

# Hand Anthropometry of Italian Elite Male Swimmers

## Antropometría de la Mano en Nadadores Italianos Masculinos de Élite

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**SUMMARY:** Hand size is part of the anthropometric parameters that are assessed in swimmers to select elite athletes, as certain anthropometric relationships involving hand measurements are significantly correlated with sports performance in various swimming disciplines. The authors present the results of the anthropometric study carried out on the hands of 15 elite male Italian swimmers from the Italian national open water swimming team. All swimmers participated at least once in World Cup and Absolute Italian Championships, winning at least one medal in their sporting career. In particular, the sample includes a medallist at the World Championships, a winner of the World Cup ultra swim marathon circuit and medallists at the European Championships. The sample consisted of 15 elite male swimmers with a mean age of 28.93 years. The following anthropometric measurements were taken on each athlete: Stature; weight; seven dimensions on each hand: hand length; hand breadth metacarpal; palm length; middle finger length; index finger length; thumb distance; and the distance from the thumb root to first flexure line of the index finger - trigger length. The size of the hands is an important factor in the swimmer's propulsion and push as a larger hand allows for greater support in the water and consequently generates more resistance. The anthropometric characteristics of the hands of Italian swimmers are missing from the anthropometric data already reported in the literature and can be used to make comparisons with elite athletes from other nations. Furthermore, anthropometric measurements could be used as predictors to estimate the swimmers' chance of success.

**KEY WORDS:** Anthropology; World Championship; European Championship; Italian Championship; Long distance swimmers.

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## INTRODUCTION

Assessing sports talent by looking for possible correlations between anthropometric measurements and sports performance (Matarazzo & D'Anastasio, 2022) is one of the objectives of anthropometry as a science that deals with the measurement and study of human body dimensions (Kanchan & Krishan, 2011). A systematic review carried out by Lima-Borges *et al.* (2022) highlights how anthropometric variables can interfere with the physical performance of swimmers; however, the authors only focused on body weight, stature, torso height and lower limb length.

Although there are studies in the literature concerning the fluid dynamics and propulsive forces generated by the hands and the influence of finger position, only very few anthropometric data on the hands of elite male swimmers have been published. Pan *et al.* (2023) reported hand width

to hand length ratio values of elite Chinese swimmers specialising in medium and short distances (races between 50 m and 400 m). The hand length of competitive youth swimmers from UK are reported by Nevill *et al.* (2015). To the best of our knowledge, there is no other anthropometric data collected on the hands of elite swimmers. In order to estimate the optimal body size, limb-segment length, and girth or breadth ratios associated with 100-m butterfly speed performance in swimmers, Sammoud *et al.* (2018a) measured their hand-lengths, but did not find a positive correlation between hand length and sport performance. Data on hand length in young swimmers were reported in a paper published by Sammoud *et al.* (2018), in which the authors demonstrated a significant correlation between hand length/forearm length ratio and sports performance in the 100 m breaststroke.

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What is the average hand size of a professional swimmer? Does hand size have a positive influence on performance? The aim of the present study is to report on the hand size of Italian elite male athletes and making the data available to the scientific literature. The creation of a database with the anthropometric measurements of swimmers' hands is the first step towards finding answers to the aforementioned questions.

## MATERIAL AND METHOD

N. Subjects 15 still active Italian elite athletes, aged between 26 and 37 years, took part in the study. The athletes were selected on the basis of their achievements in the 2022 sports season. The athletes included a medallist at the World Open Water Swimming Championships and a winner of the World Cup ultra swim marathon circuit (open water distances over 25km). The swimmers involved have won 10 medals at the European Swimming and Open Water Swimming Championships, 13 medals at World Cups, and all are multiple medallists at the Italian Swimming Championships. The athletes do 10 training sessions per week for a total of 5 hours of daily training. Each athlete's height, weight and the following 7 hand dimensions were measured (Fig. 1): hand length (1); palm length (2); hand breadth metacarpal (3); middle finger length (4); index finger length (5); thumb distance (6); distance from the thumb root to first flexure line of the index finger - trigger length. (7). Hand dimensions were measured with a Cerescorf anthropometric tape; stature was measured using a portable stadium meter; weight was measured by a mechanical column scale, SECA model 711, Hamburg, Germany. Linear dimensions were noted with an accuracy of one millimeter, while weight was noted with an accuracy of 0.5 kg following ISO 15535:2006-General requirements for the creation of anthropometric databases. Hand dimensions were taken on the right hand. As references (EN ISO 15535, 2006), flexion lines, i.e. the joint lines in the vicinity of the synovial joints, produced by the adhesions of the skin to the deep sub-adjacent fascia, were used for the main measurements. The flexion lines bend the skin across the flexor surfaces of the wrist, palm and fingers and are the sites of skin bending during movement. Considering the small sample size and the absence of anthropometric data on the hand of professional swimmers of other nationalities in the literature, only descriptive database statistics (mean and standard deviation) were carried out, omitting comparative statistical elaborations.

