mean±SD i.e 15.77 ± 1.70 and Right hand length ranged from 8.5 to 48.50 with mean±SD i.e 17.99 ±2.44.

Parameters	r	p
Arm length (Right)	0.549	.000
Forearm length (Right)	0.582	.000
Upper extremity length (Right)	0.546	.000
Palmar length (Right)	0.553	.000
Third finger length (Right)	0.475	.000
Hand width (Right)	0.389	.000
Wrist WIDTH(Right)	0.312	.000
Wrist Circumference(right)	0.602	.000
RHL	0.435	.000

This table shows Pearson correlation coefficient( r) between height and arm length i.e r= 0.549 (p<0.01), relationship between height and forearm length r= 0.582 (p<0.01), Height and Upper extremity length r= 0.546 (p<0.01), height and palmar length r= 0.553 (p<0.01), height and third finger length r= 0.475 (p<0.01), height and hand Width r= 0.389 (p<0.01), height and wrist width r= 0.312 (p<0.01), height and wrist circumference r= 0.602 (p<0.01), Height and right hand length r= 0.435 (p<0.01). All above results showed significant positive correlation between stature and right upper limb.

## CONCLUSION

These Anthropometric measurements used by anatomist, forensic anthropologist, forensic pathologist, archeologist and forensic medicine investigators use them as alternative method under circumstances when

difficulties are encountered in DNA analysis for economic or other reasons, such as war and mass disasters. Stature of a person is a substantial parameter in forensic inspection and anthropological studies, and the morphometry of the upper limb affords remarkable evidence in crime scene examination which helps in criminal stature estimation.

This study represents an ultimate and powerful correlation between the stature and upper limb. it will assist in medicolegal situations in establishing personal identification while only some remains of the body are found.

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