

A STUDY OF MORPHOMETRY OF HAND IN A GROUP OF PEOPLEK. Sudharani¹, Konadhula Srinivas Reddy², P. David Anand Kumar³, P. Ratnachary⁴, P. Raveen⁵**HOW TO CITE THIS ARTICLE:**

K. Sudharani, Konadhula Srinivas Reddy, P. David Anand Kumar, P. Ratnachary, P. Raveen. "A Study of Morphometry of Hand in a Group of People". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 35, April 30; Page: 6068-6076, DOI: 10.14260/jemds/2015/884

ABSTRACT: This study is conducted to know the various patterns of the human hand and digits. Anthropometric measurements were taken from 124 men and women, aged between 25 to 45 years in a factory in Ranga Reddy District, Telangana State. The data was analyzed by inferential statistics. The results have shown that various size factors are the principal source of variation in the hand size. Sexual dimorphism is predominantly seen in this study. Men have greater dimensional features with respect to women.

KEYWORDS: Hand size, palm, digits, morphometric variations.

INTRODUCTION: In the family Hominids, the hand evolved with a combination of human and pongid characters. Various evolutionary studies have shown that the hand of a Homo sapiens is characterized by a long opposable thumb,^{1,2} broad ungual tufts and a capacity to flex and rotate the digits. These morphological features are responsible for the precise human grasp. Embryologically the hand begins to develop from 28th–30th day,^{3,4} the digital rays are well defined by 46th day and the digits are completely separated by 52nd day.⁵ the shape and number of the digits are genetically determined. The homeotic genes, that determine these characters are highly conservative and belong to the HOXA and HOXD clusters.⁶ the arrangement of the genes on these clusters corresponds to the topographical and temporal sequence of their expression during the formation of the limb. The genes on the HOXA cluster control the proximo-distal differentiation of the limb, while those on the HOXD cluster control the antero-posterior (Radio-ulnar) development.⁷ the same clusters are also known to control the differentiation of the urogenital system⁸. Various investigations deal with phyletic affinities during evolution and comparison with non-human hominoids.^{9,10} Maximum studies deal with the lengths of the digits, particularly 2D:4D ratio.^{10,11} Few studies correlate the length of the fingers with genetic and behavioral characteristics.¹² Others studies deal with sexual dimorphism and inter-population variability.¹³

THE AIM OF THIS STUDY: is to know the variations in finger size and their contribution in the formation of hand.

MATERIALS AND METHODS: 124 individuals (63 men and 61 women), who are employees Srinath Spinners Ltd, Medchal Town of Ranga Reddy Dist, aged between 25 to 45 years have been selected randomly. The morphological data was obtained in a structured way. All subjects were in good general health. An informed consent was obtained from each subject.

The following variables were measured:

1. Length of the hand.
2. Width of the hand.
3. Size of the palm.
4. Span size.
5. Width of the fingers.

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The measurements were taken to the nearest millimeter with a sliding caliper. The length of the hand is the distance between the distal wrist creases to the tip of the 3rd digit. Breadth of the hand is the width of the palm along with the thumb. Span size is the distance from the tip of the thumb to the tip of the little finger. The length of the finger is the distance between the proximal Meta carpo-phalangeal flexion creases to the fingertip excluding the projected nails. A digital formula was used to indicate the relative lengths of the fingers. The fingers are indicated by numbers 1 (thumb) to 5 (little finger) in the order of their decreasing length.

RESULTS: Tables shown below gives the results of the statistical comparison of various metric characters of two sides. Sexual dimorphism is significant in this study. The most common digital formula in both sexes is 3>4> 2>1>5.

Men	Right hand (mean measurements)	Standard Deviation	Left hand (mean measurements)	Standard deviation
Hand length	18.42	2.15	18.51	1.66
Width of the hand	9.43	0.397	9.42	0.46
Palm size	7.61	0.567	7.61	0.553
Span size	19.98	2.49	20.3	2.5
Length of thumb	6.37	0.316	6.41	0.4
Length of 2 nd digit	7.61	0.303	7.61	0.347
Length of 3 rd digit	8.13	0.684	8.23	0.243
Length of 4 th digit	7.54	0.594	7.61	0.2
Length of 5 th digit	6.13	1.024	6.22	0.29
width of thumb	2.16	0.218	2.21	0.2
width of 2 nd digit	1.88	0.113	1.9	0.136
Width of 3 rd digit	1.94	0.09	2.0	0.1
Width of 4 th digit	1.77	0.137	1.9	0.109
Width of 5 th digit	1.54	0.063	1.6	0.1
Nail Length thumb	1.29	0.057	1.3	0.056
Nail Length 2 nd digit	1.12	0.031	1.12	0.1
Length 3 rd digit	1.15	0.036	1.20	0.05
Length 4 th digit	1.12	0.035	1.12	0.1
Length 5 th digit	0.99	0.085	1.0	0.07