## RESULTS

Descriptive statistics were performed on hand measurements taken from a sample of participants with an

average age of 28.93 ( $\pm$  3.67) years, with an interval range of 26-37 years. Height varies between 181 and 195 cm, with an average value of 185.5cm ( $\pm$  4.35). The swimmers had an average weight of 81.32kg ( $\pm$  6.75) and an average BMI value of 23.64 ( $\pm$  1.53). The values of the anthropometric hand measurements are shown in Table I.

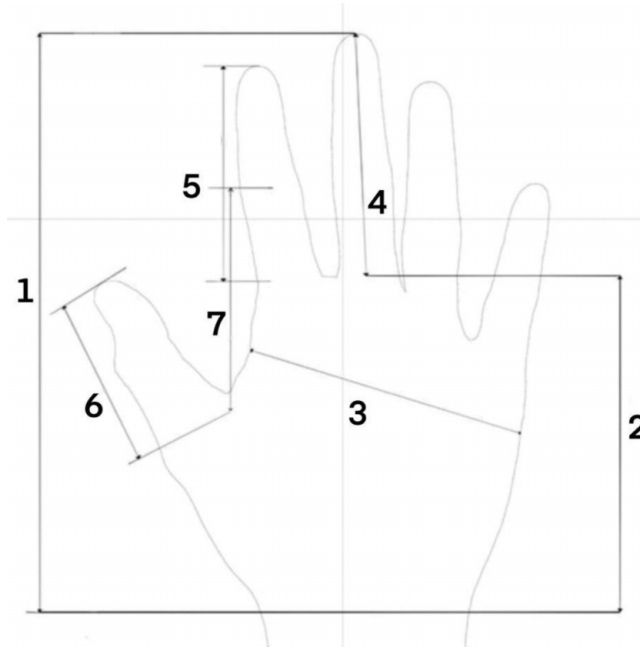


Fig. 1. Anthropometric measurements: hand length (1); palm length (2); hand breadth metacarpal (3); middle finger length (4); index finger length (5); thumb distance (6); distance from the thumb root to first flexure line of the index finger - trigger length (7).

## DISCUSSION

Hand anthropometric data of elite Italian swimmers were compared with the same parameters measured in sedentary Filipino Vietnamese (Del Prado-Lu, 2007), Bangladeshi (Imrhan *et al.*, 2006), Jordanian (Mandahawi *et al.*, 2008), Turkish (Cakit *et al.*, 2014) Mexican (Imrhan & Contreras, 2005) and Czechs (Bures *et al.*, 2015) (Table II).

In most cases, the comparison is limited to hand length, palm width and third finger length only as, with the exception of the Czech population, the other anthropometric measurements have not been published in the literature.

Italian swimmers have a longer average hand length than sedentary individuals of other nationalities, with the exception of Filipino individuals. The width of the hand at metacarpal level shows the same trend. All other anthropometric parameters of the hands of Italian swimmers show higher values than sedentary individuals of other nations.

Table I. Descriptive statistics of the sample of swimmers.

swimmer	age	height (cm)	weight (kg)	BMI <sup>e</sup>	1 <sup>s</sup>	2	3	4	5	6	7
A	27	185	80,6	23,55	22,12	13,71	10,43	9,12	9,04	7,52	9,11
B	30	181	75,4	23,02	22,3	13,51	11,36	9,02	8,6	7,28	9,04
C	35	194	82,5	21,92	22,57	13,33	10,46	9,21	8,3	7,02	9,32
D	33	181	69,9	21,34	18,73	10,89	10,03	8,97	7,33	6,63	8,19
E	29	183	74,5	22,25	17,12	12,72	9,53	8,85	7,92	6,82	8,54
F	26	186,5	79,9	22,97	19,45	9,99	9,06	8,65	7,78	6,98	9,2
G	25	184,5	82,9	24,35	19,17	11,56	8,42	8,23	7,98	6,79	8,78
H	26	181	69,8	21,31	16,98	10,28	9,97	8,34	8,05	6,75	8,3
I	26	182,5	85,4	25,64	17,57	12,14	8,45	8,09	8,33	6,89	9,01
L	25	186,5	83,5	24,01	18,17	12,01	8,49	9,17	8,05	7,1	8,13
M	37	183,5	80,3	23,85	17,92	10,73	8,13	9,12	7,55	7,03	8,04
N	31	189,5	87,8	24,45	20,12	12,38	8,64	9,01	8,77	6,99	8,99
O	28	186	86,6	25,03	17,25	11,72	9,78	8,13	8,72	6,97	8,43
P	27	183,5	89,5	26,58	17,78	12,63	10,76	8,36	7,94	7,24	8,69
Q	29	195	92,7	24,39	22,86	13,46	10,72	9,24	8,8	7,43	9,21
mean	28,93	185,5	81,42	23,64	19,34	12,07	9,61	8,84	8,21	7,02	8,73
DS <sup>&amp;</sup>	± 3,67	± 4,35	± 6,75	± 1,53	± 2,14	± 1,20	± 1,02	± 0,55	± 0,83	± 0,25	± 0,43

\* BMI: Body Mass Index. \$ Numbers 1-7: anthropometric hand measures (see Fig. 1). & DS: Standard Deviation. Swimmer A: Bronze medal at the World Championships. Swimmer B: Bronze medal at the World Championships, gold medal at the European Championships. Swimmer C: Silver and bronze medal at the World Championships; silver and bronze medal at the European Championship. Swimmer D: Gold medal at the World Championships; silver and gold medal at the European Championship. Swimmer E: Gold medal at the World Championships. Swimmer H: Gold medal at the Ultra Marathon Swim Series competitions. Swimmer M Multiple medallist in World Cup stages.

