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› *COMMUNITY*

CONFLICT OF INTEREST STATEMENT

I currently have, or I have had in the past 2 years an affiliation or financial interest with [[HUR Inc.](#)] around this presentation, including:

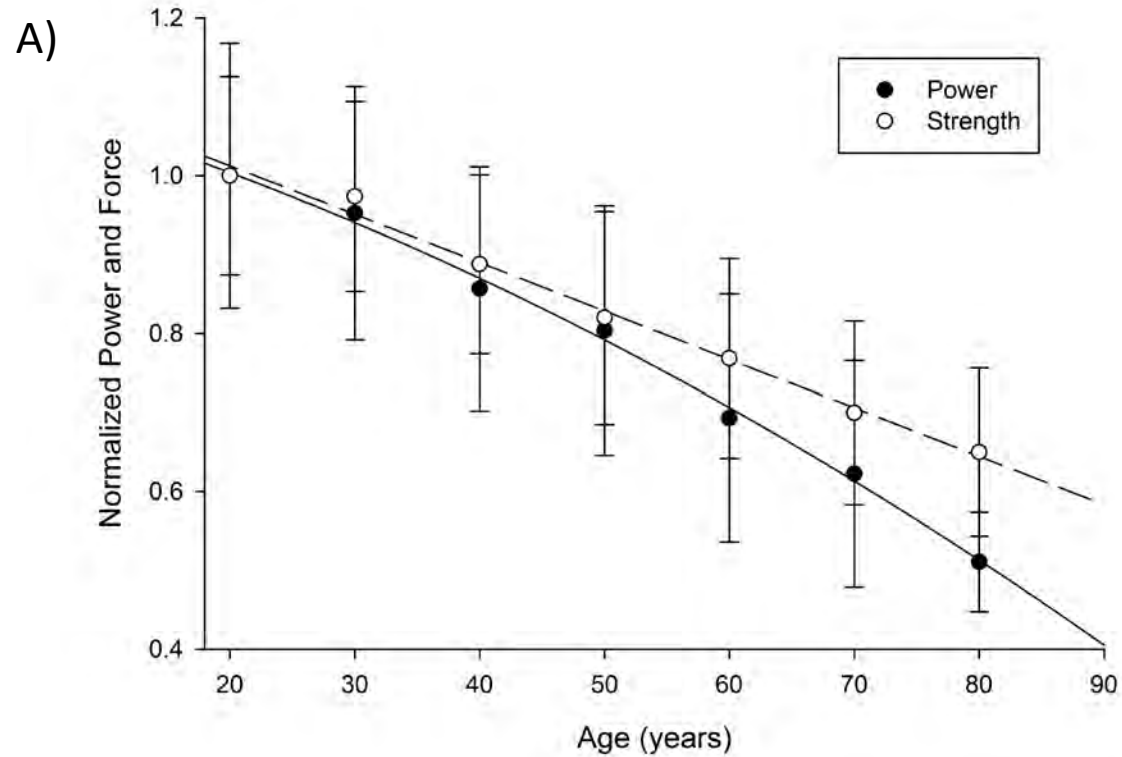
- Consulting
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High Speed Resistance Training for Elderly Populations

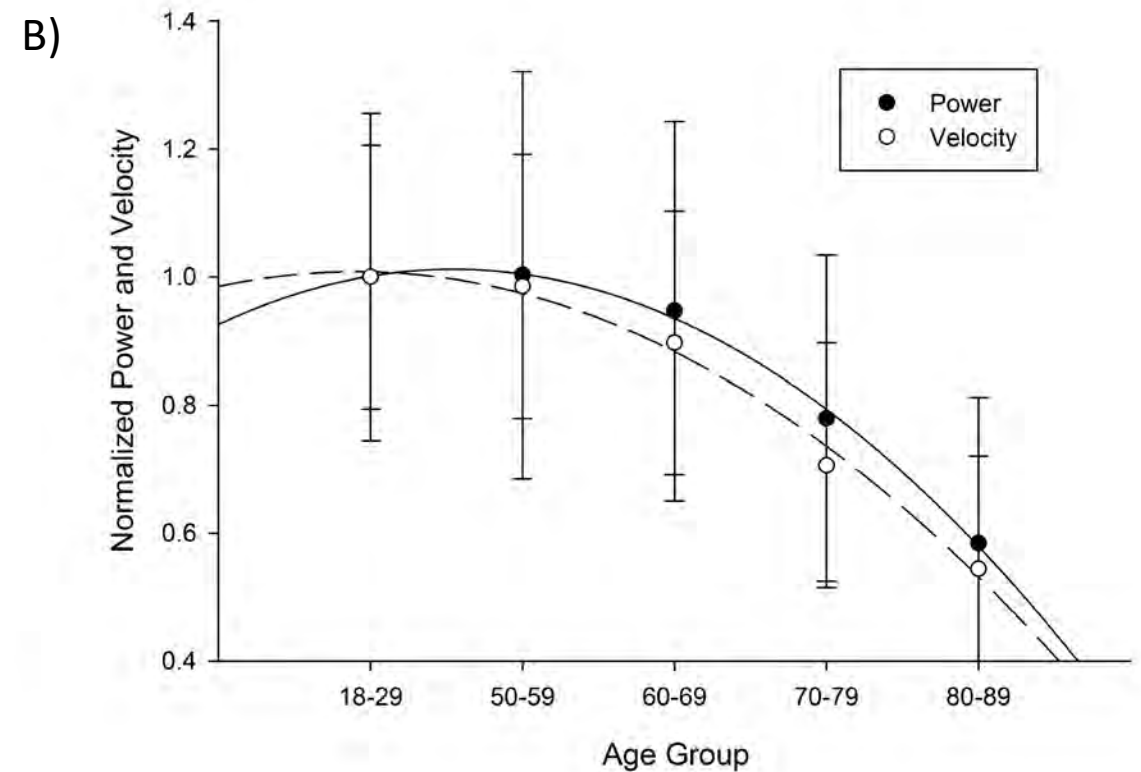
Joseph F. Signorile, PhD
University of Miami

Why High-Speed Training?

Comparative declines in power, strength, and velocity across age groups



After data from Metter et al., J Gerontol A: Bio Med Sci, 1997



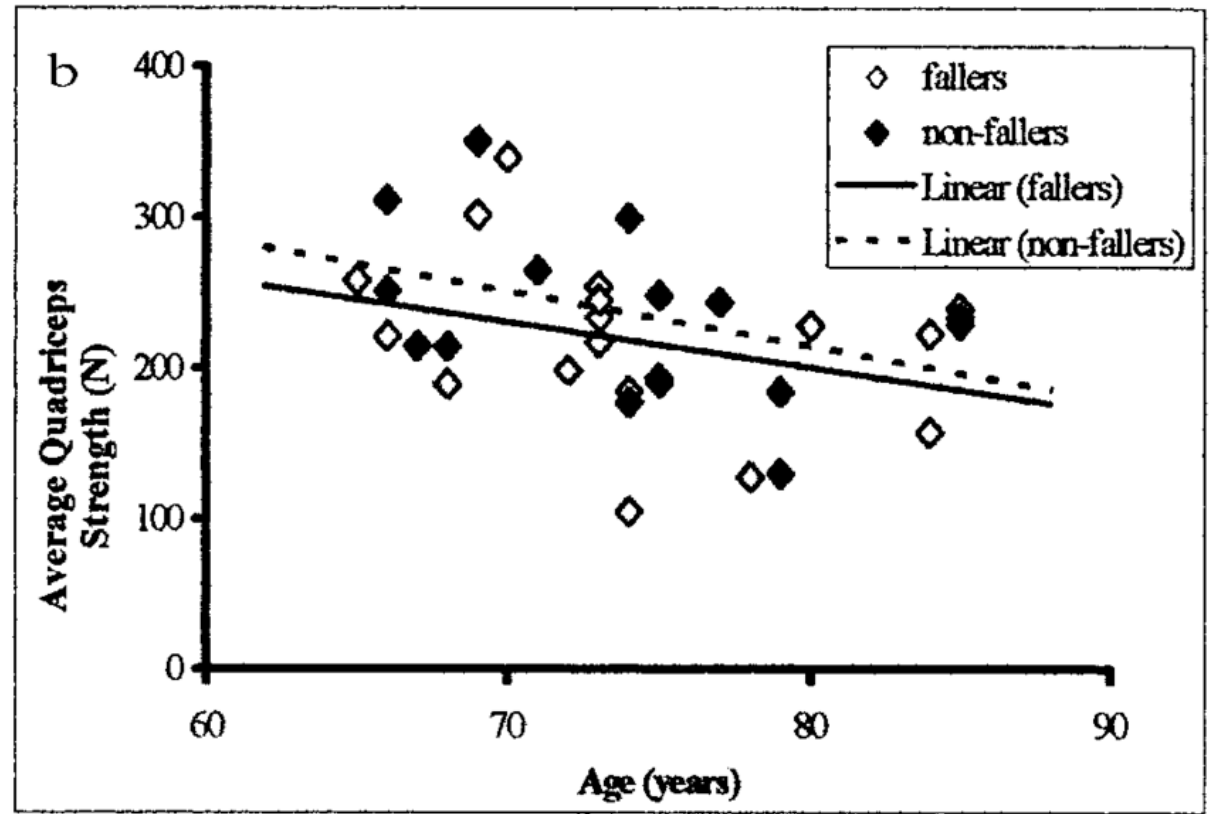
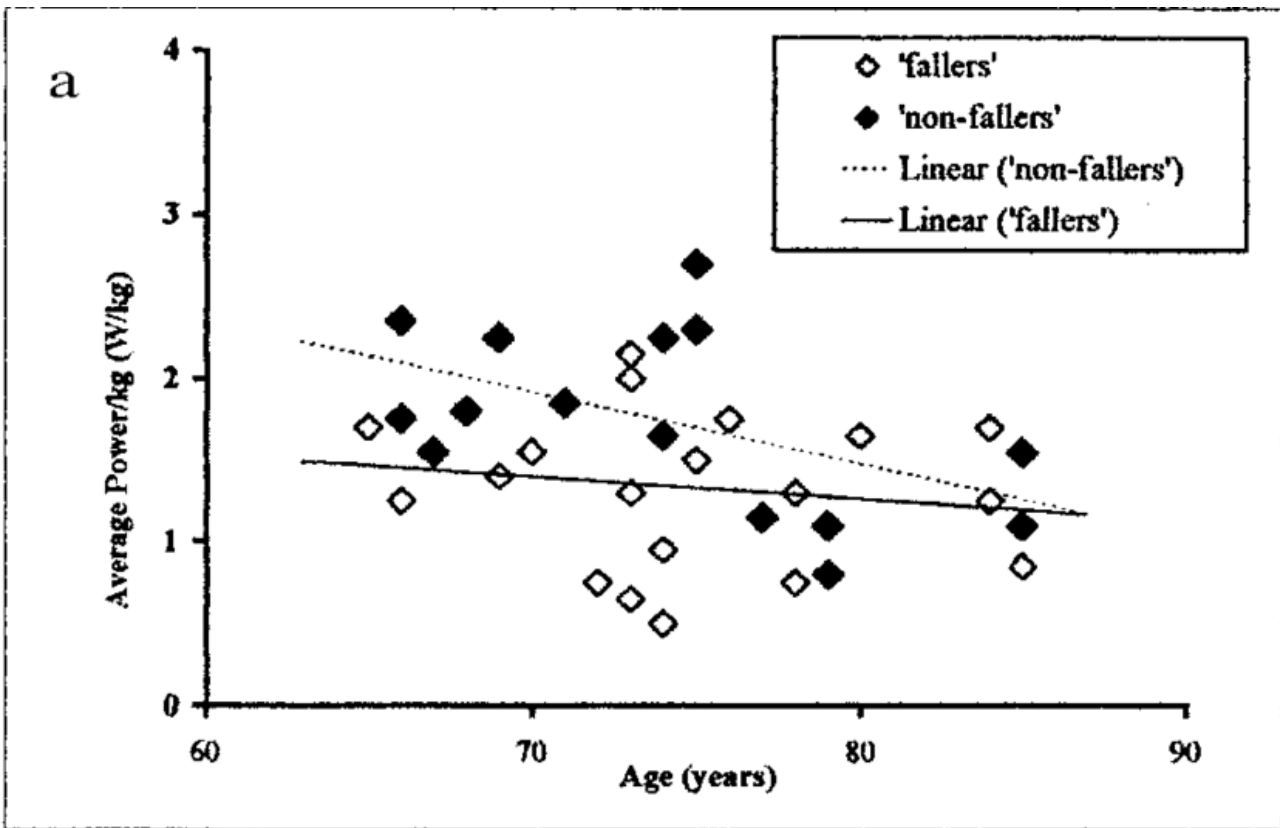
After data from Campitelli et al., J Aging Phys Act, 2021

Power training, daily activities, and fall probability

Maintaining independence and reducing fall probability

There is little doubt that lower body and upper body power are linked to maintaining independence (Foldvari et al., 2000; Cuoco et al., 2004; Bean et al., 2002; Reid et al 2012) and reducing the probability of injurious falls (Skelton et al., 2002; Whipple et al., 1987; Sran et al., 2010; Troy et al., 2009).

Power and falls across age groups



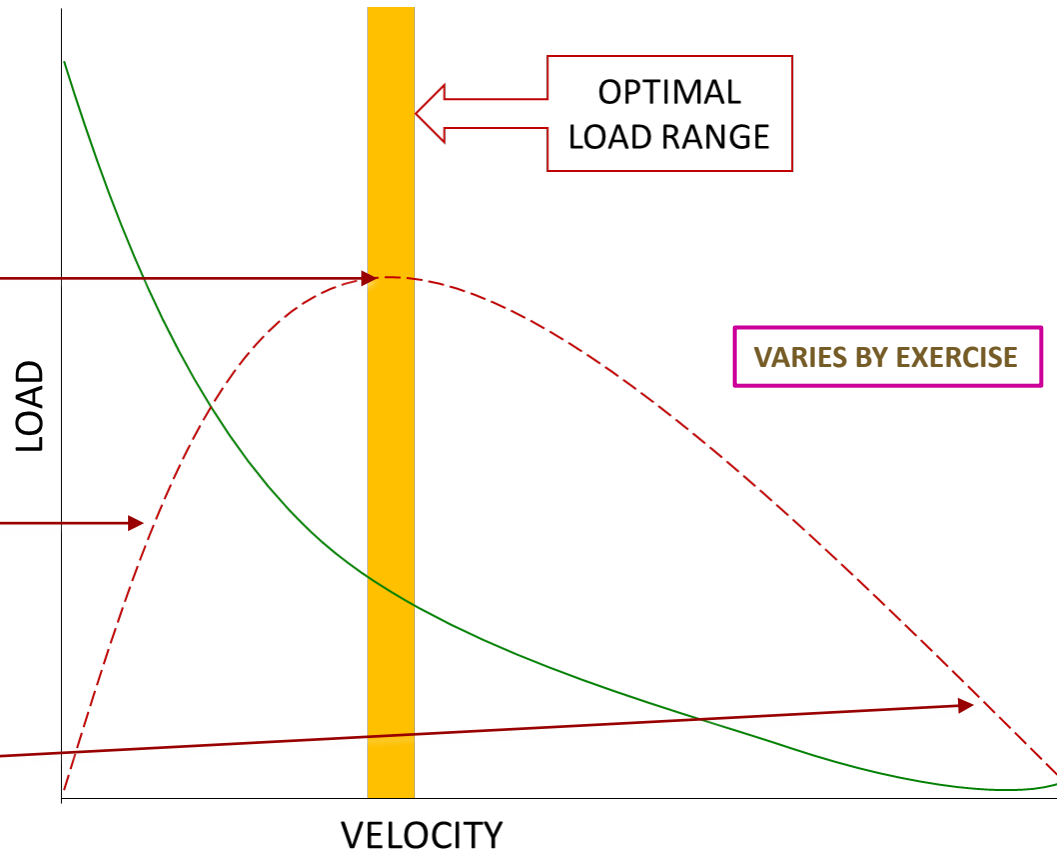
Skelton et al., Age Aging, 2002

The optimal load for power...