Table 1: Measured parameters in men

Women	Right hand (mean measurements)	Standard deviation	Left hand (mean measurements)	Standard deviation
Hand length	15.973	0.506	15.89	1.093
Width of the hand	8.506	0.33	8.3	0.483
Palm size	6.817	0.294	6.68	0.353
Span size	17.552	1.384	17.59	1.434
Length of thumb	5.503	0.167	5.43	1.38
Length of 2 nd digit	6.584	0.302	6.63	0.317
Length of 3 rd digit	7.217	0.32	7.26	0.377

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Length of 4 th digit	6.709	0.333	6.63	0.437
Length of 5 th digit	5.243	0.763	5.12	0.783
width of thumb	1.714	0.134	1.68	0.230
width of 2 nd digit	1.5	0.2	1.53	0.16
Width of 3 rd digit	1.565	0.146	1.56	0.135
Width of 4 th digit	1.473	0.107	1.43	0.130
Width of 5 th digit	1.256	0.137	1.27	0.019
Nail Length thumb	1.34	0.26	1.16	0.1
Nail Length 2 nd digit	1.047	0.103	1.07	0.073
Length 3 rd digit	1.057	0.087	1.08	0.066
Length 4 th digit	1.006	0.078	1.03	0.068
Length 5 th digit	0.797	0.055	0.81	0.064

Table 2: Measured parameters in women

LENGTH OF THE HAND Length (cms)	MALE		FEMALE	
	Right (no's)	Left (no's)	Right (no's)	Left (no's)
15.1 – 15.9	0	0	11	16
16.1 – 16.9	1	1	27	26
17.1 – 17.9	8	9	16	17
18.1 – 18.9	16	17	4	2
19.1 – 19.9	19	21	2	1
20.1 – 20.9	12	10	0	0
21>	6	6	0	0

Table 3: LENGTH OF THE HAND (male and female)

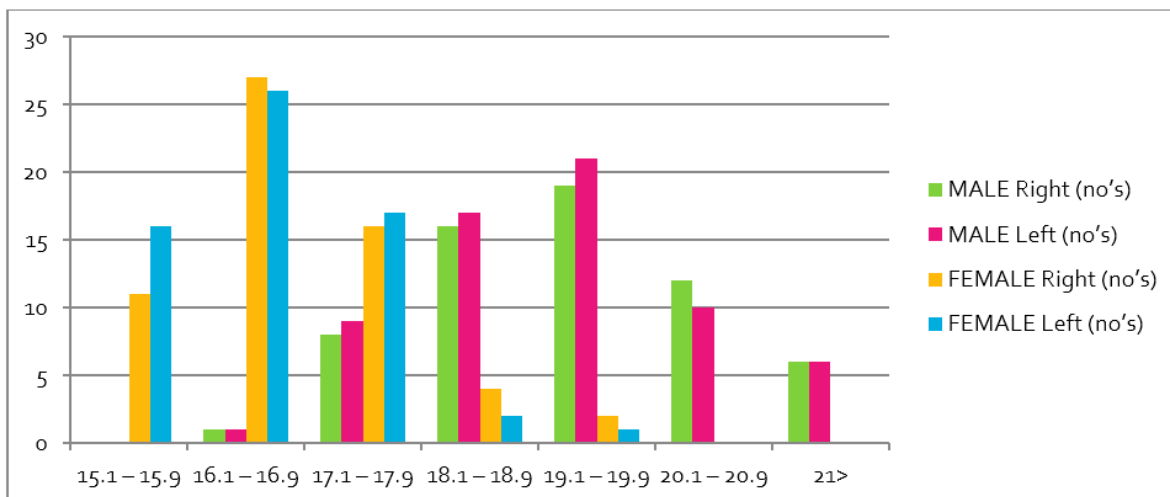


Fig. 1: LENGTH OF THE HAND (Male and female)

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WIDTH OF THE HAND width (cms)	Male		Female	
	Right	Left	Right	Left
7.1 – 8.9	7	7	39	35
9.1 – 9.9	29	31	21	24
10.1 – 10.9	23	22	1	2
11.1 – 11.9	4	3	0	0

Table 4: WIDTH OF THE HAND (Male and Female)