Table II. Anthropometric measurements of the hand in human populations.

Nationality	1 <sup>*</sup>	2	3	4	5	6	7
Swim Italian National Team	193,4 ± 4,46	12,07 ± 1,59	9,81 ± 1,14	8,84 ± 0,55	8,21 ± 0,83	7,02 ± 0,25	8,73 ± 0,68
Vietnamese	17,7 ± 1,2	98,8 --	79,2 ± 0,69	7,82 ± 4,2	--	--	--
Bangladeshi	17,4 ± 0,86	9,76 --	8,01 ± 0,71	7,4 ± 0,32	--	--	--
Filipino	19,75 ± 0,78	--	9,8 ± 0,40	--	--	--	--
Jordanian	19,12 ± 0,10	10,99 --	8,77 ± 0,48	8,13 ± 0,71	--	--	--
Turkish	19,02 ± 0,96	10,85	8,73 ± 0,46	8,19 ± 5,15	--	--	--
Mexican	18,55 ± 0,71	10,7 --	8,53 ± 0,49	7,55 ± 0,44	--	--	--
Czech	192 ± 0,98	11,0 ± 0,61	8,9 ± 0,56	8,2 ± 0,52	7,4 ± 0,48	6,4 ± 0,50	7,4 ± 0,64

\* Numbers 1-7: anthropometric hand measures (see Fig. 1)

The anthropometric profile of an athlete is correlated with sports performance (Norton *et al.*, 1996), although it is not the only determining factor (e.g. 'resilience' also has its relevance in sports success) (Sarkar & Fletcher, 2014). With regard to studies (few, to the best of our knowledge) on the anthropometric measurements of swimmers' hands and their possible influence on sports performance, the findings are contradictory. Sammoud *et al.* (2018a), observed that there is no significant statistical correlation between hand length alone and swimming performance. In contrast, the relationship between hand length and other anthropometric measures appears to positively influence sports performance (Sammoud *et al.*, 2018, 2019). The anthropometric data from the Italian sample suggest that other anthropometric measures of the hand, in addition to length and width, and their relationships could be correlated with sports

performance. Furthermore, the interaction between the aforementioned anthropometric parameters could play an important role in favoring better sports performance. Further anthropometric data of the hand and studies correlating it with sports performance may support or disprove these hypotheses.

### CONCLUSION

The study makes available the anthropometric hand data of Italian elite male swimmers, who are part of national teams. The data may contribute to the creation of a database of anthropometric hand measurements of elite swimmers to be used for subsequent studies. The observations and results of this study will benefit all those who wish to learn more about an important propulsion factor such as the hands in the swimming environment.

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**MATARAZZO, A.; D'ANGELO, A.; D'ANASTASIO, R.; RIPARI, P.** Antropometría de la mano en nadadores italianos masculinos de élite. *Int. J. Morphol.*, 42(1):82-85, 2024.

**RESUMEN:** El tamaño de la mano es uno de los parámetros antropométricos que se evalúan en los nadadores para seleccionar a los deportistas de élite. Los autores presentan los resultados de un estudio antropométrico realizado en las manos de 15 nadadores italianos masculinos de élite pertenecientes al equipo nacional de natación en aguas abiertas. Todos los nadadores participaron al menos una vez en Copas del Mundo y Campeonatos de Italia, ganando al menos una medalla en su carrera deportiva. En concreto, la muestra incluye un medallista en los Campeonatos del Mundo, un ganador de la Copa del Mundo del circuito de ultra maratón de natación y medallistas en los Campeonatos de Europa. La muestra consta de 15 nadadores masculinos de élite con una edad media de 28,93 años. Se tomaron las siguientes medidas antropométricas a cada atleta: estatura; peso; siete dimensiones en cada mano: longitud de la mano, anchura de la mano en el metacarpiano, longitud de la palma, longitud del primer, segundo y tercer dedo, distancia entre la raíz del primer dedo y la primera línea de flexión del segundo dedo. El tamaño de las manos es un factor importante para la propulsión y el empuje del nadador, ya que una mano más grande permite un mayor apoyo en el agua y, en consecuencia, genera más resistencia. Las características antropométricas de las manos de los nadadores italianos faltan en los datos antropométricos recolectados en la literatura y pueden utilizarse para hacer comparaciones con los atletas de élite de otras naciones. Además, las medidas antropométricas podrían utilizarse como predictores para estimar las posibilidades de éxito de los nadadores.

**PALABRAS CLAVE:** Antropología; Campeonato del Mundo; Campeonato de Europa; Campeonato de Italia; Nadadores de larga distancia.

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