

Bezkorovainyi et al. (2024)

Factors of the effectiveness of competitive activity of arm wrestlers aged 14-15 years at the stage of preliminary basic training · DOI: 10.15391/sns.v.2024-4.006

Short study description

Sample: 29 arm wrestlers aged 14-15 years in the 60-70 kg category. Nine athletes were identified by the authors as having high competitive performance ("leaders"), and 20 athletes formed the general group.

Measurements: strength and speed-strength characteristics in four arm-wrestling-specific exercises: finger flexion, hammer pull, hook, and wrist flexion, tested separately for the left and right arms.

Test procedure: the athlete was instructed to generate maximal force as quickly as possible on an electrical tensodynamometer. Maximal-force results were reported separately for each exercise; most speed-related variables were published as aggregate values across the four exercises.

Sport level: the paper compares "leaders" with the general group, but does not report an individual competition place/ranking for each athlete.

Authors' conclusions - summary

- Leaders showed higher sport-specific strength primarily in the hook and wrist-flexion tests; finger flexion and hammer pull did not differ significantly between groups.
- Leaders performed better in several speed-strength characteristics: force reached after 500 ms, rate of force development during the first 500 ms, and time required to develop 1 kg of force.
- Total time to maximal force and the overall rate-of-force-development index to maximum did not differ significantly between groups.
- The authors' factor analysis highlighted an important role of temporal and speed-strength characteristics; absolute strength was treated as one component of the athlete profile rather than the sole determinant of competitive performance.
- The authors recommend developing maximal strength together with starting, accelerating, and fast strength during the first 500 ms of muscle tension at this stage of training.

Bezkorovainyi et al. (2024) - results table

● = statistically significant difference ($p < 0.05$). r_{pb} color: red $|r| < 0.30$; yellow $0.30-0.49$; green ≥ 0.50 . r_{pb} indicates the strength of association between the result and membership in the leader group.

Speed-related data are aggregated across the 4 exercises because the authors did not publish them separately for each exercise.

Exercise / parameter	General group	Leaders	Leader difference	r_{pb}
Finger flexion (L) (Strength)	29.96 kg	32.23 kg	+7.6%	0.342
Finger flexion (R) (Strength)	31.32 kg	32.03 kg	+2.3%	0.101
Hammer pull (L) (Strength)	30.60 kg	33.18 kg	+8.4%	0.362
Hammer pull (R) (Strength)	32.09 kg	34.00 kg	+6.0%	0.258
Hook (L) (Strength)	32.43 kg	38.82 kg	● +19.7%	0.643
Hook (R) (Strength)	34.11 kg	41.05 kg	● +20.3%	0.621
Wrist flexion (L) (Strength)	36.23 kg	42.41 kg	● +17.1%	0.730
Wrist flexion (R) (Strength)	39.34 kg	44.93 kg	● +14.2%	0.677
Mean maximal force across 4 exercises (L) (Strength)	32.30 kg	36.66 kg	● +13.5%	0.747
Mean maximal force across 4 exercises (R) (Strength)	34.22 kg	38.00 kg	● +11.0%	0.618
Total time to maximal force across 4 exercises (L) (Speed)	8892 ms	9353 ms	5.2% longer	0.128
Total time to maximal force across 4 exercises (R) (Speed)	8784 ms	8646 ms	1.6% shorter	-0.046
Overall rate of force development to maximum (L) (Speed)	15.04 kg/ms	16.21 kg/ms	+7.8%	0.182
Overall rate of force development to maximum (R) (Speed)	16.26 kg/ms	17.76 kg/ms	+9.2%	0.196
Force relative to body mass (L) (Strength)	1.95 kg/kg	2.16 kg/kg	● +10.8%	0.619
Force relative to body mass (R) (Strength)	2.06 kg/kg	2.23 kg/kg	● +8.3%	0.464
Total time to 50% of maximal force across 4 exercises (L) (Speed)	1472 ms	1381 ms	6.2% shorter	-0.139
Total time to 50% of maximal force across 4 exercises (R) (Speed)	1497 ms	1192 ms	● 20.4% shorter	-0.462
Total force reached after 500 ms across 4 exercises (L) (Speed)	79.45 kg	90.47 kg	● +13.9%	0.551
Total force reached after 500 ms across 4 exercises (R) (Speed)	85.69 kg	92.75 kg	● +8.2%	0.630
Rate of force development during first 500 ms across 4 exercises (L) (Speed)	159 g/ms	181 g/ms	● +13.9%	0.551
Rate of force development during first 500 ms across 4 exercises (R) (Speed)	167 g/ms	186 g/ms	● +10.8%	0.630
Time required to develop 1 kg of force (L) (Speed)	22.91 ms/kg	18.84 ms/kg	● 17.8% shorter	-0.369
Time required to develop 1 kg of force (R) (Speed)	22.13 ms/kg	15.75 ms/kg	● 28.8% shorter	-0.487

Bezkorovainyi et al. (2023)

Comparative Analysis of the Efforts of Highly Qualified Elite Armwrestlers with Different Strength Abilities · DOI: 10.17309/tmfv.2023.6.06

Short study description

Sample: four world-leading arm wrestlers weighing 80-100 kg. Athlete 1: 38 years, 90 kg, multiple world champion; Athlete 2: 32 years, 85 kg, multiple international medalist; Athlete 3: 28 years, 82 kg, multiple world champion; Athlete 4: 33 years, 93 kg, multiple world champion.