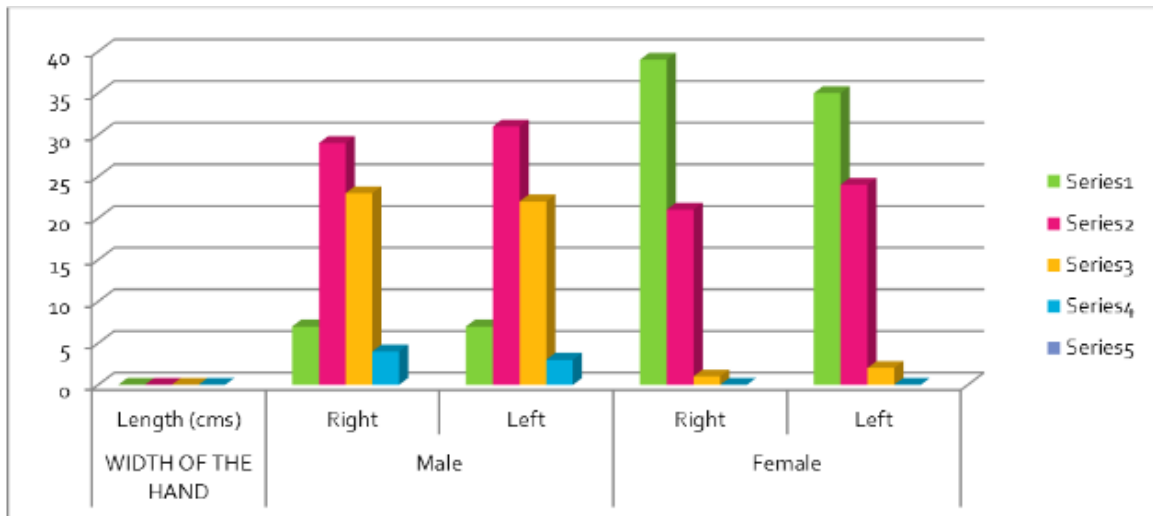


Fig. 2: WIDTH OF THE HAND (Male and Female)

Men	Right hand (mean width)	Standard deviation	Left hand (mean width)	Standard deviation
width of thumb	2.16	0.218	2.21	0.2
width of 2nd digit	1.88	0.113	1.9	0.136
Width of 3rd digit	1.94	0.09	2.0	0.1
Width of 4th digit	1.77	0.137	1.9	0.109
Width of 5th digit	1.54	0.063	1.6	0.1

Table 5: WIDTH OF FINGERS IN MEN

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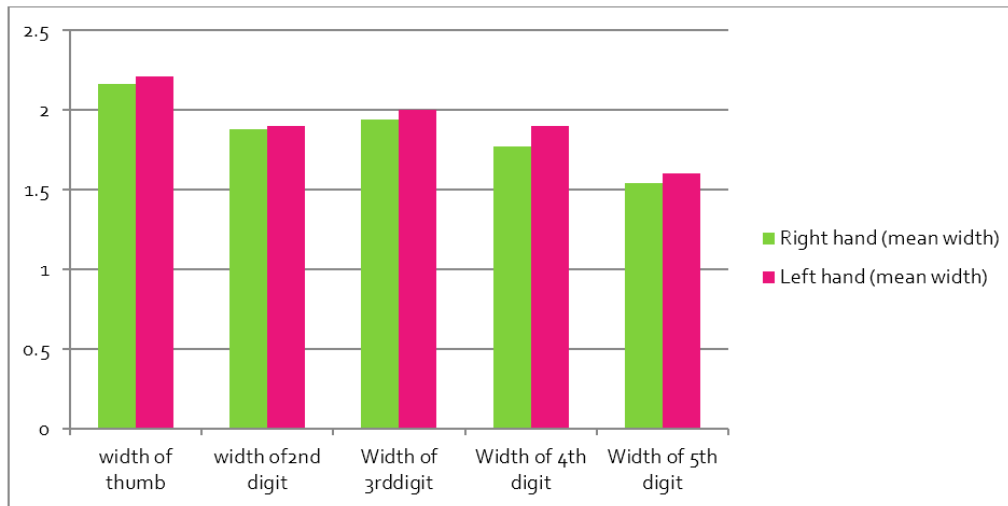


Fig. 3: WIDTH OF FINGERS IN MEN

Women	Right hand (mean width)	Standard deviation	Left hand (mean width)	Standard deviation
width of thumb	1.714	0.134	1.68	0.230
width of 2nd digit	1.5	0.2	1.53	0.16
Width of 3rd digit	1.565	0.146	1.56	0.135
Width of 4th digit	1.473	0.107	1.43	0.130
Width of 5th digit	1.256	0.137	1.27	0.019

