



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

UWTSD Sport and Exercise Science Physiological Testing Protocols

Assessment of Isometric Hand Grip Strength

Taken From:

Lab 23

**Housh, T.J., Cramer, J.T., Weir, J.P., Beck, T.W. and
Johnson, G.O. (2016). Laboratory manual for
Exercise Physiology, Exercise Testing and Physical
Activity. London: Routledge.**

BACKGROUND

Isometric hand grip strength is an important component of physical fitness and provides a simple method for characterising overall body strength.^{1,2} The performance of many manual labour activities, such as yard and garden work and lifting and carrying large objects, depends on a certain degree of hand grip strength. Thus, the purpose of this lab is to describe the procedures for measuring isometric hand grip strength with a hand grip dynamometer.

KNOW THESE TERMS & ABBREVIATIONS

- hand grip dynamometer = an instrument that measures isometric hand grip strength, which provides a simple method for characterising overall body strength.
- isometric strength = tension production by a muscle without movement at the joint or shortening of the muscle fibres.
- percentile rank = in this lab, a score between 10% and 90% that shows how the subject performed relative to others in the age group. A percentile ranking of 70, for example, indicates that the subject's grip strength is higher than 70% of the others in the age group and lower than 30% of the others in the age group.

PROCEDURES

The isometric hand grip strength test can be performed using a variety of dynamometers (photo 23.1).

1. Prior to beginning the test, adjust the length of the handle on the hand grip dynamometer such that it feels comfortable in the hand. For individuals with very small hands, the handle of the dynamometer should be shortened, while for those with very large hands, the handle should be lengthened.¹
2. Have the subject hold the hand grip dynamometer in the right hand with the palm facing up and the elbow at approximately 90 degrees (photo 23.2). When ready, the subject should squeeze the dynamometer maximally for 3 seconds. Read the force value (kg) from the dynamometer and record it on worksheet 23.1. Perform the strength test two more times with the right hand, separating the trials by 2 minutes of rest.
3. Repeat the procedures described in step 2 for the left hand.
4. Add the highest strength value (kg) for the right hand to that from the left hand and record the value on worksheet 23.1. Divide the sum by body weight in kg and record this value on worksheet 23.1.
5. Percentile rank norms by age and gender are provided in tables 23.1 through 23.4. Compare the sum of right and left hand grip strength to the values in tables 23.1 and 23.2 based on age and gender. Compare the sum of right and left hand grip strength divided by body weight to the values in tables 23.3 and 23.4 based on age and gender.

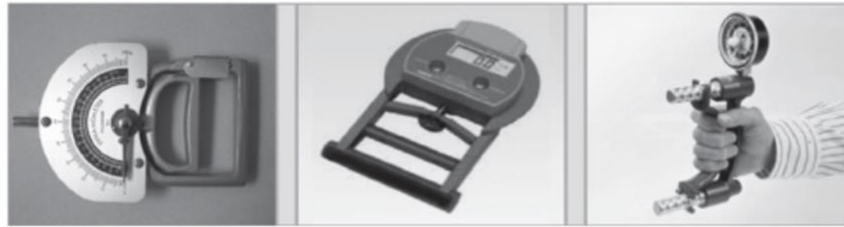


PHOTO 23.1 Three different hand grip dynamometers.



PHOTO 23.2 The correct elbow position for performing the hand grip dynamometer strength test.