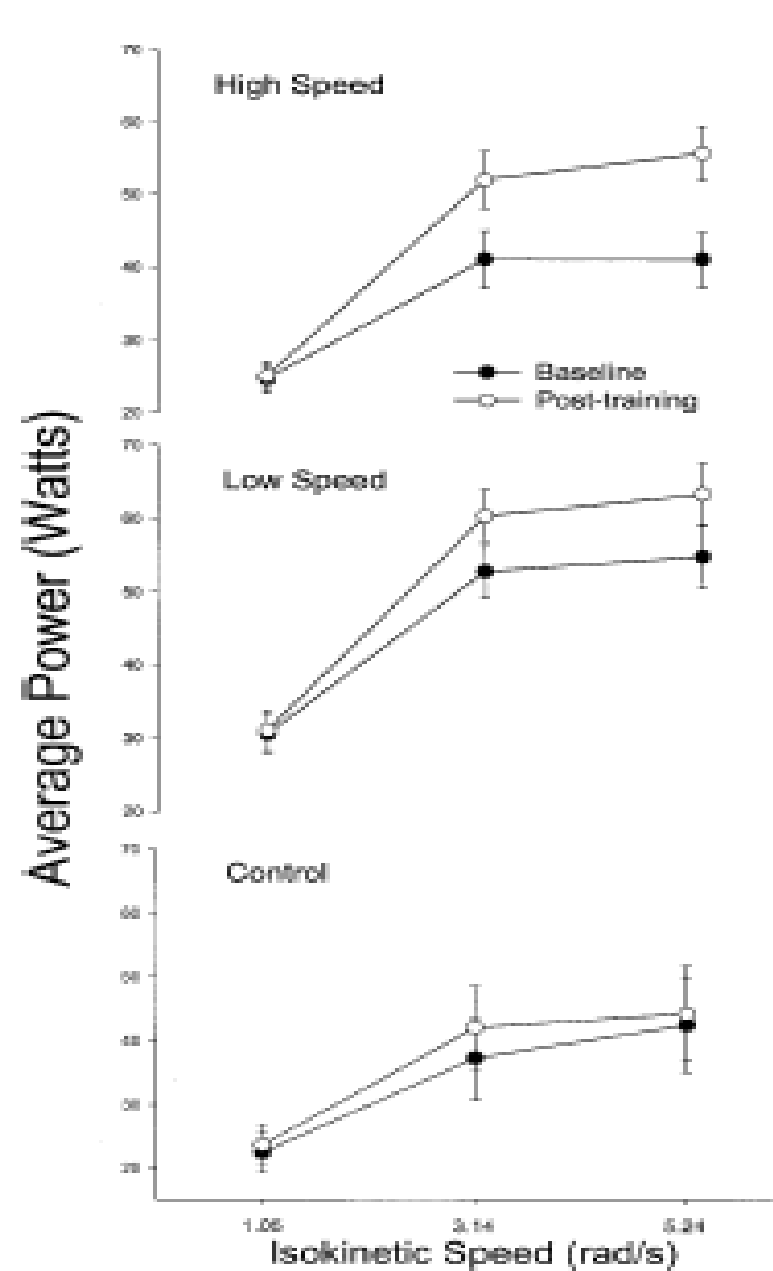
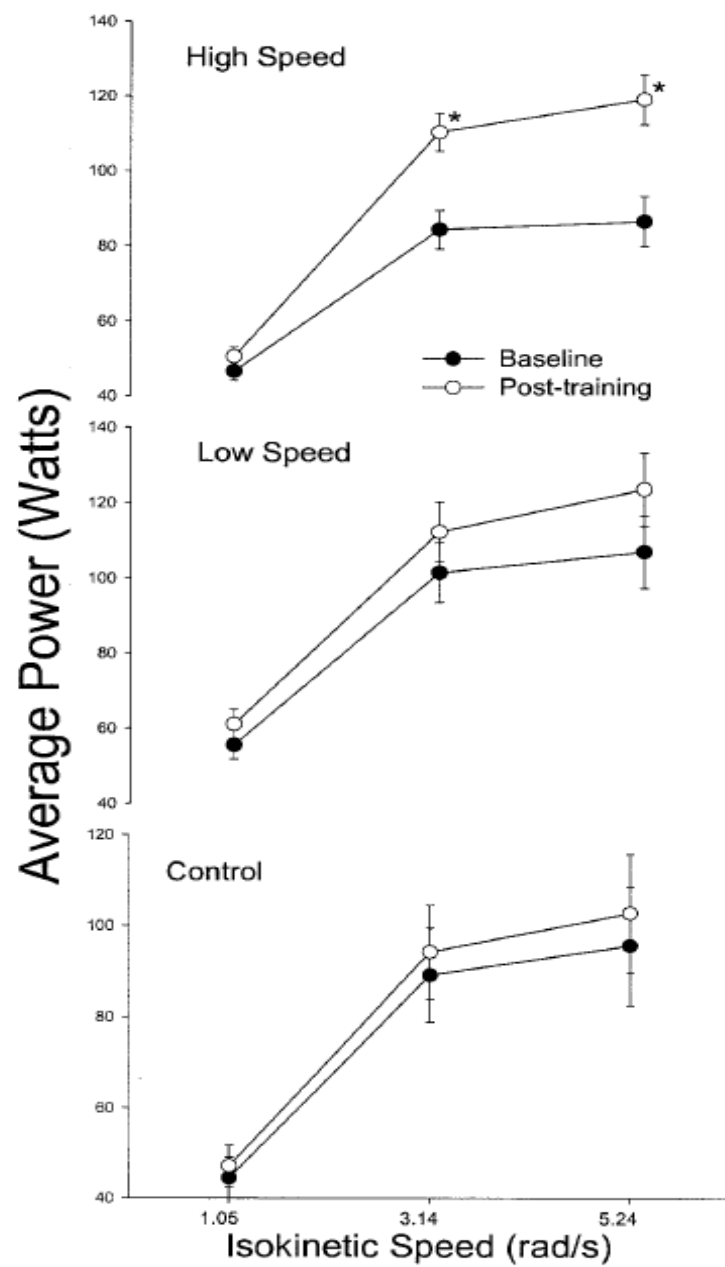
...Does one exist?

Optimal load to maximize power increases

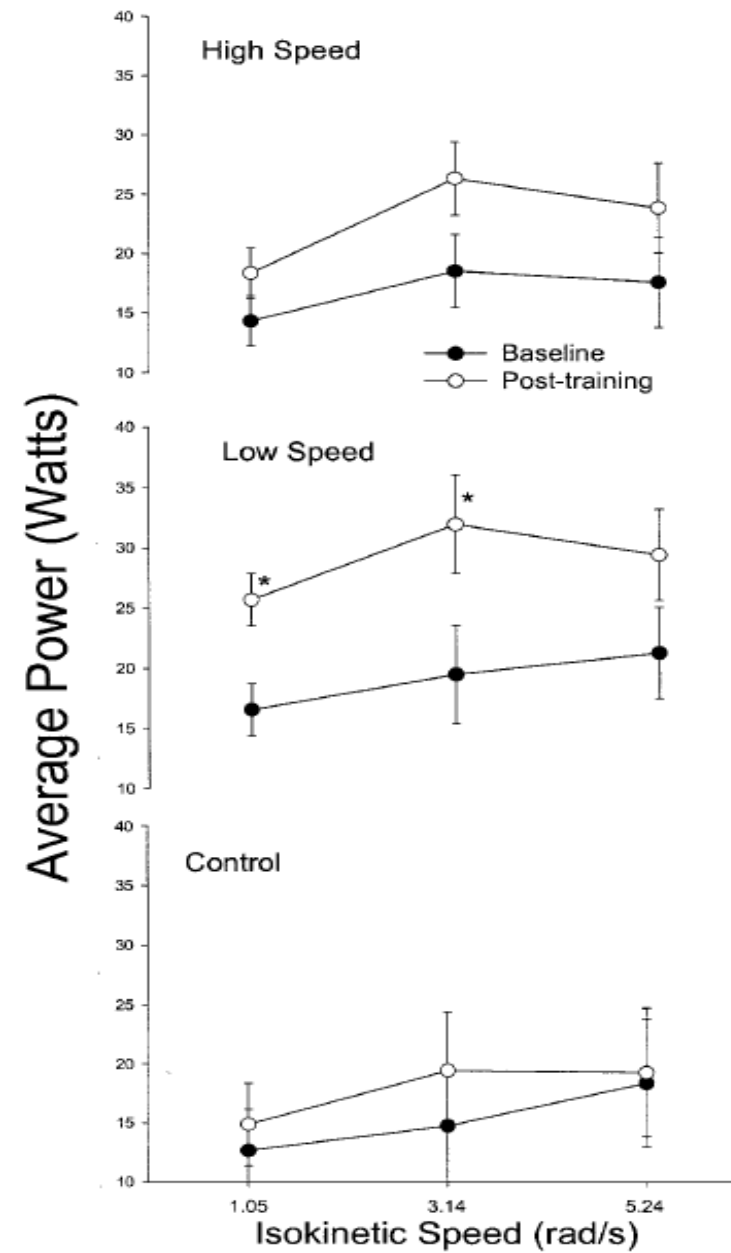
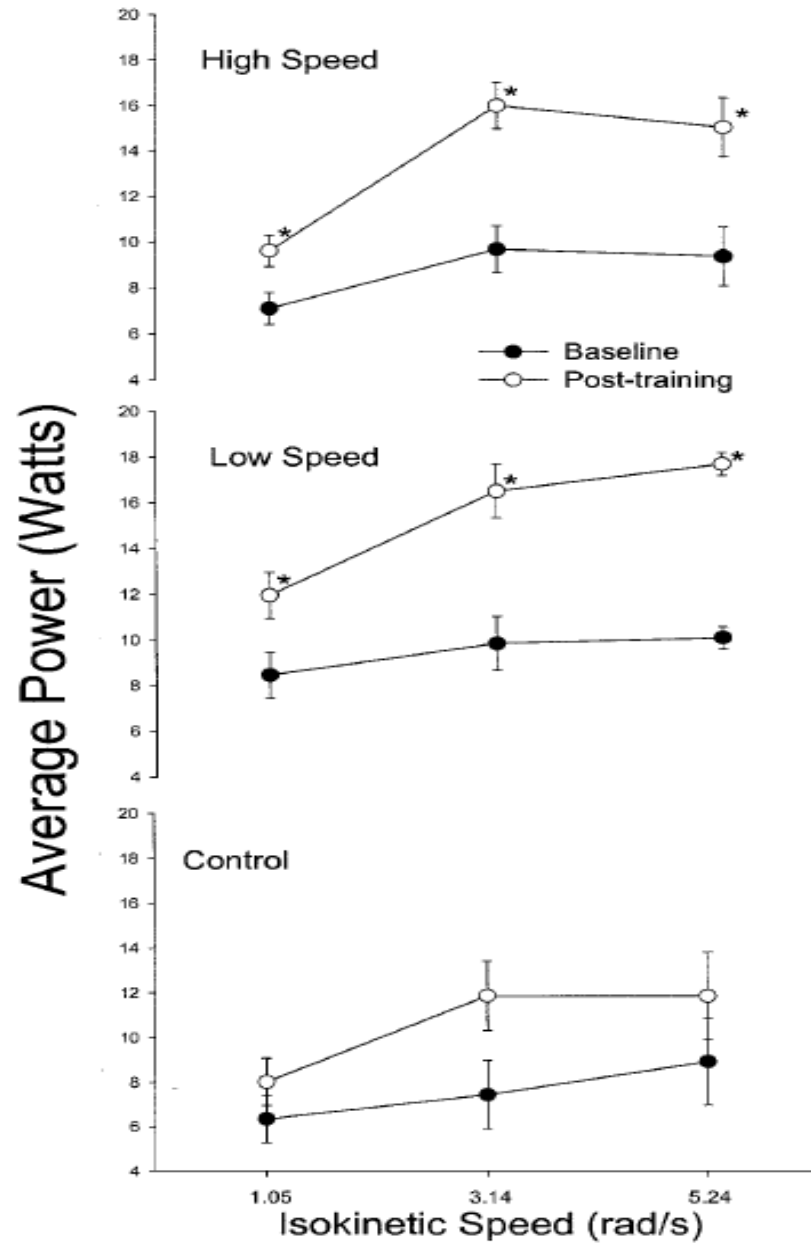
- Maximum Power
- Training at the load end of the curve, not enough velocity, low power.
- Training at the velocity end of the curve, not enough load, low power.



Biomechanical Considerations



Signorile et al., J Gerontol A Bio Med Sci. 2002



Signorile et al., J Gerontol A Bio Med Sci. 2002

Optimal load by exercise

Table 2
Relative peak power at each load among exercises.

Exercise	40%	50%	60%	70%	80%
Multi-joint exercises					
Leg press	0.761 ± 0.034 ^c	0.841 ± 0.026 ^{ab}	0.887 ± 0.023 ^{ab†}	0.839 ± 0.020 ^{bc}	0.822 ± 0.027 ^{bc}
Chest press	0.859 ± 0.025 ^{bc}	0.913 ± 0.019 ^{ab†}	0.897 ± 0.018 ^{bc}	0.861 ± 0.024 ^c	0.735 ± 0.028 ^d
Seated row	0.859 ± 0.025 ^a	0.893 ± 0.021 ^{a†}	0.874 ± 0.021 ^a	0.809 ± 0.024 ^b	0.755 ± 0.025 ^b
Shoulder press	0.807 ± 0.043	0.847 ± 0.041	0.917 ± 0.024 [†]	0.902 ± 0.020	0.855 ± 0.025
Single-joint exercises					
Hip adduction	0.869 ± 0.021 ^{cd}	0.929 ± 0.012 ^{ab†}	0.922 ± 0.017 ^{ab}	0.885 ± 0.885 ^{bc}	0.827 ± 0.031 ^d
Hip abduction	0.884 ± 0.021	0.922 ± 0.016 [†]	0.910 ± 0.019	0.870 ± 0.021	0.849 ± 0.024
Leg curl	0.840 ± 0.027	0.872 ± 0.027 [†]	0.849 ± 0.024	0.865 ± 0.023	0.844 ± 0.024
Calf raise	0.698 ± 0.041 ^c	0.831 ± 0.039 ^{ab}	0.885 ± 0.032 ^{a†}	0.812 ± 0.030 ^{ab}	0.726 ± 0.036 ^{bc}
Biceps curl	0.711 ± 0.042 ^c	0.777 ± 0.038 ^{bc}	0.845 ± 0.034 ^{ab†}	0.842 ± 0.048 ^{ab}	0.837 ± 0.046 ^{ab}
Triceps extension	0.800 ± 0.029 ^b	0.887 ± 0.018 ^a	0.922 ± 0.015 ^{a†}	0.898 ± 0.019 ^a	0.891 ± 0.022 ^a

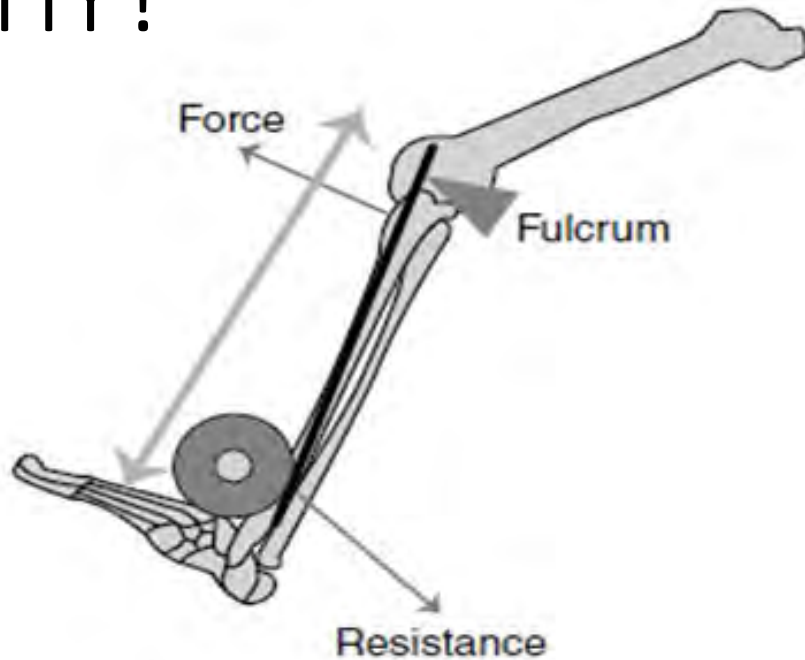
Values are mean ± SD. Loads are presented as a percentage of one-repetition maximum (1RM). † indicates load at which peak power was obtained. All values with similar letter are not significantly different from each other (*p* < 0.05).