Table 6: WIDTH OF FINGERS IN WOMEN

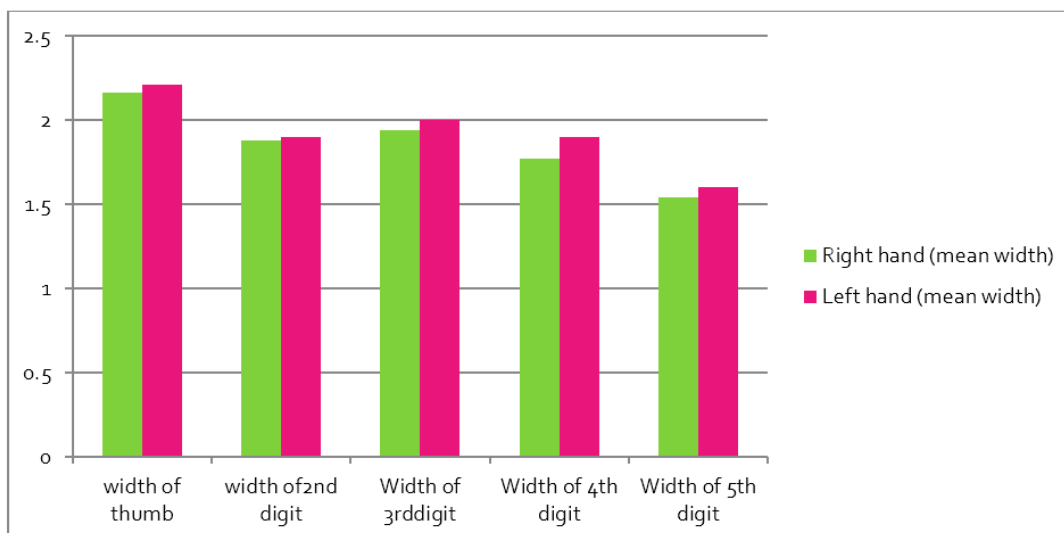


Fig. 4: WIDTH OF FINGERS IN WOMEN

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Women	RIGHT SIDE IN CMS	% of length when compared with right palm size	LEFT SIDE IN CMS	% of length when compared with left palm size
Palm size	6.81	100	6.68	100
Length of thumb	5.50	80.76	5.41	80.98
Length of 2 nd digit	6.58	96.62	6.64	99.40
Length of 3 rd digit	7.21	105.87	7.25	108.53
Length of 4 th digit	6.70	98.34	6.64	99.40
Length of 5 th digit	5.24	76.94	5.12	76.64

Table 7: DIGIT LENGTHS AGAINST PALM SIZE IN WOMEN (%)

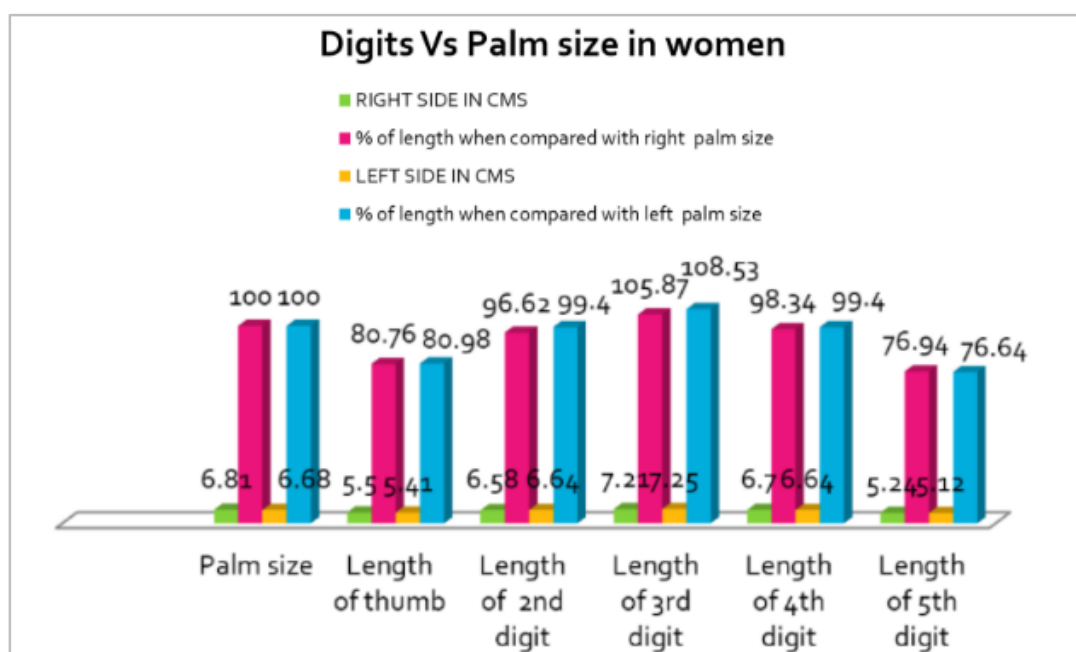


Fig. 5: DIGIT LENGTHS AGAINST PALM SIZE IN WOMEN (%)

