

Supplementary material S1. Interventions characteristics.

Study	Sessions analyzed	Eccentric training description	Concentric training description	Isometric training description
Resistance / neuromuscular protocols				
(Clarkson et al., 1986)	1 session	Exercises: Biceps curl Sets: 6 Reps: 10 (60 total) Rest between sets: 50 s Rest between reps: 10 s Pace of reps: Controlled by a timing device with sequential lights (constant rate) Intensity of reps: 100% of concentric 1RM	Exercises: Biceps curl Sets: 6 Reps: 10 (60 total) Rest between sets: 50 s Rest between reps: 10 s Pace of reps: Maximal effort for each 10 s period Intensity of reps: Maximal effort	Exercises: Biceps curl Sets: 6 Reps: 10 (60 total) Rest between sets: 50 s Rest between reps: 10 s Pace of reps: Maximal contraction for each 10 s period Intensity of reps: Maximal effort
(Latella et al., 2019)	1 ECC session, 1 CON session	Exercises: Isokinetic elbow flexor eccentric contractions Sets: 3 Reps: 10 Rest between sets: 180 s (3 minutes) Rest between reps: NR Pace of reps: 3 seconds per contraction, at 40°/s over ROM 120° to 0° Intensity: Maximal effort (3 sets × 10 maximal isokinetic ECC contractions)	Exercises: Isokinetic elbow flexor concentric contractions Sets: 3 Reps: 10 Rest between sets: 180 s (3 minutes) Rest between reps: NR Pace of reps: 3 seconds per contraction, at 40°/s over ROM 0° to 120° Intensity: Maximal effort (3 sets × 10 maximal isokinetic CON contractions)	N/A
(Muthalib et al., 2010)	1 session	Exercises: Elbow flexor eccentric contractions Sets: 10 Reps: 6 per set Rest between sets: 2 min Rest between reps: 3 s (passive recovery) Pace of reps: 90°/s elbow joint extension, 1 s contraction duration Intensity of reps: Maximal voluntary contraction resisted by subject	Exercises: Elbow flexor concentric contractions Sets: 10 Reps: 6 per set Rest between sets: 2 min Rest between reps: 3 s (passive recovery) Pace of reps: 90°/s elbow joint flexion, 1 s contraction duration Intensity of reps: Maximal voluntary contraction	N/A
(Ochi et al., 2016)	1 ECC session, 1 CON session	Exercises: Maximal voluntary isokinetic eccentric contractions of elbow flexors (one arm) Sets: 5	Exercises: Maximal voluntary isokinetic concentric contractions of elbow flexors (other arm) Sets: 5	N/A