Strand et al., Exp Gerontol, 2019

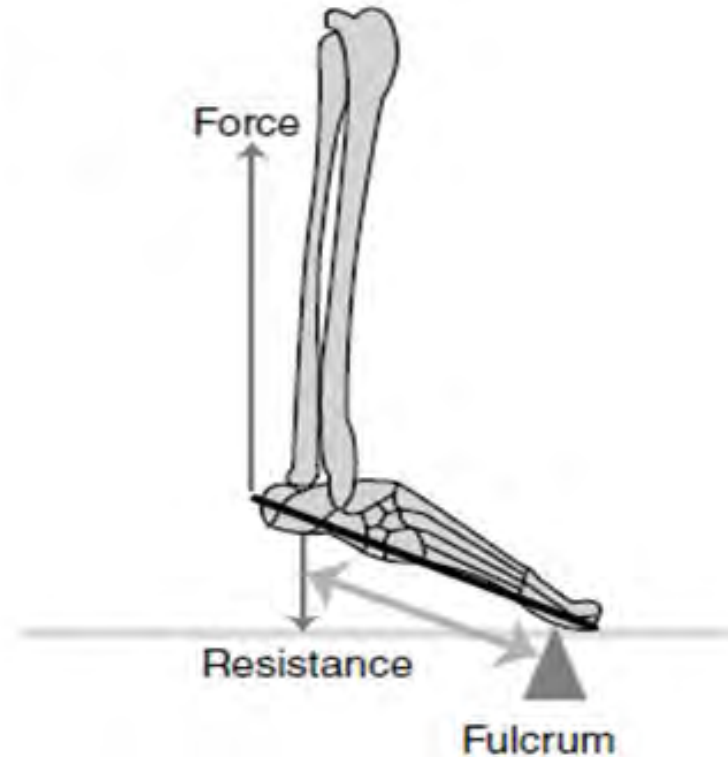
Optimal loading

Biomechanical Considerations

WHY?



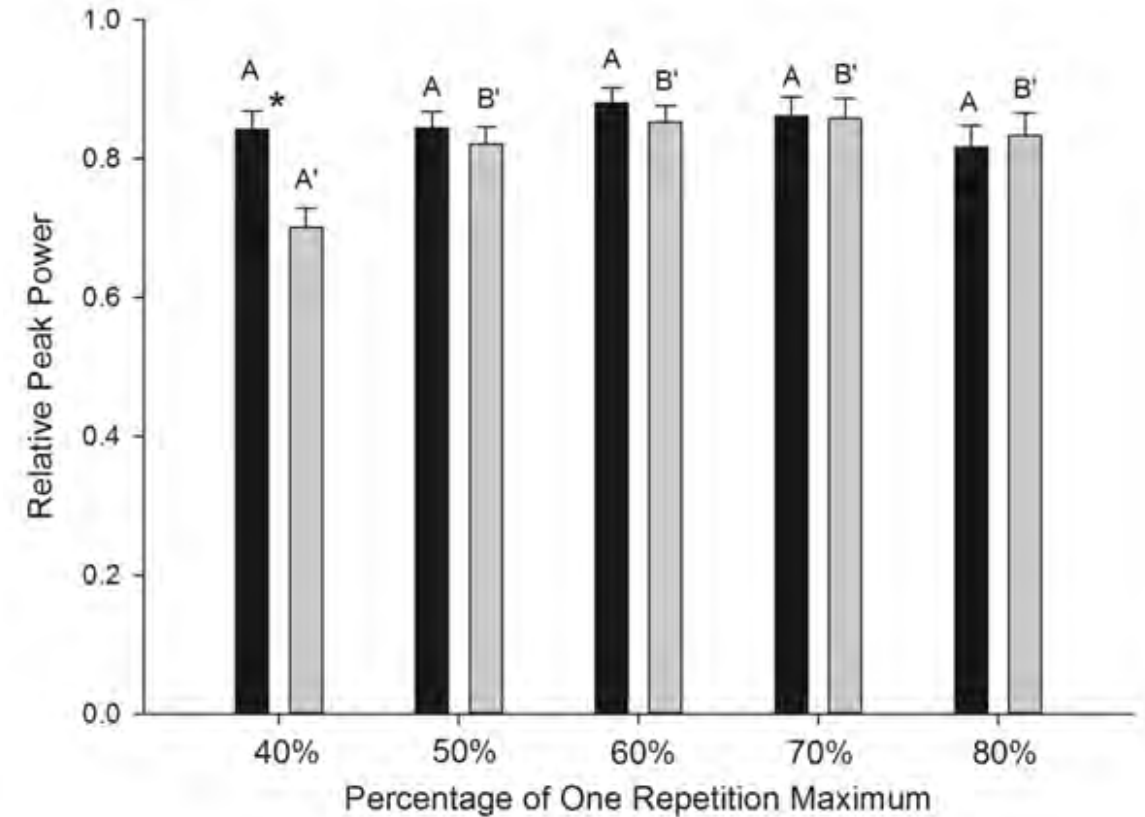
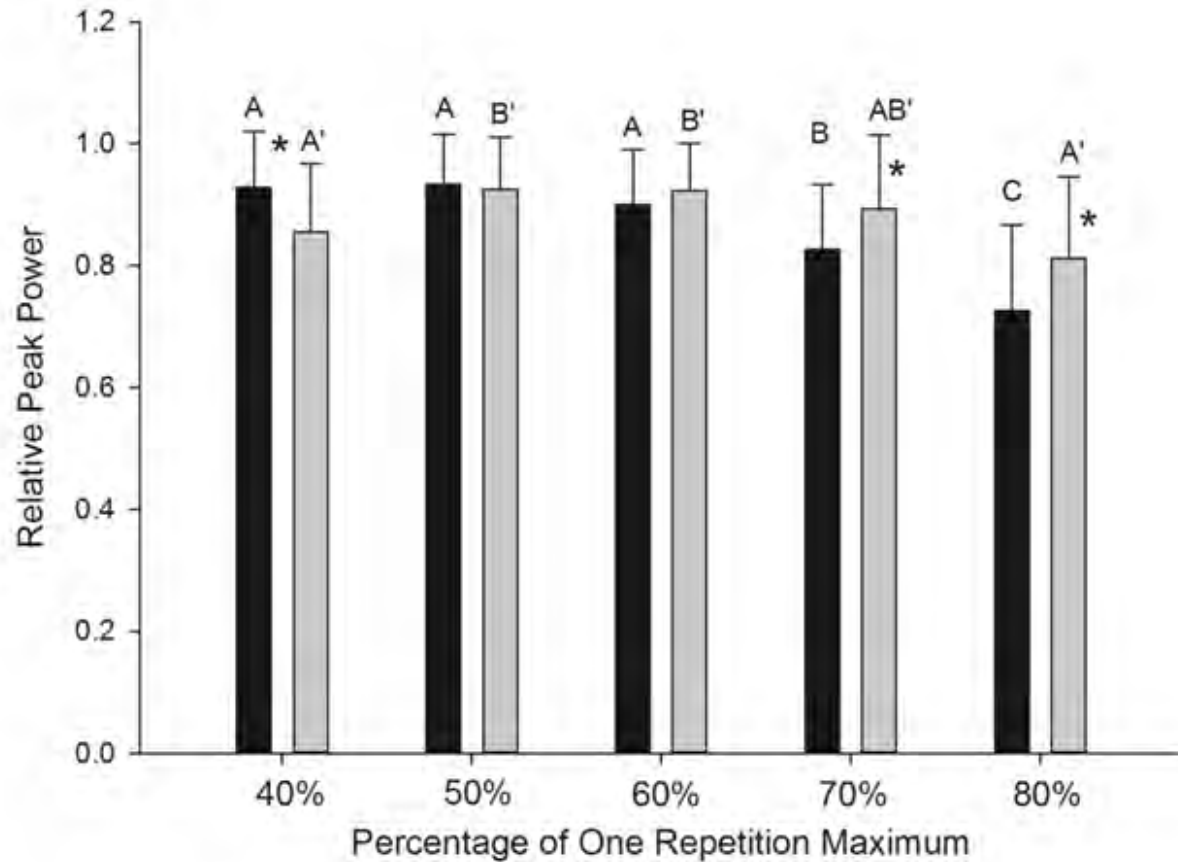
Long third class lever:
Favors movement velocity



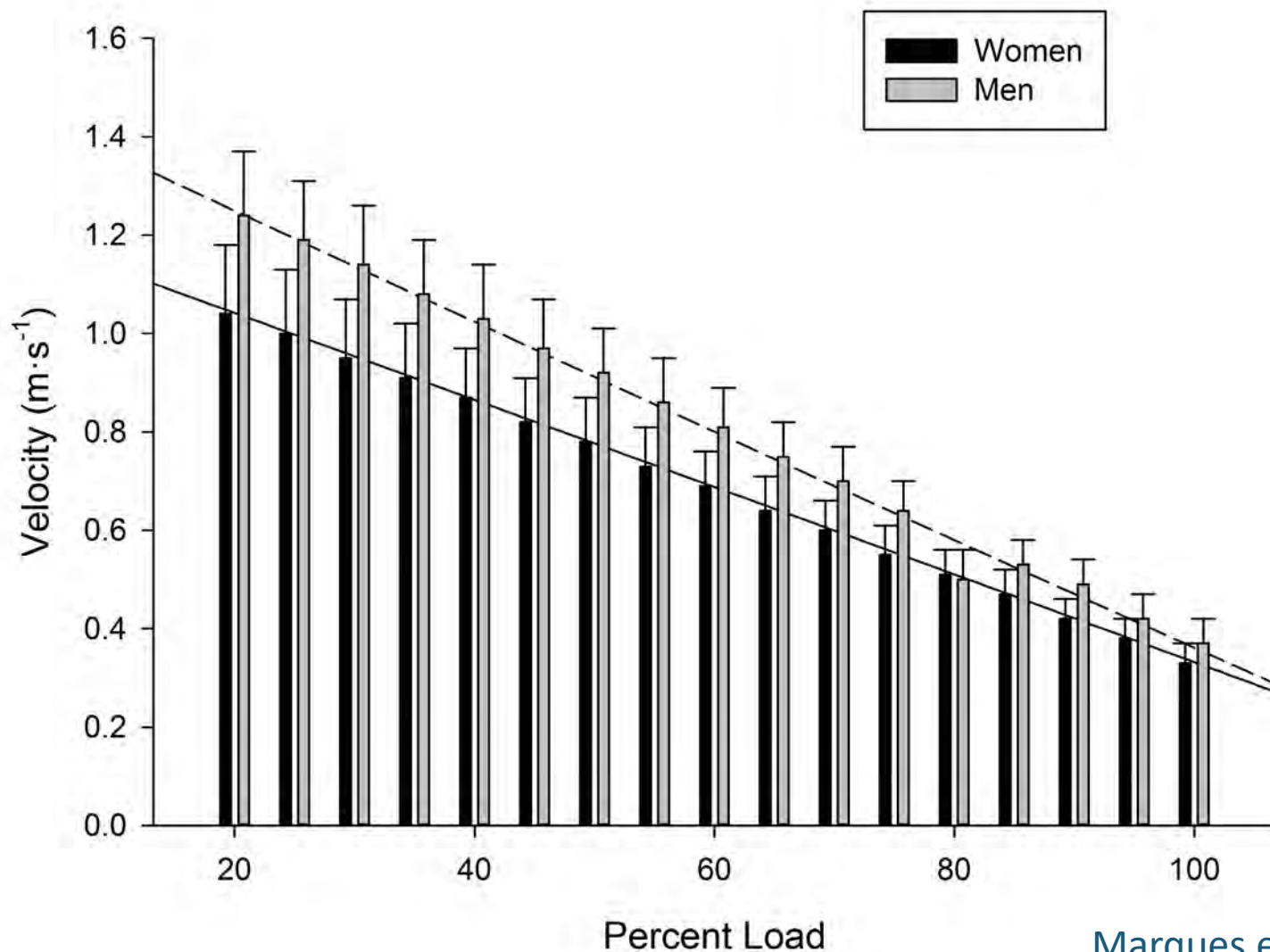
Short second class lever:
Favors force production

