



Original Research Article

Morphometric study of sexual dimorphism in lumbrical muscles in human cadaveric hands

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ABSTRACT

The lumbrical muscles of hand, by producing flexion at metacarpo phalangeal (MCP) joints & extension at interphalangeal joints help in writing, stitching and other forms of precision work. Variations in length, breadth or tendon length may cause carpal tunnel syndrome. Variations are also seen between parameters of both sexes and right and left hands of the same individuals. Their hypertrophy may cause compression of radial & ulnar collateral arteries leading to chronic subischemia. Also these may cause surgical complications in hand surgeries. So this study has been undertaken to know about morphometry and comparison between parameters of lumbrical muscles in both sexes of human hands.

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1. Introduction

Pre eminent position that the man enjoys amongst the animals is due to functional specialization of the human hand that can perform very intricate and highly skilled precise movements. Adoption of upright posture & bipedal locomotion in humans as well as in primates makes the upper limb free from burden of weight bearing. The progressive separation of thumb from other fingers in higher primates permits opposition of the thumb, so that the hand is utilized for prehension to manipulate the environment by grasping mechanism.

Human hand possesses three basic grips- Power, Hook & Precision. Power and Hook grips are primitive while Precision grip is characteristic of human. In precision grip, finger tips & thumb are used to hold finer objects like pen, pencil or needle for skillful manipulation. This grip enriches human culture in arts and crafts. This is contributed by a high degree of neuromuscular co-ordination & a larger cortical representation of the hand in sensory & motor cortex in human brain. Evolution of grasping ability of

human being contributed by lumbrical muscles is attributed to the ecological context of such skills in the frogs.¹ Hence human hand is revolution in evolution.

The lumbricals of the upper limb are 4 small muscles resembling earthworms hence the name. They are numbered 1 to 4 from lateral to medial side. They arise from bare areas of tendons of flexor digitorum profundus (FDP) about the middle of the palm. The narrow tendon of insertion joins the radial margins of extensor expansion (EE) as distal wing tendons.[Dutta, 1995].²

Normally 1st and 2nd lumbricals are unipennate. They arise from the radial sides of FDP tendons for index and middle fingers. They are supplied by branches from Median nerve. 3rd and 4th lumbricals are bipennate. They arise from adjacent sides of FDP tendons for middle & ring and ring & little fingers. They are supplied by deep branch of ulnar nerve. Then they pass distally along the radial side of MCP joints anterior to deep transverse metacarpal ligament. The narrow tendon of insertion joins the EE of respective fingers as distal wing tendons. Through EE, they are inserted into dorsal surfaces of bases of middle and distal phalanges.

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Fig. 1: Showing 1st lumbrical of Left Hand

2. Materials and Methods

This study was conducted in the Department of Anatomy in an Govt. Medical College, Latur and MIMS RMC, Latur with 50 forearms & hands (25 right & 25 left) of human embalmed cadavers of both sexes with the age range approximately between 45-65 years. 21 cadavers were male (42 hands) and 4 cadavers were female (8 hands). The study was carried out during the routine dissection for undergraduate medical students in the department of Anatomy. Material used for morphometry was scale, thread, marker pencil, digital vernier calliper, scalpel, blades, tooth and blunt forceps, scissor (Figure 1)

As a guide for dissection, Cunningham's manual of practical anatomy³ was used. The dissection was carried out as follows: A longitudinal incision was taken from the distal end of the flexor retinaculum, up to the level of the metacarpophalangeal joint of the middle finger. The skin, the superficial fascia, the deep fascia and the flexor retinaculum were dissected and reflected. Then, the palmar aponeurosis and the slips which pass from its distal margin to each of the fingers was dissected and reflected. Then, the tendons of the flexor digitorum superficialis and the flexor digitorum profundus were reflected distally. The lumbrical muscles which were situated at the distal end of the flexor digitorum profundus tendons were carefully observed. The lumbrical muscles were followed to their tendons which pass with the proper digital vessels and nerves to the lateral side of the base of each finger and later, the tendons of each of the lumbrical muscles were traced up to their insertion.

With the help of scale, thread and digital vernier caliper, the following parameters were measured for Morphometric study,

1. Length of muscle belly (Figure 2)
2. Length of tendon
3. Breadth of muscle
4. Width (Thickness) of muscle



Fig. 2: Showing Measurement of Belly Length of 1st lumbrical muscle.

3. Observations

The present study was carried out in 50 hands irrespective of side of hands out of which 42 hands were of male and 8 hands were of female.