Percentile ranks for sum of grip strengths (kg, right plus left) for males. **TABLE 23.1**

Percentile rank	Age (yrs)																	
	10	11	12	13	14	15	16	17	18	19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	
90	34	42	52	69	89	96	106	111	117	118	122	123	124	123	123	116	110	
80	30	37	47	60	80	90	99	105	106	113	115	115	115	115	115	108	102	
70	26	34	41	53	72	84	95	99	101	109	110	110	110	109	108	104	96	
60	24	32	38	48	66	80	91	93	98	104	105	107	106	106	103	99	93	
50	22	29	34	44	61	76	87	89	96	101	102	103	102	102	100	95	89	
40	20	26	31	42	58	73	84	85	93	98	99	100	98	98	97	91	85	
30	18	23	30	39	54	69	78	81	90	94	94	95	95	93	93	82	81	
20	15	21	27	34	49	64	74	76	86	90	89	90	90	88	87	81	75	
10	11	16	23	28	39	55	68	70	81	84	80	81	82	79	81	75	66	

Adapted from Montoye, H. J., and Lamphiear, D. E. Grip and arm strength in males and females, age 10 to 69. *Research Quarterly for Exercise and Sport*, Vol. 48, pp. 109–120, 1977. Reprinted with permission of the publisher, Taylor & Francis Ltd, www.tandfonline.com.

TABLE 23.2 Percentile ranks for sum of grip strengths (kg, right plus left) for females.

Percentile rank	Age (yrs)																	
	10	11	12	13	14	15	16	17	18	19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	
90	30	37	44	49	65	60	58	61	59	63	61	67	65	66	64	64	57	
80	25	33	40	44	50	54	53	54	55	59	57	62	60	59	58	57	52	
70	22	30	36	41	48	49	49	50	52	54	53	57	57	55	54	53	48	
60	20	27	33	38	44	45	48	47	49	50	50	53	53	53	51	52	45	
50	18	25	31	36	41	43	43	44	46	48	48	49	49	51	49	49	43	
40	17	23	28	34	39	41	41	42	43	46	45	48	47	49	47	47	40	
30	15	20	26	32	36	38	39	39	39	42	42	46	44	46	43	44	38	
20	14	17	22	30	32	36	36	36	36	39	38	43	41	43	40	40	34	
10	10	12	18	26	27	31	33	31	31	36	34	37	36	36	36	34	30	

Adapted from Montoye, H. J., and Lamphiear, D. E. Grip and arm strength in males and females, age 10 to 69. *Research Quarterly for Exercise and Sport*, Vol. 48, pp. 109–120, 1977. Reprinted with permission of the publisher, Taylor & Francis Ltd, www.tandfonline.com.

TABLE 23.3 Percentile ranks for ratio of sum of grip strengths to body weight (kg/kg body weight) for males.

Percentile rank	Age (yrs)																		
	10	11	12	13	14	15	16	17	18	19	20-24	25-29	30-34	35-39	40-49	50-59			
90	0.89	1.04	1.10	1.20	1.40	1.45	1.56	1.62	1.62	1.75	1.73	1.72	1.64	1.62	1.54	1.39			
80	0.83	0.94	0.97	1.13	1.28	1.36	1.49	1.48	1.50	1.54	1.59	1.54	1.52	1.51	1.41	1.30			
70	0.76	0.85	0.93	1.03	1.23	1.29	1.43	1.44	1.47	1.44	1.53	1.47	1.45	1.42	1.34	1.22			
60	0.69	0.80	0.86	0.98	1.15	1.25	1.39	1.39	1.44	1.36	1.45	1.40	1.39	1.35	1.28	1.19			
50	0.65	0.77	0.80	0.93	1.09	1.22	1.30	1.35	1.37	1.33	1.39	1.35	1.33	1.28	1.24	1.14			
40	0.62	0.71	0.74	0.86	1.02	1.17	1.19	1.28	1.33	1.29	1.32	1.28	1.29	1.23	1.19	1.10			
30	0.52	0.66	0.70	0.80	0.96	1.14	1.14	1.21	1.31	1.24	1.26	1.20	1.24	1.17	1.14	1.03			
20	0.45	0.58	0.66	0.77	0.90	1.06	1.09	1.16	1.22	1.17	1.18	1.12	1.18	1.11	1.07	0.98			
10	0.38	0.48	0.61	0.65	0.81	0.95	0.98	1.01	1.16	1.12	1.08	1.01	1.10	1.02	0.99	0.89			