Biomechanics and sex differences

Biomechanics and sex differences

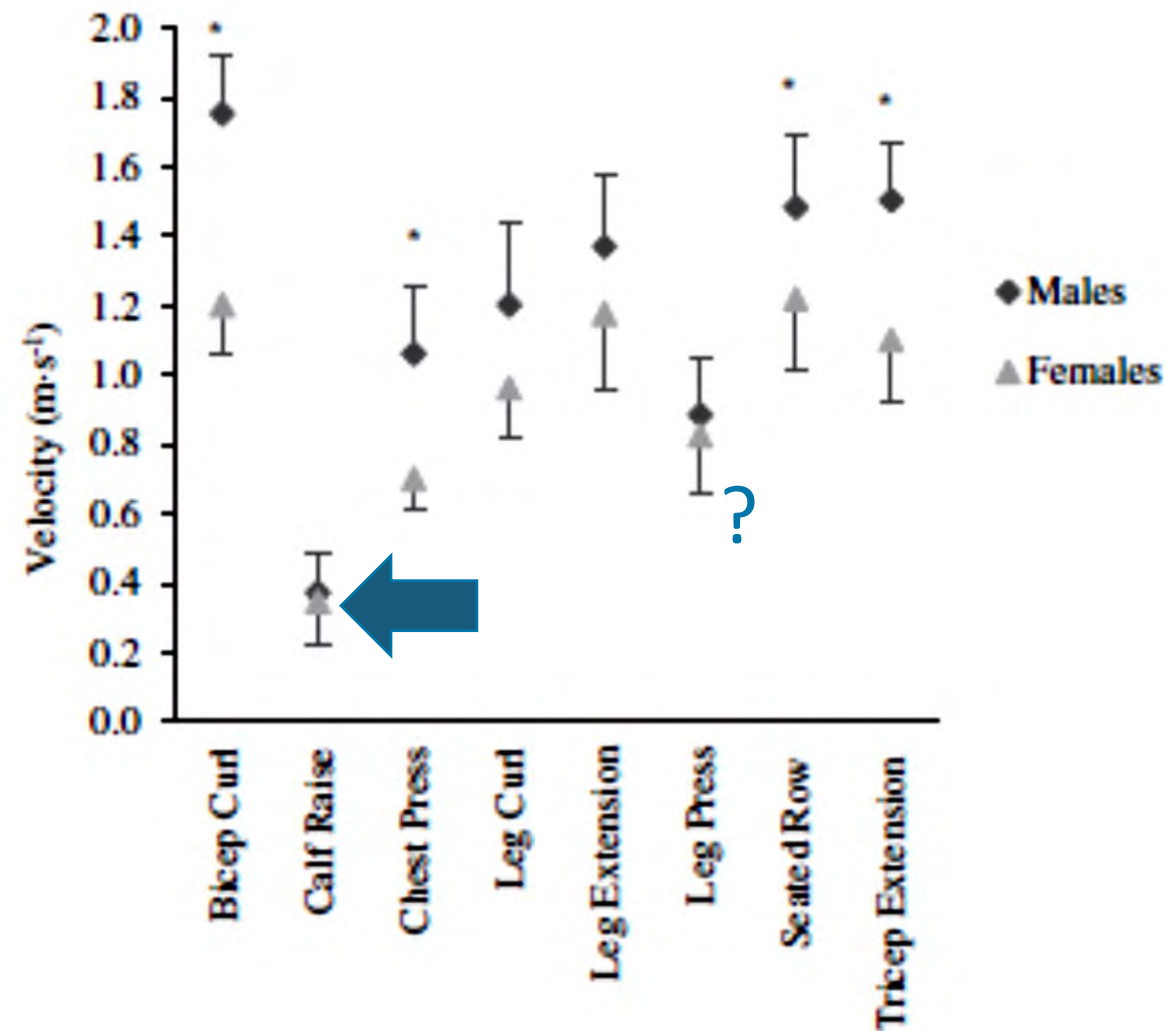


Biomechanics and sex differences



Marques et al., Exp Gerontol., 2021

Biomechanics and sex differences



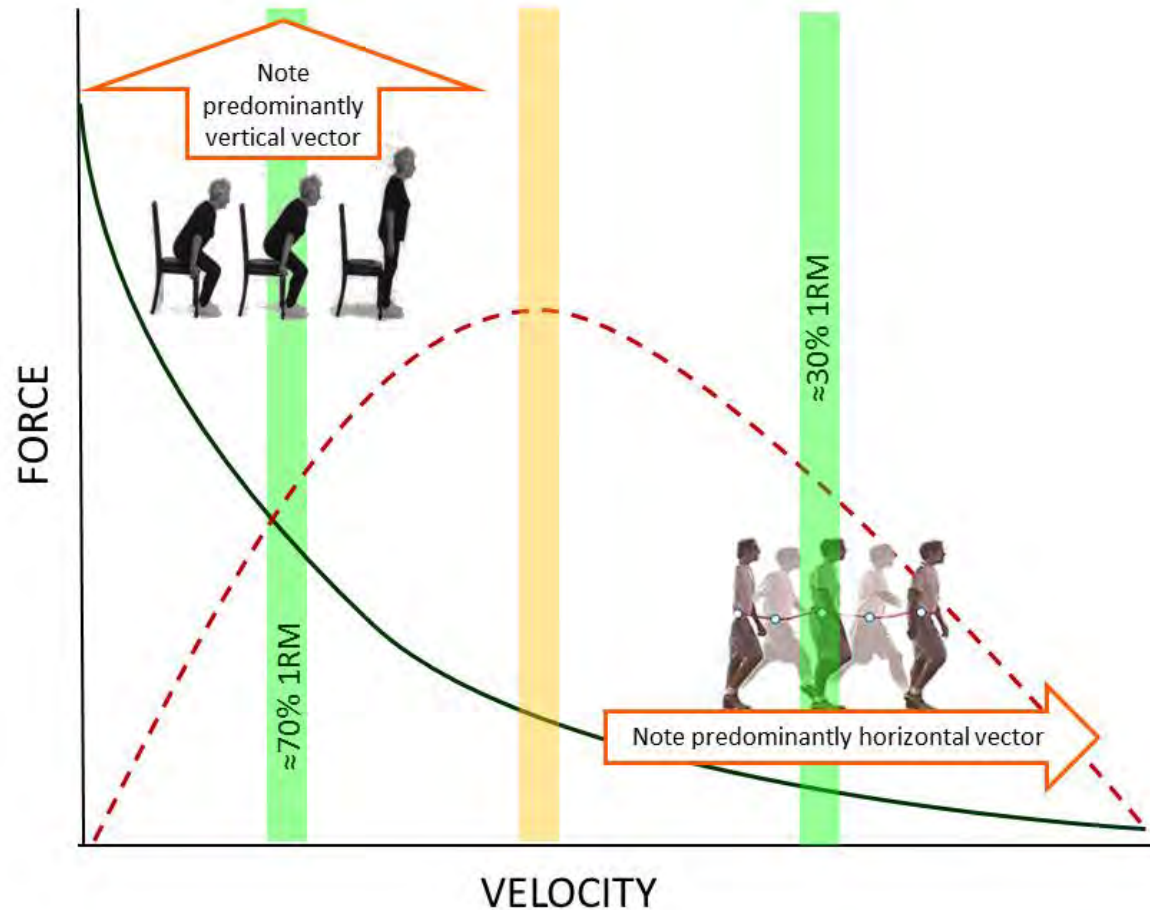
Richardson, D. L., et al., *Experimental Gerontology*, 2018

But optimal loading may not tell the whole story

Surfing the force-velocity curve

Targeted load for functional performance

- Train based on the results you want to achieve
- Speed is dictated by the load
- Training prescription should reflect the load to be moved against gravity in any daily activity (ADL).



Based on: Cucco et al., J Gerontol A biol Sci Med Sci, 2004

F-V profiling

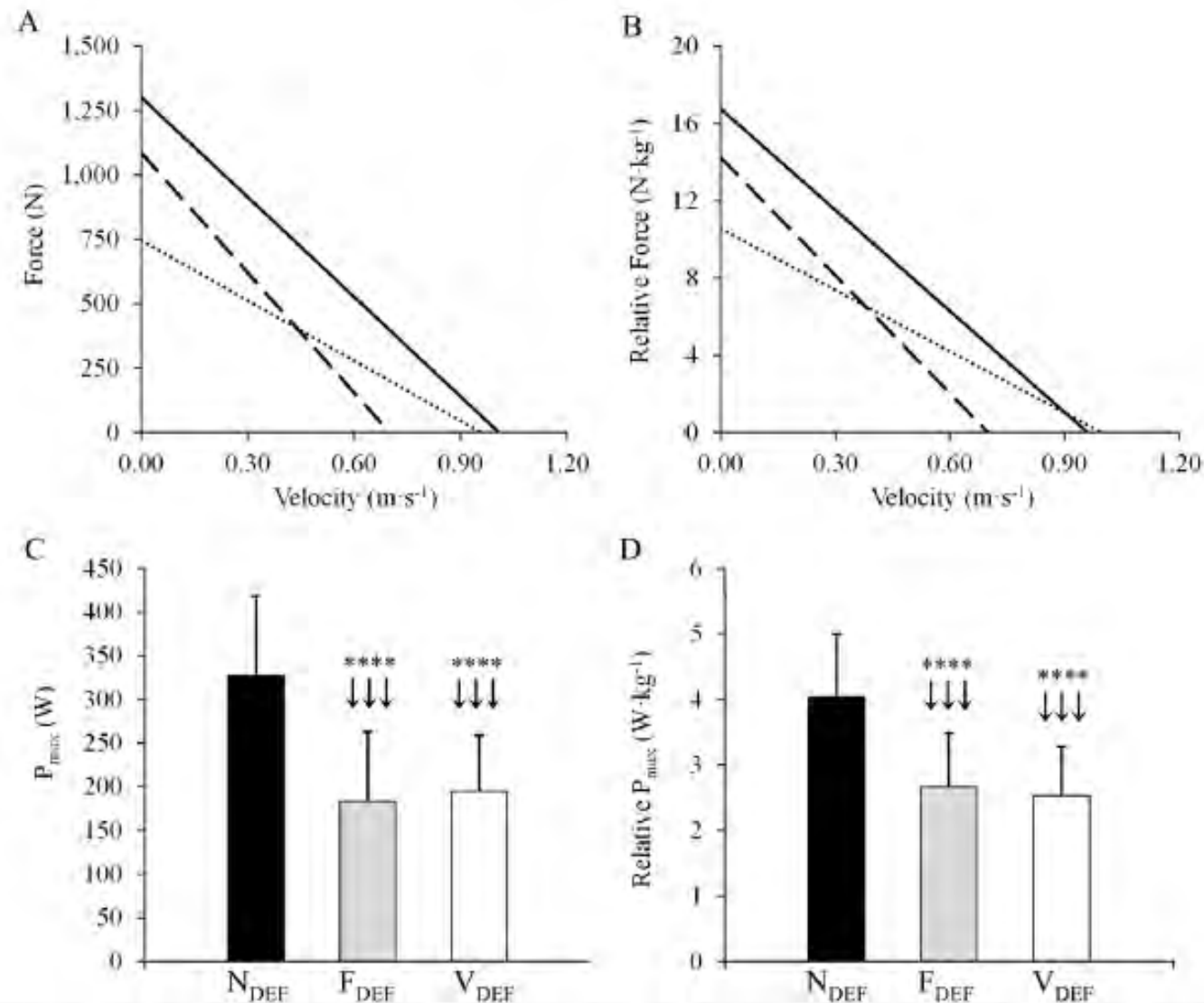


Fig. 1. Force-velocity relationship and maximal muscle power according to deficits in force and velocity: absolute (A) and relative (B) force-velocity relationship, and absolute (C) and relative (D) maximal muscle power production (D). Continuous line represents the non-deficit group, discontinuous line represents the velocity-deficit group, and dotted line represents the force-deficit group. Note. P_{max} : maximal muscle power, N_{DEF} : non-deficit group, F_{DEF} : force-deficit group; V_{DEF} : velocity-deficit group. ****Large harmful effect compared with N_{DEF} . ****Most likely (probability > 99.5%).

Alcazar et al.,
Exp Gerontol., 2018

F-V profiling

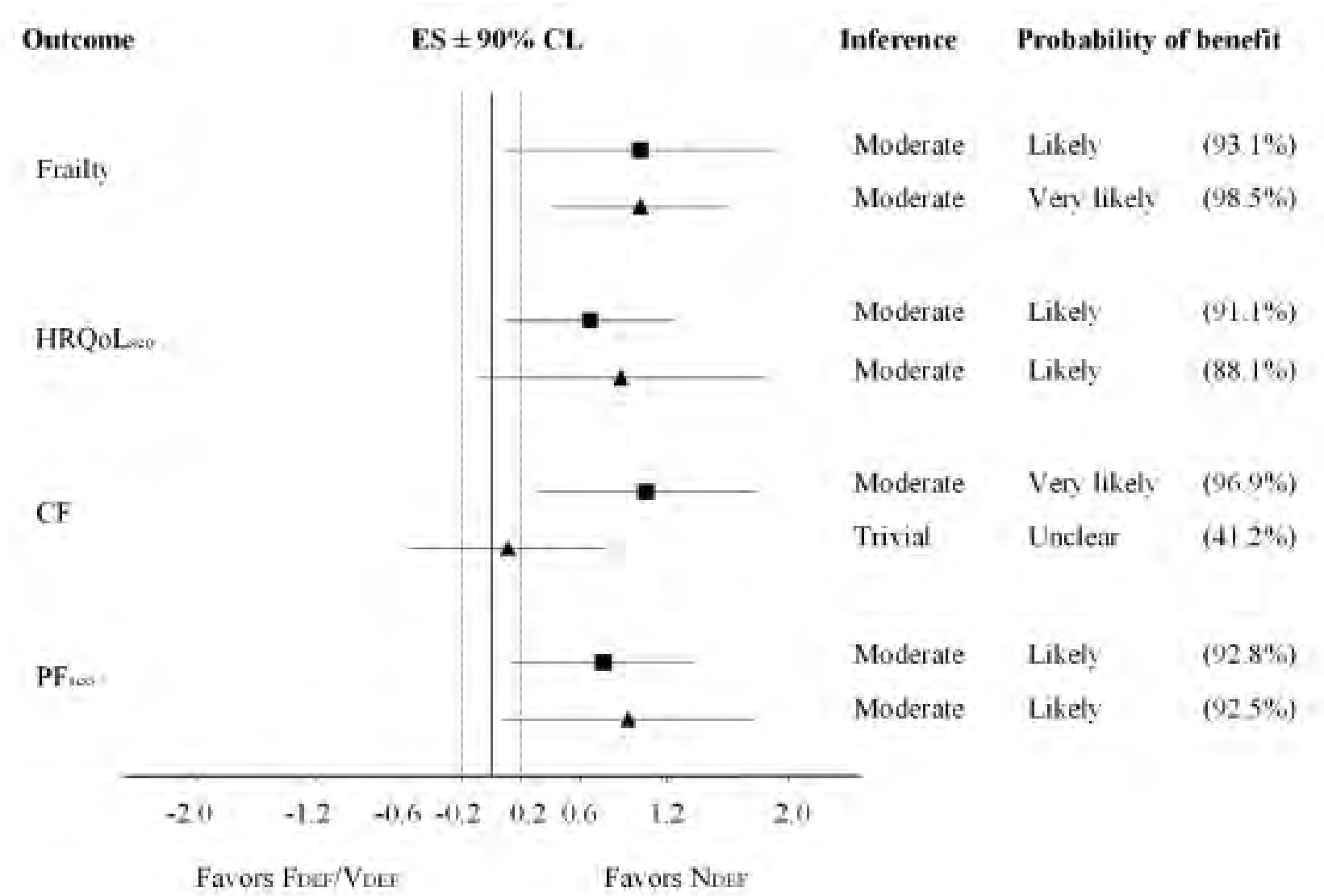


Fig. 2. Outcomes comparison between deficit groups. Squares indicate comparison between the N_{DEF} and F_{DEF} groups. Triangles indicate comparison between N_{DEF} and V_{DEF} groups. *Note.* ES: effect size; CL: confidence limit; HRQoL_{scd}: health-related quality of life score; PF_{scd}: physical function score; CF: cognitive function; N_{DEF}: non-deficit group; F_{DEF}: force-deficit group. V_{DEF}: velocity-deficit group. Absolute values were used for HRQoL_{scd} and cognitive function, while relative values were used for frailty and PF_{scd}.