Men	RIGHT SIDE IN CMS	% of length when compared with right palm size	LEFT SIDE IN CMS	% of length when compared with left palm size
Palm size	7.6	100	7.61	100
Length of thumb	6.38	83.94	6.4	84.09
Length of 2 nd digit	7.6	100	7.6	100
Length of 3 rd digit	8.13	106.97	8.2	107.75
Length of 4 th digit	7.55	99.34	7.6	100
Length of 5 th digit	6.13	80.65	6.2	81.47

Table 8: DIGIT LENGTHS AGAINST PALM SIZE IN MEN (%)

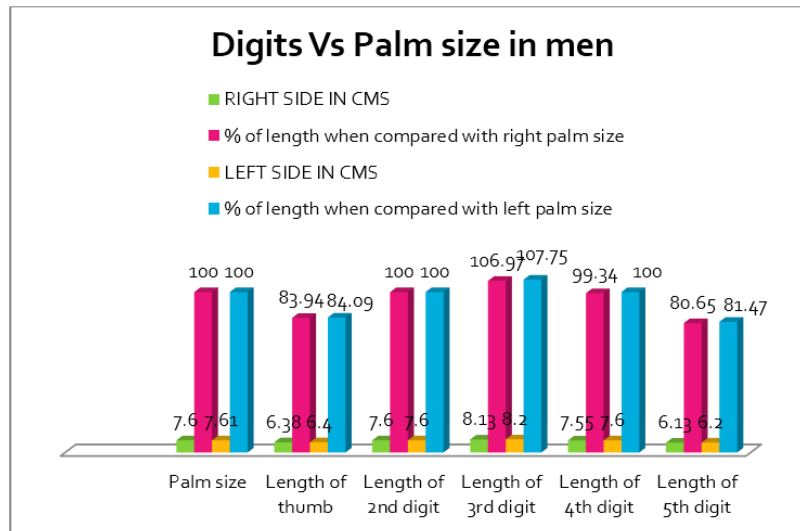


Fig. 6: DIGIT LENGTHS AGAINST PALM SIZE IN MEN (%)

Inference: The results of this study explain definite patterns of hand variation. The mean length of third digit is greatest of the fingers, and the mean length of fourth digit is greater than that of second digit. The common digital formula in decreasing order is $3 > 4 > 2 > 1 > 5$. There is a significant amount of variation between the thumb and the other fingers. These differences seem to reflect the gross anatomy, mechanics and evolution of the human hand. In modern humans, the hand is distinguished by a long thumb and a relatively short distal phalanx. These morphological factors favors thumb mobility and opposition to all four fingers.

This is responsible for precise gripping and tool behavior. The sequential position of the digits on the palm describes the genetic determination and embryological development of the hand. It is also interesting that the two sexes differ in their patterns of hand variation. The mean lengths of all the variables appear to be greater in men than in women. Moreover, the two sexes differ in finger proportions. Men exhibit greater relative dimensions of the thumb with respect to fingers 2–5, whereas women show the opposite tendency. Though the length of the 2nd digit is lesser than the 4th digit, the width is more for the 2nd digit. This can be attributed to evolutionary change, in order to support the thumb in gripping activities and skilled movements. The new data may be useful for comparative purposes in research on different populations.

ACKNOWLEDGMENT: Authors take this opportunity to express profound gratitude and deep regards to:

1. Professor and HOD, Department of Anatomy, Medciti Institute of Medical Sciences his continuous support, exemplary guidance and constant encouragement throughout the research.
2. Principal, Gandhi Medical College, Secunderabad for permitting to do this study outside college hours.
3. Management of Srinath Spinners Ltd, Medchal, for permitting us to do the study in their factory.

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FINANCIAL OR OTHER

COMPETING INTERESTS: None

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Date of Submission: 04/04/2015.
Date of Peer Review: 05/04/2015.
Date of Acceptance: 22/04/2015.
Date of Publishing: 29/04/2015.