Length of lumbrical muscles- Male and Female hands comparison

1st lumbrical - In male hands, range of length was from 5.8cm to 8.6cm, with mean value of 7.02cm. In female hands, range was from 5.3cm to 6.5cm, with mean value of 6.05cm. On applying Unpaired T test it was found highly significant statistically. (P value 0.001)

2nd lumbrical - In male hands, range was from 5.6cm to 8.2cm, with mean value of 7.09cm. In female hands, range was from 5.2cm to 6.5cm, with mean value of 6.18cm. On applying Unpaired T test it was found highly significant statistically. (P value 0.001)

3rd lumbrical - In male hands, range was from 5.4cm to 8.3cm, with mean value of 6.65cm. In female hands, range was from 5.2cm to 6.2cm, with mean value of 5.97cm. On applying Unpaired T test it was found highly significant statistically. (P value 0.011)

4th lumbrical - In male hands, range was from 4.6cm to 7.8cm, with mean value of 6.35cm. In female hands, range was from 4.7cm to 6.0cm, with mean value of 5.65cm. On applying Unpaired T test it was found significant statistically. (P value 0.019)

Tendon length of lumbrical muscles- Male and Female hands comparison

1st lumbrical - In male hands, range of tendon length was from 0.8cm to 2.1cm, with mean value of 1.32cm. In female hands, range was from 0.9cm to 1.2cm, with mean value of 1.03cm. On applying Unpaired T test it was found significant statistically. (P value 0.024)

2nd lumbrical - In male hands, range was from 0.9cm to 2.2cm, with mean value of 1.35cm. In female hands,

Table 1: Length of lumbrical muscles (in cms)

Lumbrical	Male			Female			Unpaired T test	P Value	Significance
	Min.	Max.	Average	Min.	Max.	Average			
1	5.8	8.6	7.02	5.3	6.5	6.05	3.556	0.001	HS
2	5.6	8.2	7.09	5.2	6.5	6.18	3.726	0.001	HS
3	5.4	8.3	6.65	5.2	6.2	5.97	2.646	0.011	HS
4	4.6	7.8	6.35	4.7	6.0	5.65	2.434	0.019	S

Where Min.= minimum length, Max.= maximum length, HS = highly significant, S = significant.

Table 2: Tendon length of lumbrical muscles (in cms)

Lumbrical	Male			Female			Unpaired T test	P Value	Significance
	Min.	Max.	Average	Min.	Max.	Average			
1	0.8	2.1	1.32	0.9	1.2	1.03	2.328	0.024	S
2	0.9	2.2	1.35	1.0	1.2	1.13	1.673	0.101	NS
3	0.8	1.9	1.12	0.9	1.1	1.00	1.159	0.252	NS
4	0.6	1.8	1.04	0.8	1.0	0.90	1.452	0.153	NS

Where Min.= minimum tendon length, Max.= maximum tendon length, S = significant, NS = non significant.

range was from 1.0cm to 1.2cm, with mean value of 1.13cm. On applying Unpaired T test it was found non significant statistically. (P value 0.101)

3rd lumbrical - In male hands, range was from 0.8cm to 1.9cm, with mean value of 1.12cm. In female hands, range was from 0.9cm to 1.1cm, with mean value of 1.00cm. On applying Unpaired T test it was found non significant statistically. (P value 0.252)

4th lumbrical - In male hands, range was from 0.6cm to 1.8cm, with mean value of 1.04cm. In female hands, range was from 0.8cm to 1.0cm, with mean value of 0.9cm. On applying Unpaired T test it was found non significant statistically. (P value 0.153)

Breadth of lumbrical muscles- Male and Female hands comparison

1st lumbrical - In male hands, range of breadth was from 0.4cm to 1.6cm, with mean value of 0.97cm. In female hands, range was from 0.6cm to 1.1cm, with mean value of 0.80cm. On applying Unpaired T test it was found significant statistically. (P value 0.097)

2nd lumbrical - In male hands, range was from 0.6cm to 1.6cm, with mean value of 0.92cm. In female hands, range was from 0.5cm to 1.0cm, with mean value of 0.85cm. On applying Unpaired T test it was found non significant statistically. (P value 0.436)

3rd lumbrical - In male hands, range was from 0.5cm to 1.5cm, with mean value of 0.77cm. In female hands, range was from 0.5cm to 0.9 cm, with mean value of 0.75cm. On applying Unpaired T test it was found non significant statistically. (P value 0.778)