		Reps: 6 per set (total 30 contractions) Rest between sets: 90 s Rest between reps: 3 s (passive recovery as dynamometer returns arm) Pace of reps: 30°/s (isokinetic velocity) Intensity of reps: Maximal voluntary effort	Reps: 6 per set (total 30 contractions) Rest between sets: 90 s Rest between reps: 3 s (passive recovery as dynamometer returns arm) Pace of reps: 30°/s (isokinetic velocity) Intensity of reps: Maximal voluntary effort	
(Philippou et al., 2010)	2 sessions	Exercises: Maximal voluntary eccentric contractions of elbow flexors on isokinetic dynamometer Sets: 2 Reps: 25 per set (50 total) Rest between sets: 5 min Rest between reps: 15 s Pace of reps: 4 s per eccentric contraction Intensity of reps: Maximal voluntary effort	N/A	Exercises: Maximal voluntary isometric contractions of elbow flexors on isokinetic dynamometer Sets: 2 Reps: 25 per set (50 total) Rest between sets: 5 min Rest between reps: 20 s Pace of reps: 10 s contraction duration Intensity of reps: Maximal voluntary effort
(Piitulainen et al., 2011)	3 sessions	Exercises: Maximal eccentric contractions of elbow flexors on dynamometer (elbow joint 65° to 175°) Sets: 3 Reps: 20 per set Rest between sets: Not explicitly stated (sufficient rest to avoid excessive metabolic load) Rest between reps: 15 s intervals Pace of reps: Angular velocity 60°/s, 2.8 s total contraction duration including 1 s maximal isometric pre-activation Intensity of reps: Maximal	Exercises: Maximal concentric contractions of elbow flexors Sets: 3 Reps: 20 per set Rest between sets: Not explicitly stated (sufficient rest to avoid excessive metabolic load) Rest between reps: 15 s intervals Pace of reps: Angular velocity 60°/s, 2.8 s total contraction duration including 1 s maximal isometric pre-activation Intensity of reps: Maximal	N/A
(Royer et al., 2022)	1 ECC session, 1 CON session 1 ISO session	Exercises: Knee extension Sets: 8–9 (varied to match torque-time integral) Reps: 10 contractions per set Rest between sets: 90 s Rest between reps: continuous at 60°/s Pace of reps: 60°/s over 100° range of motion	Exercises: Knee extension Sets: ~15 (varied to match torque-time integral) Reps: 10 contractions per set Rest between sets: 90 s Rest between reps: continuous at 60°/s Pace of reps: 60°/s over 100° range of	Exercises: Knee extension at fixed angle Sets: ~10 (varied to match torque-time integral) Reps: 10 contractions per set Rest between sets: 90 s Rest between reps: continuous contraction time of 1.6 s per rep Pace of reps: Isometric hold at 90° knee flexion

		(from 20° to 120° knee flexion) Intensity of reps: Maximal voluntary eccentric contractions	motion (from 120° to 20° knee flexion) Intensity of reps: Maximal voluntary concentric contractions	(1.6 s contraction time) Intensity of reps: Maximal voluntary isometric contractions
(Willoughby & Taylor, 2004)	1 ECC session 1 CON session	Exercises: Knee extensors (leg extension/leg curl machine) Sets: 7 Reps: 10 per set Rest between sets: 3 min Rest between reps: 15 sec Pace of reps: ~2-3 sec per rep Intensity of reps: 150% of concentric 1-RM (eccentric overload)	Exercises: Knee extensors (leg extension/leg curl machine) Sets: 7 Reps: 10 per set Rest between sets: 3 min Rest between reps: 15 sec Pace of reps: ~2-3 sec per rep Intensity of reps: 75% of concentric 1-RM (estimated 10-RM)	N/A
(Ye et al., 2014)	1 ECC session 1 CON session	Exercises: Isokinetic eccentric muscle actions of dominant forearm flexors on dynamometer Sets: 6 Reps: 10 per set Rest between sets: 1 minute Rest between reps: Not specified (continuous, isokinetic velocity) Pace of reps: 60°/s (isokinetic speed) Intensity of reps: Maximal effort	Exercises: Isokinetic concentric muscle actions of dominant forearm flexors on dynamometer Sets: 6 Reps: 10 per set Rest between sets: 1 minute Rest between reps: Not specified (continuous, isokinetic velocity) Pace of reps: 60°/s (isokinetic speed) Intensity of reps: Maximal effort	N/A
(Ye et al., 2015)	1 ECC session 1 CON session	Exercises: Maximal isokinetic muscle actions of forearm flexors (eccentric) Sets: 6 Reps: 10 per set Rest between sets: 1 minute Rest between reps: Not specified (likely minimal since isokinetic) Pace of reps: Velocity of 60°/s Intensity of reps: Maximal voluntary eccentric contractions	Exercises: Maximal isokinetic muscle actions of forearm flexors (concentric) Sets: 6 Reps: 10 per set Rest between sets: 1 minute Rest between reps: Not specified Pace of reps: Velocity of 60°/s Intensity of reps: Maximal voluntary concentric contractions	N/A
Aerobic modalities with predominant eccentric component				
(González-Bartholin et al., 2019)	3 cycling bouts	Exercises: Eccentric cycling on recumbent ergometer Sets: 1, continuous 30 min	Exercises: Concentric cycling on recumbent ergometer Sets: 1, continuous 30 min	N/A