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Percentile ranks for ratio of sum of grip strengths to body weight (kg/kg body weight) for females. TABLE 23.4

Percentile rank	Age (yrs)																		
	10	11	12	13	14	15	16	17	18	19	20-24	25-29	30-34	35-39	40-49	50-59			
90	0.71	0.91	0.92	0.96	1.08	1.04	0.98	1.12	1.02	1.10	1.04	1.12	1.05	1.07	1.02	0.90			
80	0.65	0.80	0.80	0.86	0.96	0.92	0.94	1.02	0.95	1.04	0.97	1.02	1.00	1.00	0.93	0.83			
70	0.62	0.72	0.75	0.81	0.86	0.89	0.84	0.96	0.90	0.94	0.91	0.97	0.94	0.93	0.87	0.78			
60	0.57	0.68	0.72	0.79	0.81	0.84	0.79	0.89	0.82	0.85	0.86	0.91	0.89	0.87	0.81	0.71			
50	0.54	0.64	0.66	0.73	0.76	0.79	0.76	0.83	0.78	0.80	0.81	0.86	0.83	0.84	0.77	0.68			
40	0.50	0.57	0.61	0.68	0.71	0.76	0.73	0.78	0.72	0.77	0.77	0.82	0.78	0.80	0.73	0.63			
30	0.46	0.53	0.57	0.65	0.67	0.69	0.71	0.71	0.69	0.74	0.72	0.75	0.72	0.75	0.69	0.59			
20	0.42	0.45	0.54	0.63	0.65	0.65	0.65	0.66	0.65	0.69	0.68	0.68	0.66	0.69	0.63	0.52			
10	0.32	0.33	0.47	0.52	0.58	0.57	0.57	0.52	0.58	0.64	0.61	0.61	0.60	0.60	0.54	0.48			

Adapted from Montoye, H. J., and Lamphicar, D. E. Grip and arm strength in males and females, age 10 to 69. *Research Quarterly for Exercise and Sport*, Vol. 48, pp. 109–120, 1977. Reprinted with permission of the publisher, Taylor & Francis Ltd, www.tandfonline.com.

Sample Calculations

Gender: Male

Age: 21 years

Body weight: 75 kg

	Trial 1 (kg)	Trial 2 (kg)	Trial 3 (kg)	Max of three trials (kg)
Right hand	<u>50</u>	<u>52</u>	<u>53</u>	<u>53</u>
Left hand	<u>51</u>	<u>50</u>	<u>52</u>	<u>52</u>

Sum of right and left = 105 kg

Approximate percentile rank = 60 (table 23.1)

Sum of right and left (kg)	Body weight (kg)	Grip strength ratio (kg/kg body weight)
<u>105</u>	<u>75</u>	<u>1.40</u>

Approximate percentile rank = 51 (table 23.3)

Worksheet 23.1 ISOMETRIC HAND GRIP STRENGTH FORM

<i>Name</i> _____		<i>Date</i> _____	
<i>Age</i> _____		<i>Gender</i> _____	

	Trial 1 (kg)	Trial 2 (kg)	Trial 3 (kg)	Max of three trials (kg)
Right hand	_____	_____	_____	_____
Left hand	_____	_____	_____	_____
			Sum of right plus left	_____

Percentile rank (see tables 23.1 and 23.2) = _____

Sum of right and left (kg)	Body weight (kg)	Grip strength ratio (kg/kg body weight)
_____	_____	_____
/ _____ = _____		

Percentile rank (see tables 23.3 and 23.4): _____

REFERENCE

1. Montoye, H. J., and Faulkner, J. A. Determination of the optimum setting of an adjustable grip dynamometer. *Res. Q. Exerc. Sport* 35: 29–36, 1964.
2. Montoye, H. J., and Lamphiear, D. E. Grip and arm strength in males and females, age 10 to 69. *Res. Q. Exerc. Sport* 48: 109–120, 1977.