Measurements: strength and time characteristics in the same four test movements: finger flexion, hammer pull, hook, and wrist flexion, with both arms. Variables included force at 100/200/300/500 ms, Fmax, force-development times, and speed-strength indices.

Important data limitation: the paper does not report the four exercises separately. Tables provide aggregate values across the four exercises for the left and right arms.

Authors' conclusions - summary

- The paper does not establish a sporting order of Athlete 1 > 2 > 3 > 4. Athlete 1 is described as the most harmonious and most titled; Athlete 2 as lower in force but fastest in temporal characteristics; Athlete 3 as very strong, especially with the left arm; Athlete 4 as relatively strong but clearly weaker in temporal characteristics and with less effective sporting achievements.
- The study showed distinct profiles: Athletes 1-2 had an early speed-strength advantage, whereas Athletes 3-4 showed greater maximal strength and more strength-endurance characteristics.
- The authors state that force-time analysis can distinguish predispositions toward explosive, fast, and slow strength, and that maximal strength alone does not describe the full athlete profile.

Bezkorovainyi et al. (2023) - Athlete 1 as the reference

Each cell shows the absolute value and the percentage change relative to Athlete 1. Green = more favorable result; red = less favorable; yellow = very small difference ($|\Delta| \leq 5\%$).

Values are aggregated across the 4 exercises for each arm; the article does not publish data for individual exercises.