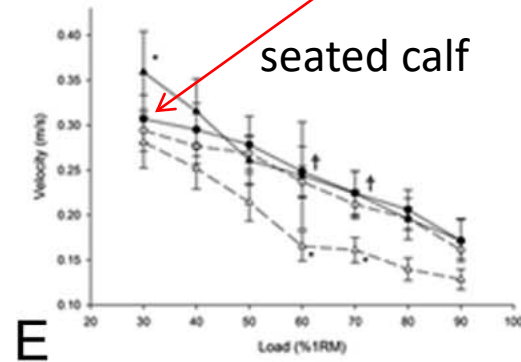
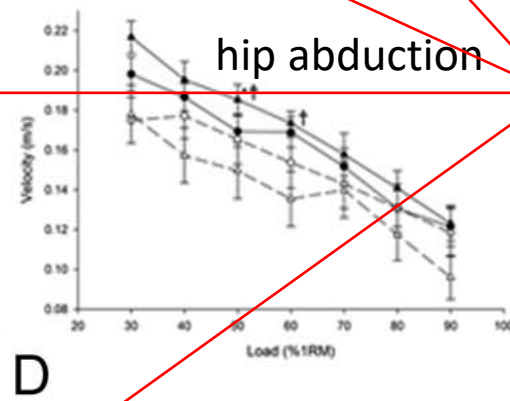
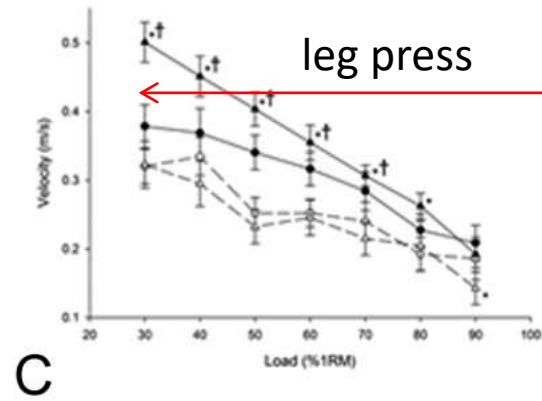
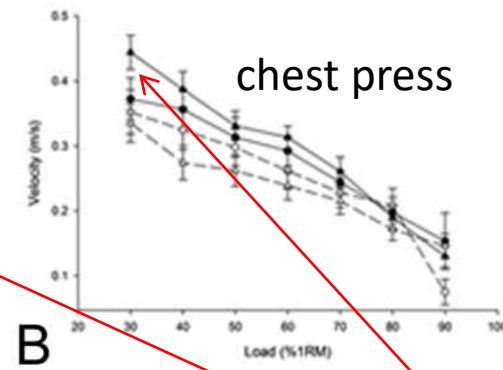
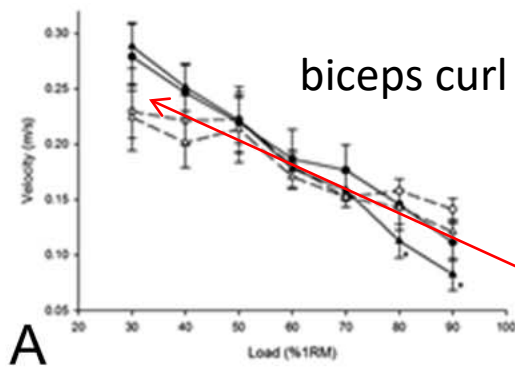
Alcazar et al., Exp Gerontol., 2018

Sifting the force-velocity curve

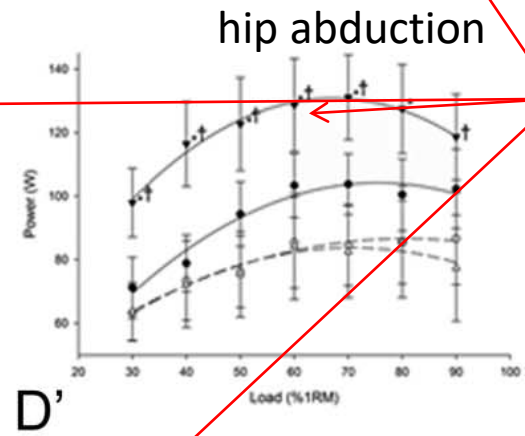
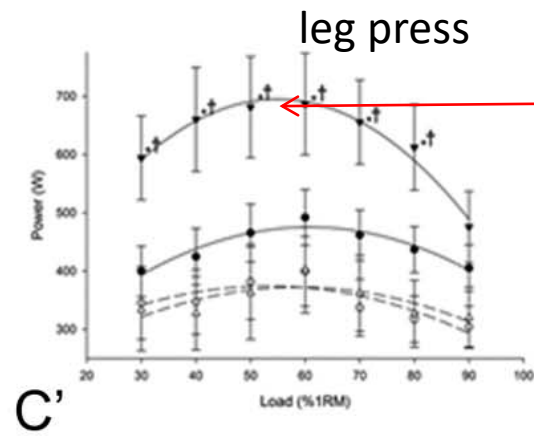
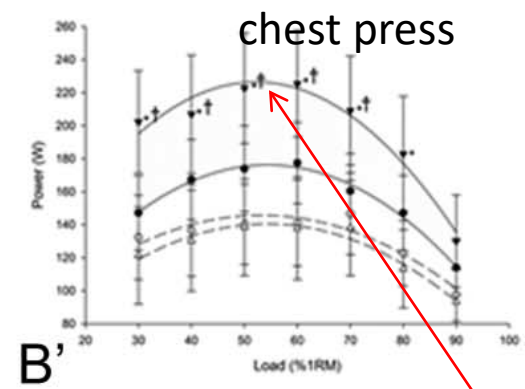
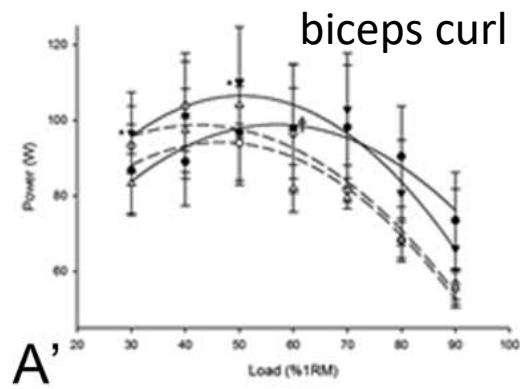
High-speed resistance training modifies load-velocity and load-power relationships in Parkinson's disease



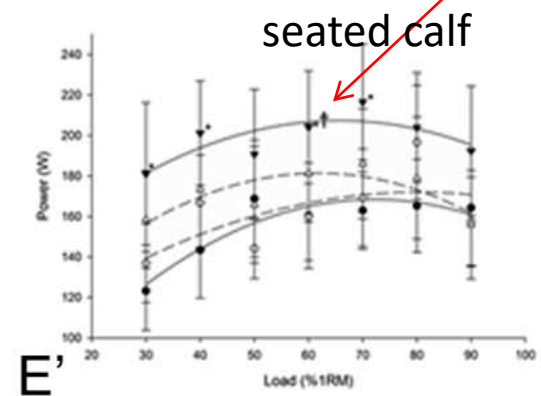
Ni M, Signorile JF. High-Speed resistance training modifies Load-Velocity and Load-Power relationships in Parkinson's disease. The Journal of Strength & Conditioning Research. 2017 Oct 1;31(10):2866-75.

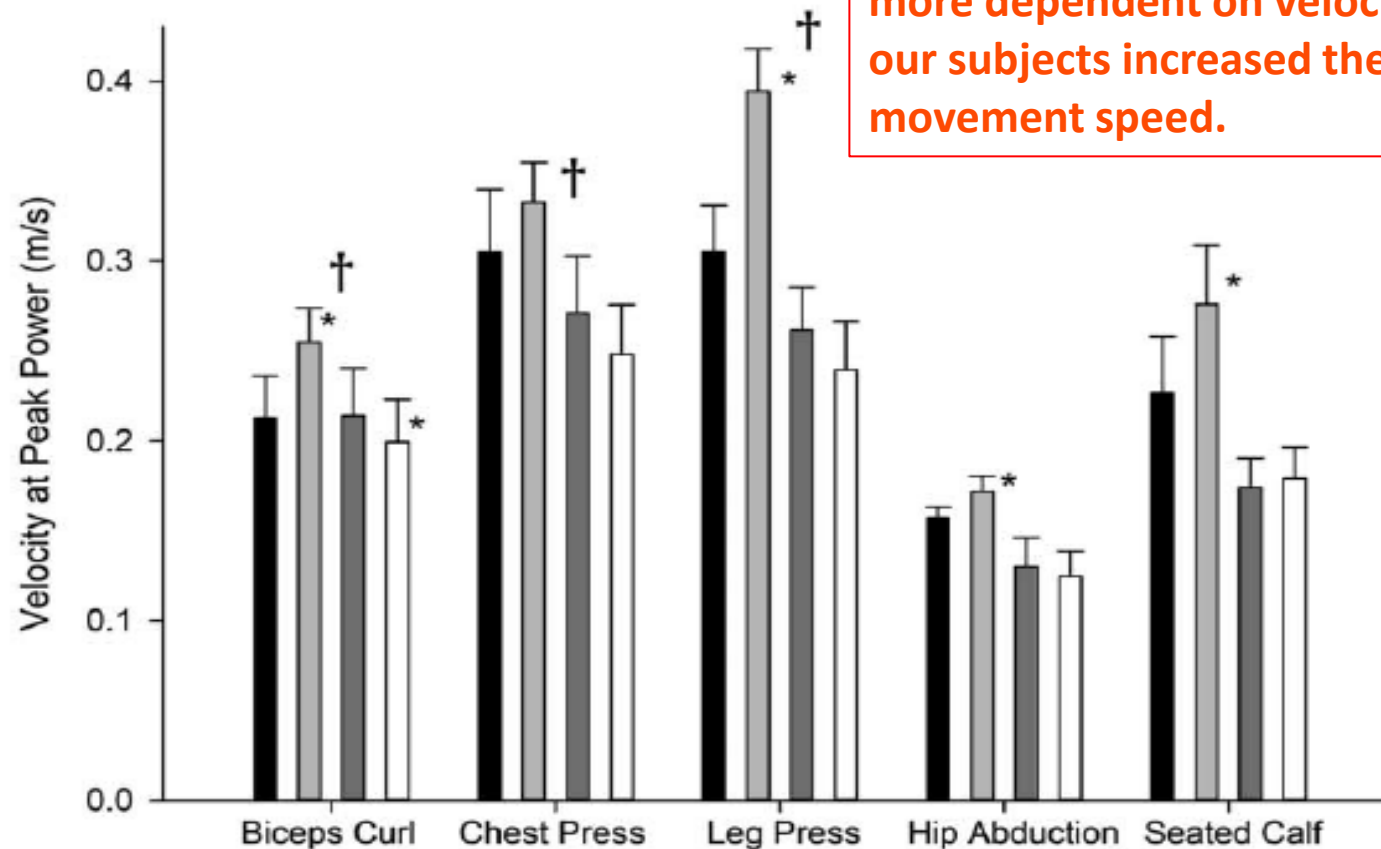


Note that the greatest changes were seen at the velocity (low load) end of the load-velocity curves...



...and POWER changes were evident in every muscle group but the biceps.





This indicates POWER became more dependent on velocity as our subjects increased their movement speed.

Velocity at the peak power before and after 3-month training. *Significantly different from pretest, †significant change difference between groups. Power training pretest (black bars) and posttest (light gray bars); Control pretest (dark gray bars) and posttest (white bars). Bars represent mean and SE.

Is high speed training enough for functional improvements?

Is high speed training enough for functional improvements?

- The scientific research consistently shows that high-speed power training can maintain, and even increase functional capacity in older persons ([Pereira et al., 2012](#); [Byrne et al., 2016](#); [Hazell et al., 2007](#); [Cuoco et al., 2004](#); [Roberson et al., 2018](#); [Cherup et al., 2019](#)).
- it is also a cornerstone for improvement of balance and reduction in falls. However in the greater impact over strength training is equivocal ([Tshopp et al., 2011](#)).
- Furthermore, movement velocity is a major factor in maintaining independence ([Byrne et al., 2016](#)) and reducing the incidence of falls in older persons and improving instability ([Orr et al., 2006](#), [Faraldo-Garcia et al., 2016](#)).

Lifting Velocity and Function

Orssatto, L. B., Bezerra, E. S., Schoenfeld, B. J., & Diefenthaler, F. (2020). Effects of resistance training concentric velocity on older adults' functional capacity: A systematic review and meta-analysis of randomised trials. *Exp Gerontol*, 127, 110731.

Combined Functional Capacity Tests

A

Source	SMD (95% CI)
Tiggemann et al. 2016	-0.15 [-0.90; 0.60]
Richardson et al. 2019	-0.12 [-0.48; 0.24]
Zech et al. 2012	0.11 [-0.37; 0.59]
Henwood et al. 2008	0.21 [-0.15; 0.57]
Bean et al. 2009	0.28 [-0.05; 0.61]
Marsh et al. 2009	0.44 [-0.39; 1.27]
Ramirez-Campillo et al. 2014	0.46 [0.04; 0.88]
Yoon et al. 2017	0.51 [-0.09; 1.11]
Englund et al. 2017	0.54 [-0.24; 1.32]
Miszko et al. 2003	0.68 [0.09; 1.27]
Correa et al. 2012	0.80 [-0.81; 2.41]
Lopes et al. 2016	0.83 [0.05; 1.61]
Balachandran et al. 2014	0.84 [-0.17; 1.85]
Bottaro et al. 2007	1.45 [0.73; 2.17]
Total	0.41 [0.18; 0.65]
95% PI	[-0.33; 1.16]
Heterogeneity: $\chi^2_{13} = 23.46$ ($P = .04$), $I^2 = 45\%$	

Timed Up & Go Test

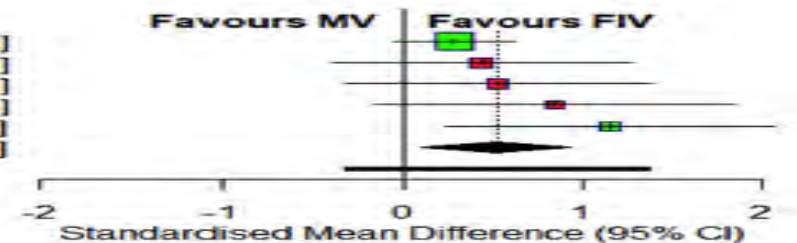
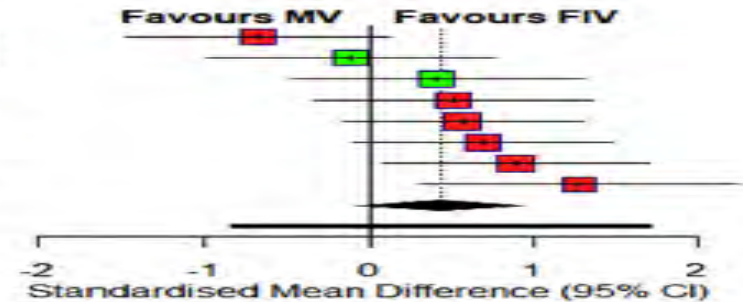
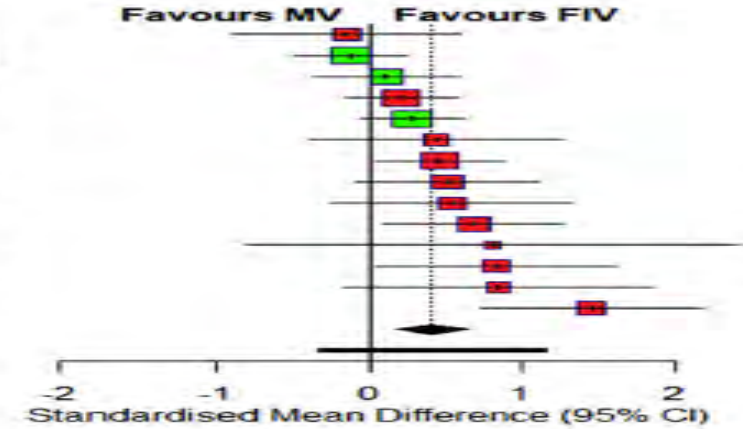
B

Source	SMD (95% CI)
Tiggemann et al. 2016	-0.68 [-1.49; 0.13]
Richardson et al. 2019 (LF)	-0.11 [-0.99; 0.76]
Richardson et al. 2019 (HF)	0.41 [-0.47; 1.30]
Yoon et al. 2017	0.51 [-0.34; 1.36]
Ramirez-Campillo et al. 2014	0.57 [-0.16; 1.30]
Englund et al. 2017	0.69 [-0.10; 1.48]
Lopes et al. 2016	0.90 [0.09; 1.71]
Bottaro et al. 2007	1.28 [0.31; 2.25]
Total	0.43 [-0.07; 0.94]
95% PI	[-0.84; 1.71]
Heterogeneity: $\chi^2_7 = 13.51$ ($P = .06$), $I^2 = 48\%$	