		Reps: continuous cycling Rest between sets: NR Rest between reps: NR Pace of reps: 60 rpm cadence Intensity of reps: ECC-moderate = 50% of concentric P _O max; ECC-High = ~100% concentric P _O max	Reps: continuous cycling Rest between sets: NR Rest between reps: NR Pace of reps: 60 rpm cadence Intensity of reps: 50% of concentric P _O max	
(Philippe et al., 2016)	1 ECC session, 1 CON session	Exercises: Downhill treadmill walking Sets: 1 continuous bout Reps: NR Rest between sets: NR Rest between reps: NR Pace of reps: Continuous walking speed (~1.67 m/s) Intensity of reps: ~40% VO ₂ max	Exercises: Uphill treadmill walking Sets: 1 continuous bout Reps: NR Rest between sets: NR Rest between reps: NR Pace of reps: Continuous walking speed (~0.80 m/s) Intensity of reps: ~40% VO ₂ max	N/A
(Rappelt et al., 2021)	1 ECC session, 1 CON session	Exercises: Eccentric cycling sprints on Cycus2 Eccentric Trainer (braking against backward crank) Sets: 10 sprints Reps: 10 seconds each sprint Rest between sets: 50 seconds active recovery between sprints Rest between reps: each rep is a 10-sec sprint Pace of reps: ~80 rpm target cadence Intensity of reps: Maximal voluntary effort (braking against backward crank)	Exercises: Concentric cycling sprints on SRM Ergo cycle ergometer (standard) Sets: 10 sprints Reps: 10 seconds each sprint Rest between sets: 50 seconds active recovery Rest between reps: N/A Pace of reps: ~80 rpm target cadence Intensity of reps: Maximal voluntary effort (all-out concentric sprints)	N/A

Supplementary material S2. Risk-of-bias assessment for randomized crossover trials (RoB 2).

Study	D1	S2	D2	D3	D4	D5	Overall
González-Bartholin et al. (González-Bartholin et al., 2019)	!	!	-	+	+	!	-
Latella et al. (Latella et al., 2019)	!	+	+	+	+	!	!
Muthalib et al. (Muthalib et al., 2010)	!	+	+	+	!	!	!
Ochi, Tsuchiya & Nosaka (Ochi et al., 2016)	!	+	+	+	+	!	!
Philippe et al. (Philippe et al., 2016)	!	!	!	+	+	!	!
Rappelt et al. (Rappelt et al., 2021)	-	+	!	+	+	!	-
Willoughby & Taylor (Willoughby & Taylor, 2004)	!	+	+	+	+	!	!
Ye et al. (Ye et al., 2014)	-	+	+	+	+	!	-
Ye et al. (Ye et al., 2015)	!	!	+	+	+	!	!

RoB 2, revised Cochrane risk-of-bias tool for randomized trials; D1, bias arising from the randomization process; D2, bias due to deviations from intended interventions; D3, bias due to missing outcome data; D4, bias in measurement of the outcome; D5, bias in selection of the reported result. Green (+), low risk; yellow (!), some concerns; red (-), high risk.

Supplementary material S3. Risk-of-bias assessment for parallel-group randomized trials (RoB 2).

Study	D1	D2	D3	D4	D5	Overall
Clarkson et al. (Clarkson et al., 1986)						
Philippou et al. (Philippou et al., 2010)						
Piitulainen et al. (Piitulainen et al., 2011)						
Royer et al. (Royer et al., 2022)						

RoB 2, revised Cochrane risk-of-bias tool for randomized trials; D1, bias arising from the randomization process; D2, bias due to deviations from intended interventions; D3, bias due to missing outcome data; D4, bias in measurement of the outcome; D5, bias in selection of the reported result. Green (+), low risk; yellow (!), some concerns; red (−), high risk.