Parameter	Athlete 1	Athlete 2 vs 1	Athlete 3 vs 1	Athlete 4 vs 1
Maximal force - sum of 4 exercises (L) (Strength)	233.8 kg	190.0 kg (-18.7%)	326.5 kg (+39.6%)	236.1 kg (+1.0%)
Maximal force - sum of 4 exercises (R) (Strength)	260.5 kg	202.2 kg (-22.4%)	173.5 kg (-33.4%)	254.1 kg (-2.5%)
Time to maximal force (L) (Speed)	5.30 s	3.90 s (-26.4%)	6.60 s (+24.5%)	6.80 s (+28.3%)
Time to maximal force (R) (Speed)	5.50 s	5.20 s (-5.5%)	5.90 s (+7.3%)	9.20 s (+67.3%)
Time to 50% of maximal force (L) (Speed)	910 ms	670 ms (-26.4%)	2046 ms (+124.8%)	1500 ms (+64.8%)
Time to 50% of maximal force (R) (Speed)	1410 ms	905 ms (-35.8%)	1935 ms (+37.2%)	2750 ms (+95.0%)
Time required to develop 1 kg of force (L) (Speed)	7.73 ms/kg	7.05 ms/kg (-8.8%)	12.53 ms/kg (+62.1%)	12.71 ms/kg (+64.4%)
Time required to develop 1 kg of force (R) (Speed)	10.82 ms/kg	7.96 ms/kg (-26.4%)	22.31 ms/kg (+106.2%)	21.64 ms/kg (+100.0%)
Force reached after 100 ms (L) (Speed)	53.7 kg	106.2 kg (+97.8%)	19.8 kg (-63.1%)	42.1 kg (-21.6%)
Force reached after 100 ms (R) (Speed)	36.0 kg	0.0 kg (-100.0%)	0.0 kg (-100.0%)	18.1 kg (-49.7%)
Force reached after 200 ms (L) (Speed)	125.4 kg	119.6 kg (-4.6%)	109.7 kg (-12.5%)	51.7 kg (-58.8%)
Force reached after 200 ms (R) (Speed)	119.7 kg	137.5 kg (+14.9%)	54.8 kg (-54.2%)	48.4 kg (-59.6%)
Force reached after 300 ms (L) (Speed)	161.9 kg	139.5 kg (-13.8%)	153.6 kg (-5.1%)	78.7 kg (-51.4%)
Force reached after 300 ms (R) (Speed)	174.3 kg	151.4 kg (-13.1%)	81.2 kg (-53.4%)	67.8 kg (-61.1%)
Force reached after 500 ms (L) (Speed)	195.9 kg	156.0 kg (-20.4%)	202.8 kg (+3.5%)	93.0 kg (-52.5%)
Force reached after 500 ms (R) (Speed)	204.9 kg	156.0 kg (-23.9%)	106.7 kg (-47.9%)	93.8 kg (-54.2%)
Rate of force rise to 100 ms (L) (Speed)	0.537 kg/ms	1.062 kg/ms (+97.8%)	0.198 kg/ms (-63.1%)	0.421 kg/ms (-21.6%)
Rate of force rise to 100 ms (R) (Speed)	0.360 kg/ms	0.000 kg/ms (-100.0%)	0.000 kg/ms (-100.0%)	0.181 kg/ms (-49.7%)
Rate of force rise to 200 ms (L) (Speed)	0.627 kg/ms	0.598 kg/ms (-4.6%)	0.548 kg/ms (-12.6%)	0.258 kg/ms (-58.9%)
Rate of force rise to 200 ms (R) (Speed)	0.598 kg/ms	0.687 kg/ms (+14.9%)	0.274 kg/ms (-54.2%)	0.242 kg/ms (-59.5%)
Rate of force rise to 300 ms (L) (Speed)	0.540 kg/ms	0.465 kg/ms (-13.9%)	0.512 kg/ms (-5.2%)	0.262 kg/ms (-51.5%)
Rate of force rise to 300 ms (R) (Speed)	0.581 kg/ms	0.505 kg/ms (-13.1%)	0.270 kg/ms (-53.5%)	0.226 kg/ms (-61.1%)
Rate of force rise to 500 ms (L) (Speed)	0.392 kg/ms	0.312 kg/ms (-20.4%)	0.410 kg/ms (+4.6%)	0.186 kg/ms (-52.6%)
Rate of force rise to 500 ms (R) (Speed)	0.409 kg/ms	0.312 kg/ms (-23.7%)	0.213 kg/ms (-47.9%)	0.188 kg/ms (-54.0%)
Overall rate of force development to maximum (L) (Speed)	44.11 kg/s	48.37 kg/s (+9.7%)	49.47 kg/s (+12.2%)	34.72 kg/s (-21.3%)
Overall rate of force development to maximum (R) (Speed)	47.36 kg/s	38.88 kg/s (-17.9%)	35.41 kg/s (-25.2%)	27.62 kg/s (-41.7%)
Force in the final phase of effort (L) (Endurance)	37.9 kg	34.0 kg (-10.3%)	123.7 kg (+226.4%)	143.1 kg (+277.6%)
Force in the final phase of effort (R) (Endurance)	55.6 kg	46.5 kg (-16.4%)	66.8 kg (+20.1%)	160.3 kg (+188.3%)
Force-speed index in the final phase (L) (Endurance)	10.82 kg/s	17.89 kg/s (+65.3%)	26.89 kg/s (+148.5%)	29.81 kg/s (+175.5%)
Force-speed index in the final phase (R) (Endurance)	12.36 kg/s	14.44 kg/s (+16.8%)	23.03 kg/s (+86.3%)	22.26 kg/s (+80.1%)

Coletta et al. (2025)

Comparative Analysis of Elbow Flexor Morphology, Physiology, and Performance Between Arm Wrestlers and Strength-Trained Athletes · J Strength Cond Res 39(5): 579-586

Short study description

Sample: nine national/international-level arm wrestlers and nine strength-trained athletes. All measurements were performed on the dominant right limb.

Limb size: upper-arm circumference, forearm circumference, and biceps brachii muscle thickness measured by ultrasound.

Speed-strength test - 3×3 s MVIC: three 3-second maximal isometric elbow-flexion contractions. RTD at 0-100, 0-200, and 0-300 ms and peak torque were measured.

Strength-endurance test - 3×20 s MVIC: three 20-second maximal isometric efforts separated by 1 minute of rest. Peak torque and RTD were analyzed across repetitions.

Authors' conclusions - summary

- Arm wrestlers had a significantly larger forearm circumference, but did not differ significantly from strength-trained athletes in upper-arm circumference or biceps thickness.
- In the 3×3 s test, arm wrestlers achieved higher peak torque and higher RTD at 0-100, 0-200, and 0-300 ms.
- In the 3×20 s test, arm wrestlers had higher peak torque at the group level; RTD did not differ significantly between groups. Peak torque declined after the first 20-second repetition.
- The authors emphasize that differences in maximal and explosive torque production occurred despite no significant differences in upper-arm circumference or biceps thickness.

Coletta et al. (2025) - limb size, speed, strength and endurance

● = statistically significant between-group difference ($p < 0.05$). The percentage shows how much higher the arm-wrestler result was than the strength-trained result.

For the 3 × 20 s test, the paper does not report exact group mean peak-torque values in a table or in the text; therefore no percentage was estimated from the graph.