Short Physical Performance Battery

C

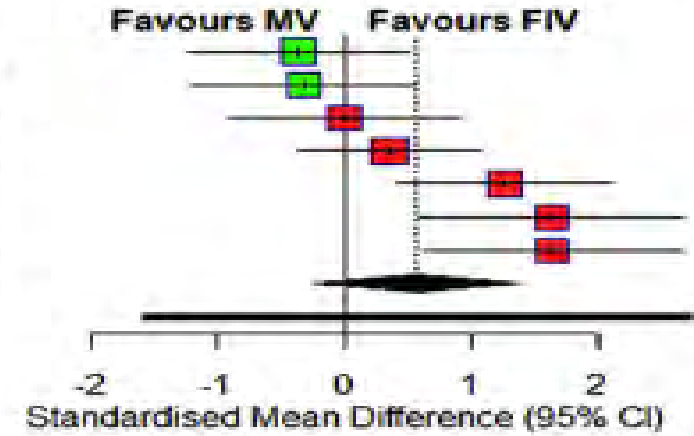
Source	SMD (95% CI)
Bean et al. 2009	0.28 [-0.05; 0.62]
Marsh et al. 2009	0.44 [-0.39; 1.27]
Yoon et al. 2017	0.52 [-0.33; 1.38]
Balachandran et al. 2014	0.84 [-0.15; 1.84]
Zech et al. 2012	1.15 [0.23; 2.06]
Total	0.52 [0.10; 0.94]
95% PI	[-0.33; 1.37]
Heterogeneity: $\chi^2_4 = 3.83$ ($P = .43$), $I^2 = 0\%$	



Lifting Velocity and Function

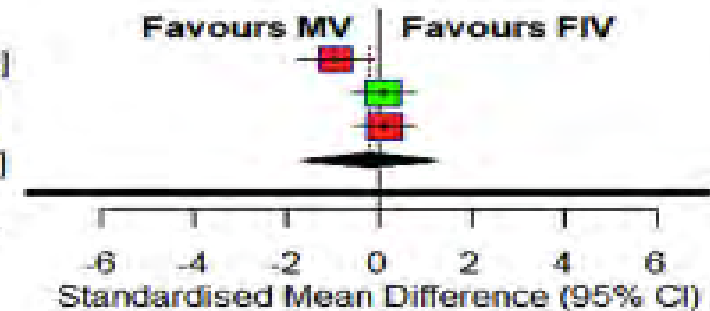
30s Chair Stand Test

Source	SMD (95% CI)
Richardson et al. 2019(LF)	-0.37 [-1.25; 0.52]
Richardson et al. 2019 (HF)	-0.32 [-1.20; 0.56]
Correa et al. 2012 (PT)	0.00 [-0.92; 0.92]
Ramirez-Campillo et al. 2014	0.35 [-0.37; 1.07]
Lopes et al. 2016	1.26 [0.42; 2.11]
Correa et al. 2012 (RS)	1.64 [0.59; 2.68]
Bottaro et al. 2007	1.65 [0.62; 2.68]
Total	0.58 [-0.24; 1.39]
95% PI	[-1.59; 2.74]
Heterogeneity: $\chi^2_6 = 20.78$ ($P < .01$), $I^2 = 71\%$	



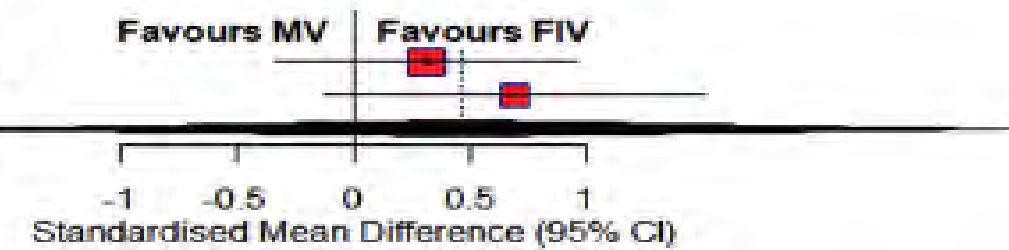
5x Chair Stand Test

Source	SMD (95% CI)
Tiggemann et al. 2016	-0.92 [-1.75; -0.09]
Zech et al. 2012	0.11 [-0.57; 0.78]
Henwood et al. 2008	0.15 [-0.49; 0.78]
Total	-0.18 [-1.63; 1.27]
95% PI	[-7.56; 7.19]
Heterogeneity: $\chi^2_2 = 4.70$ ($P = .10$), $I^2 = 57\%$	



Stair Climb Test

Source	SMD (95% CI)
Henwood et al. 2008	0.31 [-0.33; 0.95]
Tiggemann et al. 2016	0.69 [-0.12; 1.50]
Total	0.46 [-1.89; 2.81]
Heterogeneity: $\chi^2_1 = 0.52$ ($P = .47$), $I^2 = 0\%$	

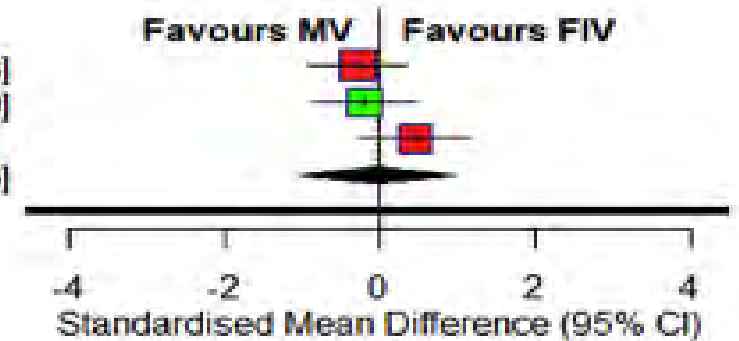


Orssatto, L. B., Bezerra, E. S., Schoenfeld, B. J., & Diefenthaler, F. (2020). Effects of resistance training concentric velocity on older adults' functional capacity: A systematic review and meta-analysis of randomised trials. *Exp Gerontol*, 127, 110731.

Lifting Velocity and Function

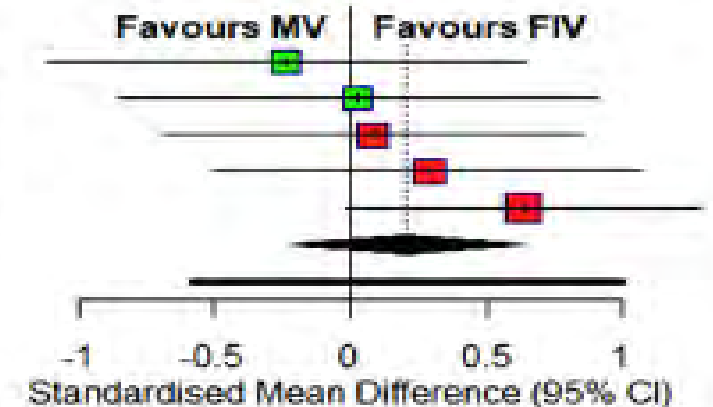
6-min Walk Test

Source	SMD (95% CI)
Henwood et al. 2008	-0.26 [-0.90; 0.38]
Zech et al. 2012	-0.19 [-0.86; 0.49]
Ramirez-Campillo et al. 2014	0.47 [-0.26; 1.19]
Total	-0.02 [-0.99; 0.96]
95% PI	[-4.51; 4.48]
Heterogeneity: $\chi^2_2 = 2.52$ ($P = .28$), $I^2 = 21\%$	



≤ 10-m Walk Test

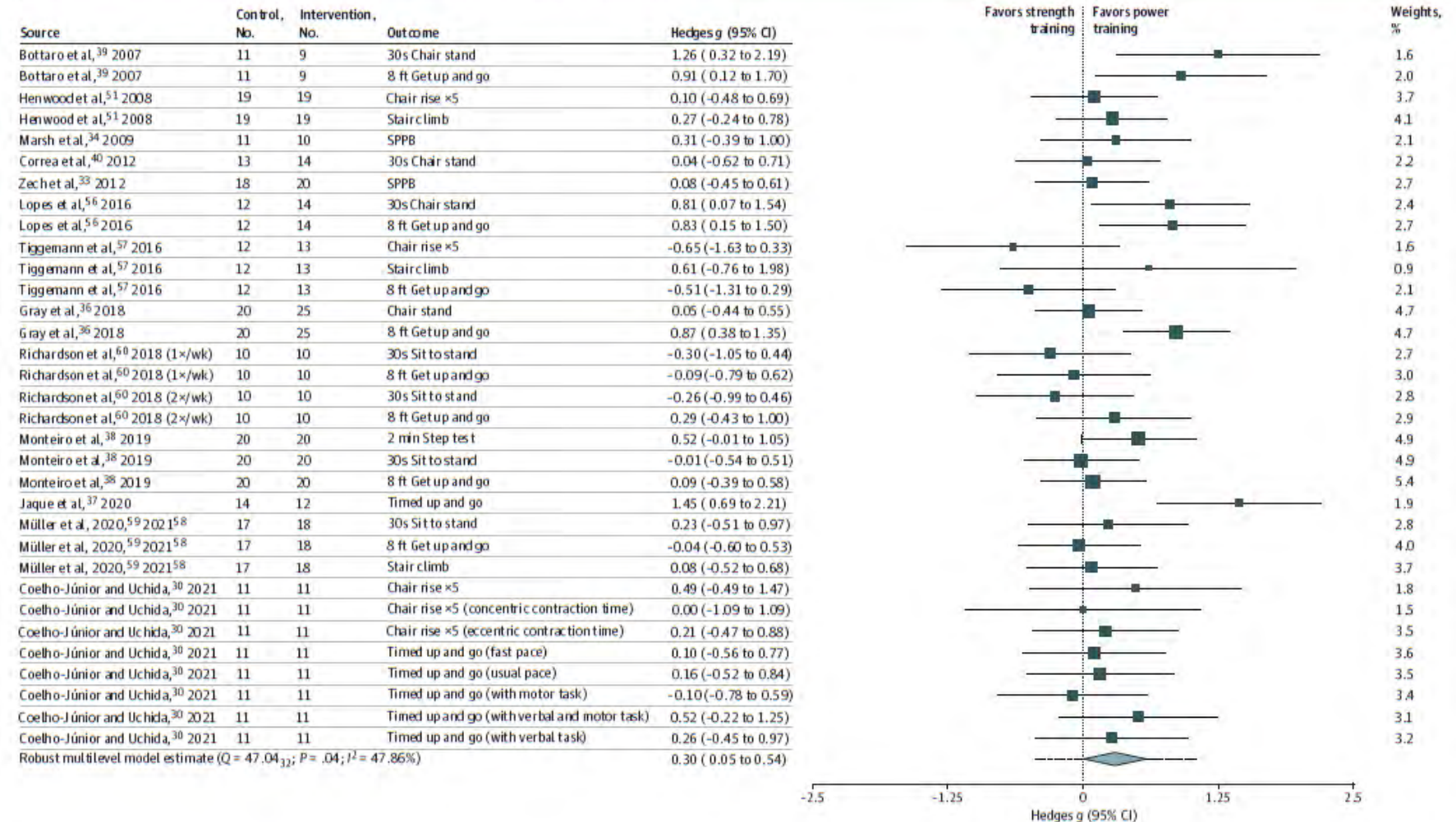
Source	SMD (95% CI)
Richardson et al. 2019 (LF)	-0.24 [-1.12; 0.64]
Richardson et al. 2019 (HF)	0.03 [-0.85; 0.90]
Lopes et al. 2016	0.08 [-0.69; 0.85]
Tiggemann et al. 2016	0.29 [-0.50; 1.08]
Henwood et al. 2008	0.64 [-0.02; 1.29]
Total	0.21 [-0.21; 0.63]
95% PI	[-0.59; 1.00]
Heterogeneity: $\chi^2_4 = 2.96$ ($P = .56$), $I^2 = 0\%$	



Orssatto, L. B., Bezerra, E. S., Schoenfeld, B. J., & Diefenthaeler, F. (2020). Effects of resistance training concentric velocity on older adults' functional capacity: A systematic review and meta-analysis of randomised trials. *Exp Gerontol*, 127, 110731.

Power Training vs Traditional Strength Training Association With Physical Function Outcomes

Figure 2. Power Training vs Traditional Strength Training Association With Physical Function Outcomes



The box sizes reflect a study's relative weight. The diamond represents the aggregate standardized mean difference and 95% CI and the dotted line represents prediction interval. SPPB indicates short physical performance battery.

What about periodized training with functional components?

Periodized resistance training with and without functional training improves functional capacity, balance, and strength in Parkinson's disease

Strand KL, Cherup NP, Totillo MC, Castillo DC, Gabor NJ, Signorile JF. Periodized resistance training with and without functional training improves functional capacity, balance, and strength in Parkinson's disease. *The Journal of Strength & Conditioning Research*. 2021 Jun 1;35(6):1611-9.



Training intervention details for the SPH (strength, power, and hypertrophy) and SP + Func (strength, power, and functional) groups.*

SPH group					SP + Func group			
Day	Protocol	Set × reps, loads	Tempo	Recovery	Protocol	Set × reps, loads	Tempo	Recovery
1	Strength	3 × 8 at 80% 1RM	2–3 second concentric and eccentric	90 s	Strength	3 × 8 at 80% 1RM	2–3s concentric and eccentric	90 s
2	Power	3 × 6 at 50% 1RM	Maximal concentric velocity, 1–2 second isometric hold, 2–3 second eccentric	120 s	Power	3 × 6 at 50% 1RM	Maximal concentric velocity, 1–2s isometric hold, 2–3s eccentric	120 s
3	Hypertrophy	3 × 12 at 70% 1RM	2–3s concentric and eccentric	60 s	Functional	Table 3		

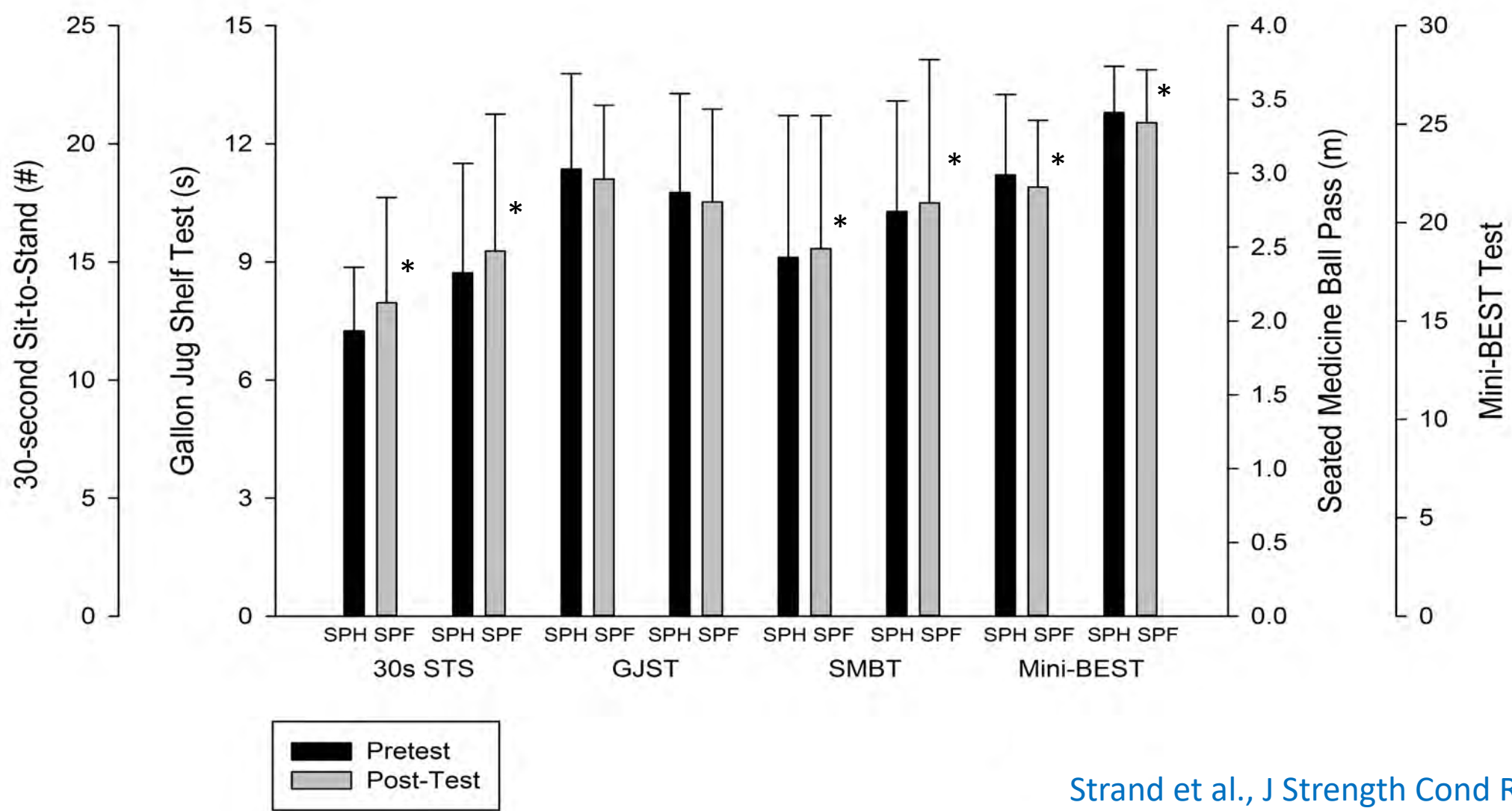
*1RM = 1 repetition maximum.