4th lumbrical - In male hands, range was from 0.4cm to 1.4cm, with mean value of 0.74cm. In female hands, range was from 0.4cm to 1.2cm, with mean value of 0.73cm. On applying Unpaired T test it was found non significant statistically. (P value 0.955)

Thickness of lumbrical muscles- Male and Female hands comparison

1st lumbrical - In male hands, range of thickness was from 0.4cm to 1.4cm, with mean value of 0.66cm. In female hands, range was from 0.3cm to 0.8cm, with mean value of 0.57cm. On applying Unpaired T test it was found non significant statistically. (P value 0.293)

2nd lumbrical - In male hands, range was from 0.3cm to 1.5cm, with mean value of 0.63cm. In female hands, range was from 0.3cm to 0.9cm, with mean value of 0.58cm. On applying Unpaired T test it was found non significant statistically. (P value 0.621)

3rd lumbrical - In male hands, range was from 0.3cm to 1.4cm, with mean value of 0.51cm. In female hands, range was from 0.2cm to 0.6cm, with mean value of 0.47cm. On applying Unpaired T test it was found non significant statistically. (P value 0.617)

4th lumbrical - In male hands, range was from 0.3cm to 1.2cm, with mean value of 0.48cm. In female hands, range was from 0.4cm to 0.7cm, with mean value of 0.48cm. On applying Unpaired T test it was found non significant statistically. (P value 0.993)

4. Discussion

After careful search, only one reference was found in literature for comparison of morphometry of lumbrical muscle with the present study.

Mutalik [2011]⁴ has noted that the length of 1st lumbrical of left hand is more than that of right hand. (P value 0.049). She has also reported that breadth of 4th lumbrical of left hand is more that of right hand. (P value 0.044).

In the present study, it is found that the length of 1st lumbrical muscle in male hands is more than that of female hands. (P value 0.001). The length of 2nd lumbrical muscle in male hands is more than that of female hands. (P value

Table 3: Breadth of lumbrical muscles (in cms)

	Lumbrical Male			Female			Unpaired T test	P Value	Significance
	Min.	Max.	Average	Min.	Max.	Average			
1	0.4	1.6	0.97	0.6	1.1	0.80	1.692	0.097	S
2	0.6	1.6	0.92	0.5	1.0	0.85	0.786	0.436	NS
3	0.5	1.5	0.77	0.5	0.9	0.75	0.283	0.778	NS
4	0.4	1.4	0.74	0.4	1.2	0.73	0.057	0.955	NS

Where Min.= minimum breadth, Max.= maximum breadth, S = significant, NS = non significant.

Table 4: Thickness of lumbrical muscles (in cms)

	Lumbrical Male			Female			Unpaired T test	P Value	Significance
	Min.	Max.	Average	Min.	Max.	Average			
1	0.4	1.4	0.66	0.3	0.8	0.57	1.063	0.293	NS
2	0.3	1.5	0.63	0.3	0.9	0.58	0.497	0.621	NS
3	0.3	1.4	0.51	0.2	0.6	0.47	0.503	0.617	NS
4	0.3	1.2	0.48	0.4	0.7	0.48	0.009	0.993	NS

Where Min.= minimum thickness, Max.= maximum thickness, NS = non significant.

0.001). The length of 3rd lumbrical muscle in male hands is more than that of female hands. (P value 0.011). The length of 4th lumbrical muscle in male hands is more than that of female hands. (P value 0.019). The tendon length of 1st lumbrical muscle in male hands is more than that of female hands. (P value 0.024). The breadth of 1st lumbrical muscle in male hands is more than that of female hands. (P value 0.097).

5. Conclusions

In the present study, following values were found statistically significant.

1. The length of 1st lumbrical muscle in male hands is more than that of female hands. (P value 0.001)
2. The length of 2nd lumbrical muscle in male hands is more than that of female hands. (P value 0.001)
3. The length of 3rd lumbrical muscle in male hands is more than that of female hands. (P value 0.011)
4. The length of 4th lumbrical muscle in male hands is more than that of female hands. (P value 0.019)
5. The tendon length of 1st lumbrical muscle in male hands is more than that of female hands. (P value 0.024)
6. The breadth of 1st lumbrical muscle in male hands is more than that of female hands. (P value 0.097)

The observations of the present study will be useful to anatomists, orthopedic and plastic surgeons. It is specially useful in surgeries where the lumbrical muscles, especially the 1st and 2nd ones, are used as muscle flaps for the

coverage of the median nerve and its palmar branches. They are also helpful in studying pathogenesis of carpal tunnel syndrome.

6. Source of funding

None.

7. Conflict of interest

None.

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