Parameter	Strength-trained	Arm wrestlers	Arm-wrestler difference
Upper-arm circumference (Size)	35.6 cm	37.9 cm	+6.5%
Forearm circumference (Size)	32.5 cm	36.6 cm	● +12.6%
Biceps thickness by ultrasound (Size)	35.7 mm	39.3 mm	+10.1%
RTD 0-100 ms - 3 × 3 s (Speed)	562 N·m/s	720 N·m/s	● +28.1%
RTD 0-200 ms - 3 × 3 s (Speed)	391 N·m/s	522 N·m/s	● +33.5%
RTD 0-300 ms - 3 × 3 s (Speed)	294 N·m/s	374 N·m/s	● +27.2%
Peak torque - 3 × 3 s (Strength)	107.2 N·m	136.9 N·m	● +27.7%
Peak torque - 3 × 20 s (Endurance)	value not reported	value not reported	● arm wrestlers higher
RTD - 3 × 20 s (Endurance)	value not reported	value not reported	no group difference

Akpinar et al. (2013)

Anthropological and Perceptual Predictors Affecting the Ranking in Arm Wrestling Competition · Int J Morphol 31(3): 832-838

Short study description

Sample: 73 senior athletes competing at the Turkish Championships. The right-arm analysis included 69 competitors and the left-arm analysis 65.

Sport level: athletes were divided into Top 3 and the remaining competitors (4th place and lower) based on actual competition results.

Measurements: relative maximal grip strength, auditory reaction time, forearm circumference, and forearm length. Grip strength was the best of three maximal isometric contractions and was divided by body mass.

Authors' conclusions - summary

- Relative grip strength was a significant predictor of Top 3 status for both the right and left arms.
- Auditory reaction time was a significant predictor only for the right arm.
- Forearm circumference was a significant predictor only for the left arm; the right-arm difference was not significant.
- Forearm length was not a significant predictor of Top 3 status for either arm.
- The model combining the four variables correctly classified 88.4% of right-arm cases and 83.1% of left-arm cases.

Akpinar et al. (2013) - Top 3 vs others

● = the variable was a significant predictor of Top 3 status in logistic regression ($p < 0.05$). The percentage shows the mean Top 3 difference relative to the other competitors.

Parameter	Others	Top 3	Top 3 difference
Auditory reaction time (R) (Speed)	146.67 ms	123 ms	● -16.1%
Relative grip strength (R) (Strength)	0.82	0.92	● +12.2%
Forearm circumference (R) (Size)	32.5 cm	33.39 cm	+2.7%
Forearm length (R) (Size)	26.97 cm	27.44 cm	+1.7%
Auditory reaction time (L) (Speed)	146.52 ms	133 ms	-9.2%
Relative grip strength (L) (Strength)	0.80	0.92	● +15.0%
Forearm circumference (L) (Size)	31.1 cm	32.4 cm	● +4.2%
Forearm length (L) (Size)	26.85 cm	27.31 cm	+1.7%

Rovnaya et al. (2019)

The Application of the Index Method to Assess the Condition of Armwrestling Athletes with Different Levels of Sports Mastery · Revista Romaneasca pentru Educatie Multidimensionala 11(4 Suppl. 1): 242-256

Short study description

Sample: 37 arm wrestlers. Group 1: n=17, from beginners to first-rank athletes. Group 2: n=20, from Candidate Master of Sport to International Master of Sport.

Body-size measurements: limb lengths and circumferences and derived upper-arm and forearm segment mass indices. The segment mass index is an anthropometric index calculated from segment circumference and length; it does not represent muscle mass in kilograms.

Strength measurement: hand dynamometry was performed. Strength is reported as the power index = grip strength / body mass × 100%.

Authors' conclusions - summary

- Athletes with higher sports mastery had significantly higher mass indices for the right and left upper arm and the right and left forearm.
- Relative grip strength (power index) was only slightly higher in the more qualified group and did not differ significantly between groups.

Rovnaya et al. (2019) - lower vs higher sports mastery

● = significant between-group difference according to the authors' table ($p < 0.05$). The percentage shows how much higher the value was in the higher-mastery group.

The segment mass index is an anthropometric index derived from segment circumference and length; it does not represent muscle mass in kilograms.

Parameter	Lower mastery	Higher mastery	Difference
Relative grip strength (L) (Strength)	75.89%	78.69%	+3.7%
Relative grip strength (R) (Strength)	83.62%	84.46%	+1.0%
Upper-arm segment mass index (R) (Size)	99.70	109.69	● +10.0%
Upper-arm segment mass index (L) (Size)	99.32	108.56	● +9.3%
Forearm segment mass index (R) (Size)	114.45	125.44	● +9.6%
Forearm segment mass index (L) (Size)	113.57	121.84	● +7.3%

Sources

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