Functional training details.

Circuit	Focus	Exercise	Volume
1	Strength/mobility	Weighted walk	3 × 50 m
	Balance	Anterior-posterior go-stop	3 × 30 s
	Balance	Lateral go-stop	3 × 30 s
2	Strength/mobility	Sit-to-stand transfers	3 × 5 each direction
	Power	Standing medicine ball throw	3 × 10
3	Balance/mobility	Forward ladder drills	2 × 4 drills
	Balance	Medicine ball wood chops	2 × 5 each side
	Balance/mobility	Lateral ladder drills	2 × 4 drills
	Power	Lateral medicine ball throws	2 × 5 each side
4	Strength	Step-ups	2 × 10 each leg
	Power	Ball bounce pass and catch	2 × 10
	Strength/balance	Cone lunges	2 × 10 each leg

Strand et al., J Strength Cond Res, 2021

Block periodization with and without functional training



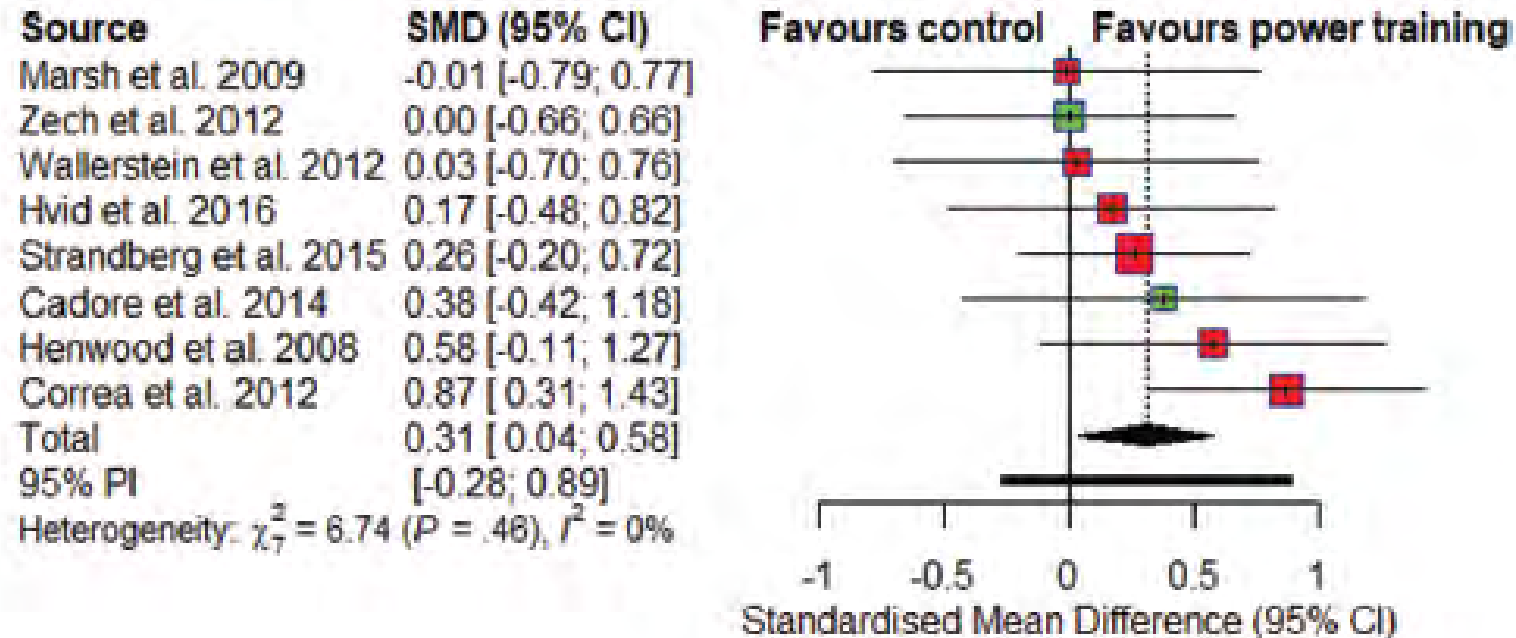
Strand et al., J Strength Cond Res, 2021

YES...

...But can high-speed power training produce muscle hypertrophy?

High-speed training and hypertrophy

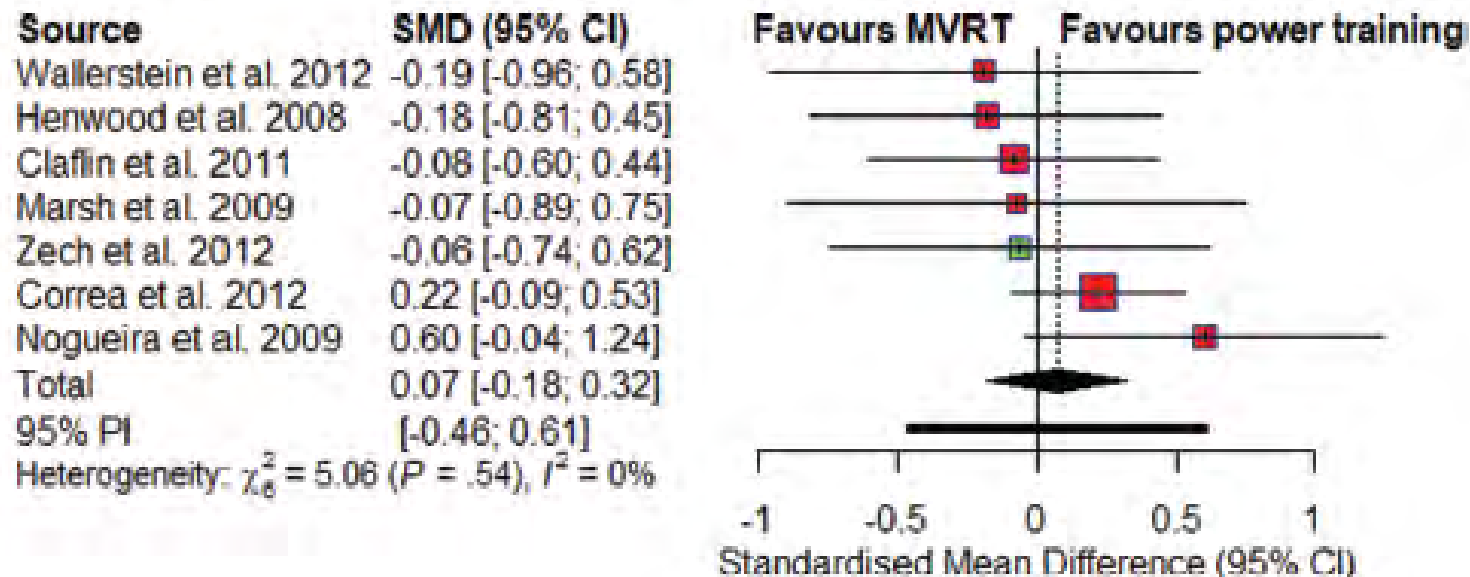
Fig. 2. Forest plot presenting standardised mean differences and 95% confidence intervals from studies comparing the effect of power training to control conditions. CI, confidence interval; PI, predictive interval; SMD, standardised mean difference. **Red, low quality studies** (Physiotherapy Evidence Database (PEDro) score < 6); **Green, high quality studies** (PEDro score ≥ 6). [Colour online.]



Orssatto, Lucas BR, et al. "Is power training effective to produce muscle hypertrophy in older adults? A systematic review and meta-analysis." *Applied Physiology, Nutrition, and Metabolism* 45.9 (2020): 1031-1040.

High-speed training and hypertrophy

Fig. 3. Forest plot presenting standardised mean differences and 95% confidence intervals from studies comparing the effect of power training and moderate-velocity resistance training. CI, confidence interval; MVRT, moderate-velocity resistance training; PI, predictive interval; SMD, standardised mean difference. **Red, low quality study:** (Physiotherapy Evidence Database (PEDro) score < 6); **Green, high quality Study:** (PEDro score ≥ 6). [Colour online.]



Orssatto, Lucas BR, et al. "Is power training effective to produce muscle hypertrophy in older adults? A systematic review and meta-analysis." *Applied Physiology, Nutrition, and Metabolism* 45.9 (2020): 1031-1040.

Now you've got me thinking about high-speed training.
High-speed circuits and cognition

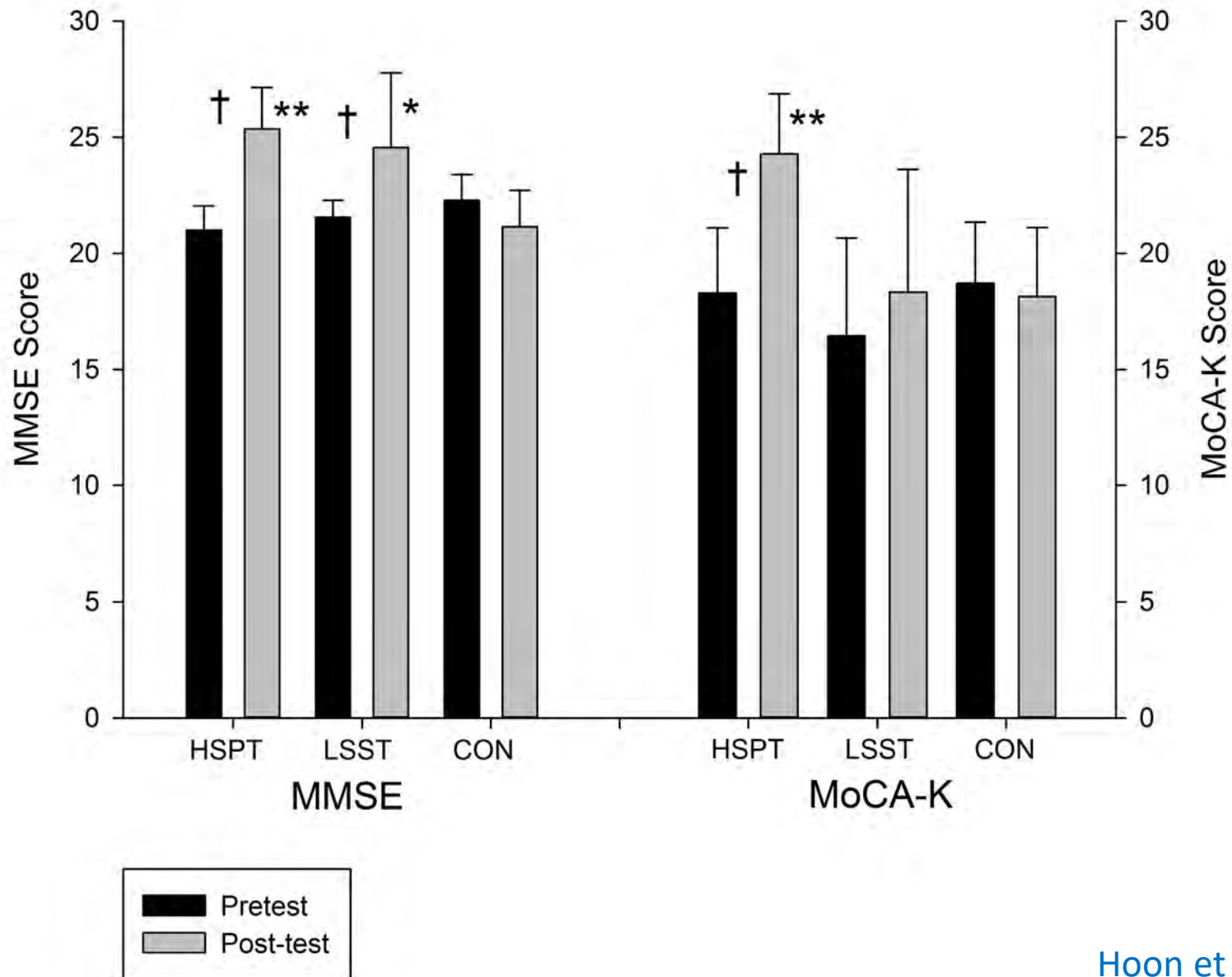
High-speed training and cognition

Our results indicate that high-speed circuit training can:

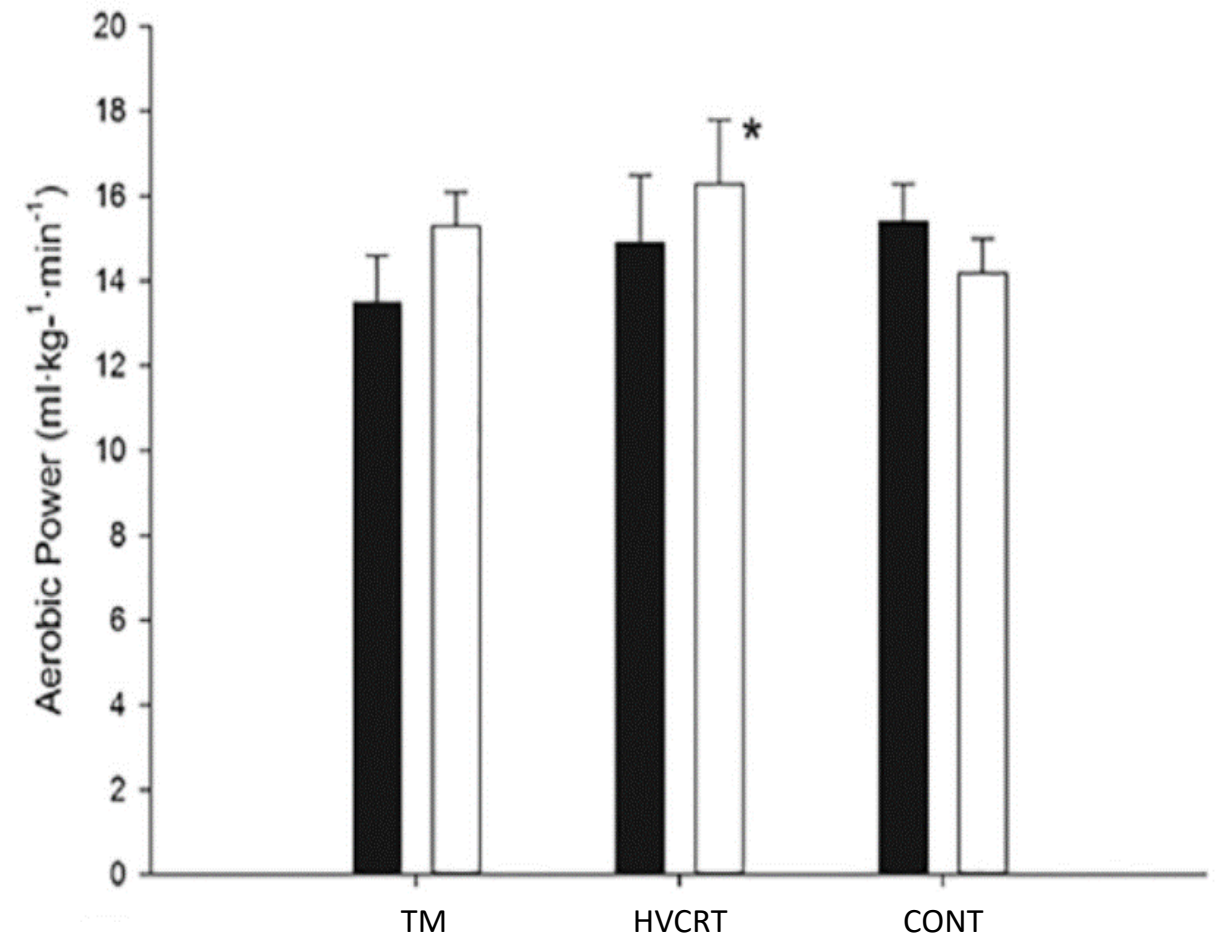
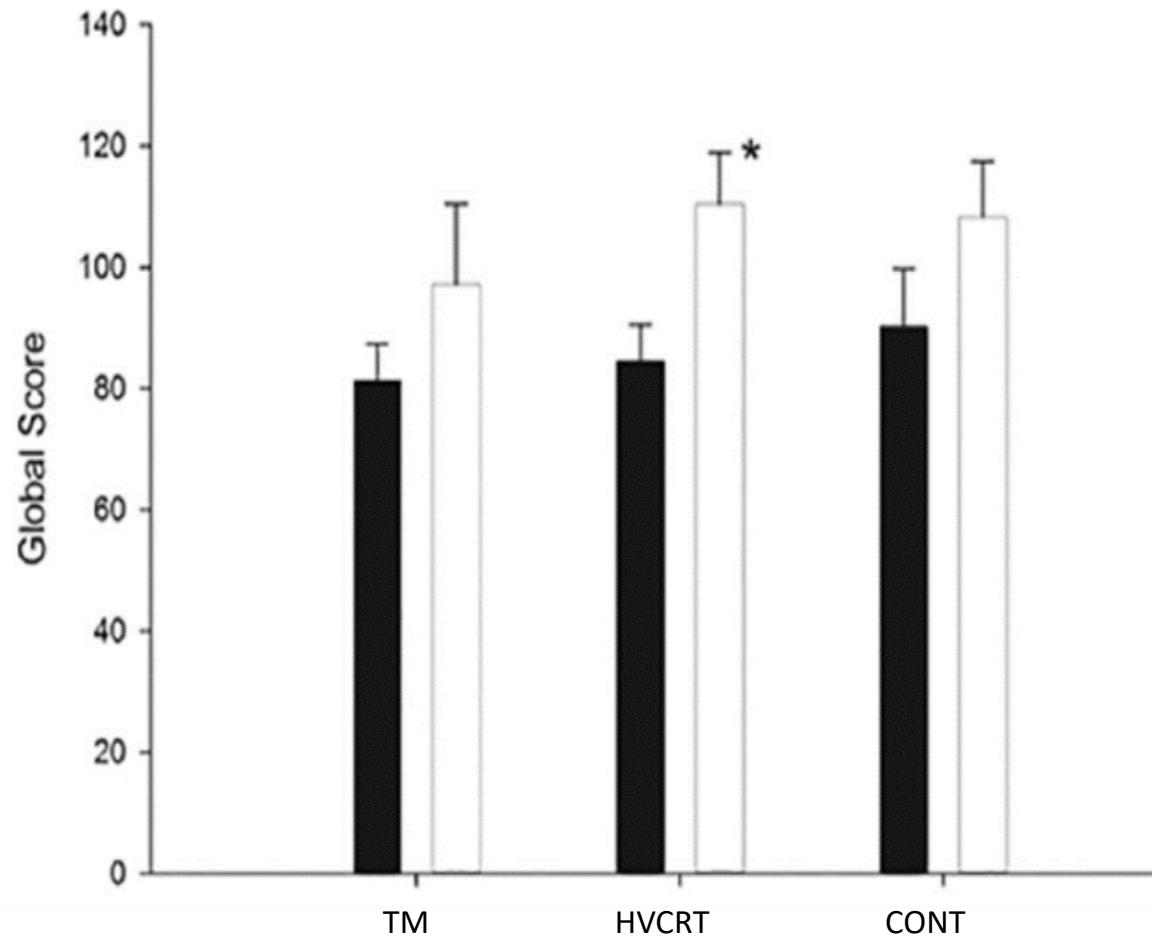
- maximize cardiovascular benefits, increase strength and power, and improve executive function in older adults ([Cherup et al., 2018](#); [Roberson et al., 2018](#)); and,
- improve memory and processing speed in persons with severe mental illness ([Strassnig et al., 2015](#)).

High-speed training and cognition

- Muscle mass maintenance is correlated with decreased risk of ADRD (Boyle et al., 2009), and age-related decreases in leg power appear predictive of cognitive decline (Steves et al., 2016).
- Further, high-speed power training increases cognitive function to a greater degree than low-speed strength training (Yoon et al., 2017).



Hoon et al., Geriatrics Gerontol Int., 2017



Cherup et al., *Exp Gerontol*, 2018

What equipment is optimal?

High-speed training and modalities

Although free weights and stack-loaded machines are common modalities used to develop power; however, they have three inherent problems.

- Deceleration
- Momentum
- Safety

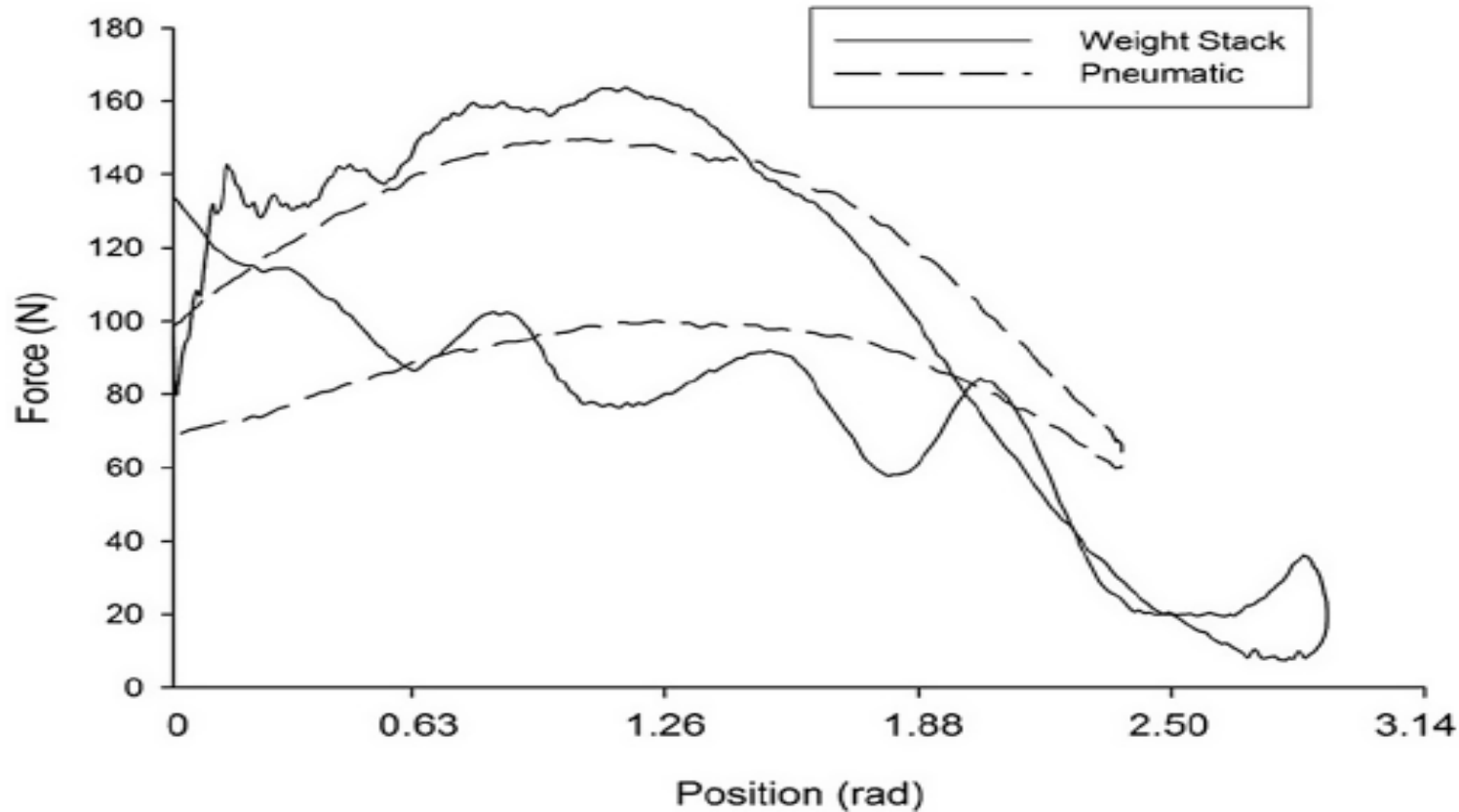
High-speed training and modalities

Deceleration

- During explosive movements, the bar, dumbbell or weight-stack must be decelerated at the end of the movement ([Gambetta V., 1998](#)).
- In fact, it has been estimated that during a 7RM (81% max) lift, over half the duration of the lift is spent slowing the weight down as you approach your endpoint ([Elliot et al., 1989](#); [Wilson et al., 1993](#); [Wolfe et al., 1982](#)).
- The time necessary to slow down the weight would increase as the load is decreased and velocity increases, causing a reduction in maximal power improvements ([Schmidtbleicher, D., 1982](#); [Schmidtbleicher et al., 1988](#)).

High-speed training and modalities

Momentum



Pneumatic resistance provides uninterrupted loading throughout the exercise, thereby providing a training stimulus throughout the natural range of motion of the exercise movements as opposed to the interrupted loading patterns typical of traditional plate-loaded machines.

Napoli et al., Human Movement Science, 2015

High-speed training and modalities

Injury Potential

- No exercises should be performed behind the head, rather the bar/handles can pull the bar towards the chest without touching; and, can raise the arms slightly in front of the head without extending completely, in the military press ([Sousa et al., 2014](#)).
- Any history of tissue injury history should dictate special considerations in loading, speed of the tissues, and range of motion with previously injured tissues ([Escamilla RF., 2001](#)).

High-speed training and modalities

Injury Potential

- The highest injury risks occur at the extreme end ranges of motion of a resistance-based exercise ([Kumar S., 2001](#)). This may be exacerbated by momentum during the use of stack- or plate-loaded machines or free weights ([Elliot et al., 1989](#); [Wilson et al., 1993](#); [Wolfe et al., 1982](#)).
- Older adults should not completely extend joints during the concentric phase, to prevent joint lock position ([Colado, J. C., & García-Massó, X., 2009](#)).
- Never allow the elbows to cross the line of the shoulders during the military press ([Sousa et al., 2014](#)).

Time course changes during power training

Time course changes during power training

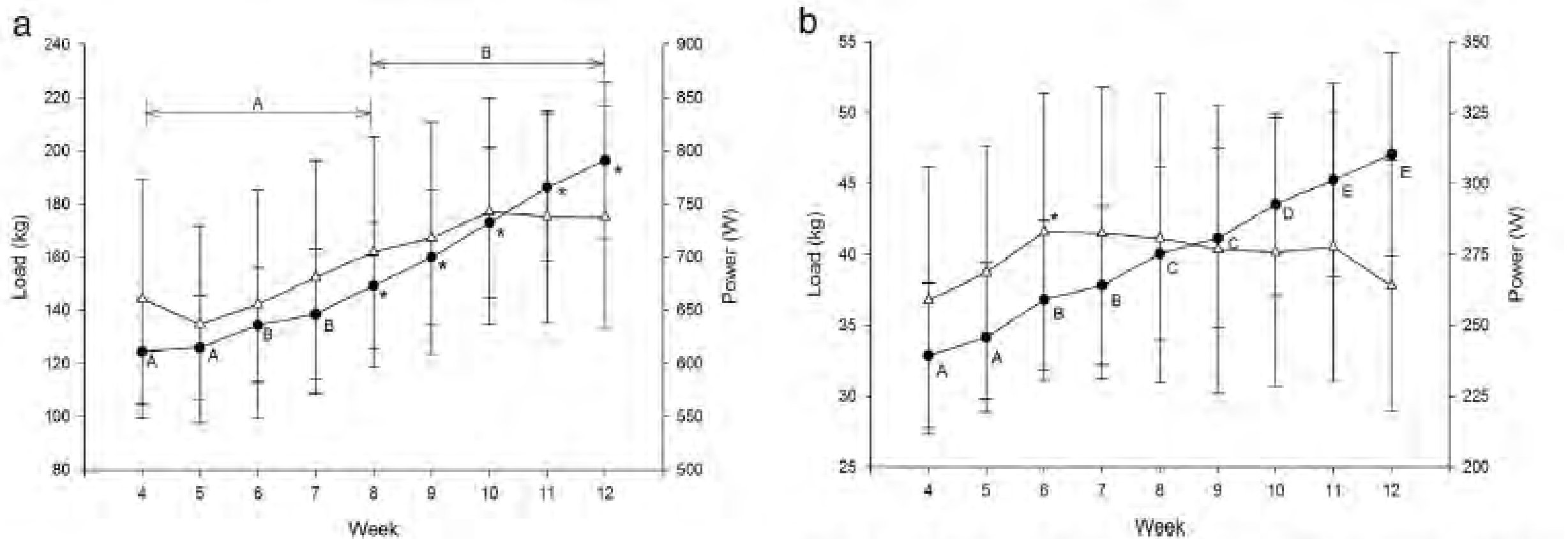


Fig. 6. Power changes for leg press (a) and chest press (b) across 9 weeks of training allowing for the two-week familiarization phase and a third week to stabilize loading patterns. Values are Mean $\pm$ SE; Time points with the same letter are not significantly different from each other. *significantly different from neighboring time points. $\bullet$ load; Δ power. Significant level set at $p \leq .05$.

Cherup et al., Exp Gerontol., 2019

How about diagnostics for high-speed power?

A number of techniques can be used to assess upper body power including:

- Isoinertial testing,
- Isokinetic testing,
- Field tests

...given their more universal viability, let's examine field tests

Lower body power

Comparison of available equations to estimate sit-to-stand muscle power and their association with gait speed and frailty in older people: Practical applications for the 5-rep sit-to-stand test.

Baltasar-Fernandez I, Alcazar J, Losa-Reyna J, Soto-Paniagua H, Alegre LM, Takai Y, Ruiz-Cárdenas JD, Signorile JF, Rodriguez-Mañas L, García-García FJ, Ara I. Comparison of available equations to estimate sit-to-stand muscle power and their association with gait speed and frailty in older people: Practical applications for the 5-rep sit-to-stand test. *Experimental gerontology*. 2021 Dec 1;156:111619.



Sit-to-Stand Equation Comparison

- All the equations presented adequate criterion validity;
- Relative STS power higher in men than women was negatively associated with age;
- Positive and moderate association between relative STS power and habitual gait speed, and a negative and moderate association with frailty (except with the Smith's equations).
- Muscle power during the 5-rep STS test, the equation provided by [Alcazar et al. \(2018\)](#) showed the highest level of clinical relevance due to its ability to identify older adults with impaired physical function and frailty
- This equation would be the most feasible in the clinical setting when compared to other equations.

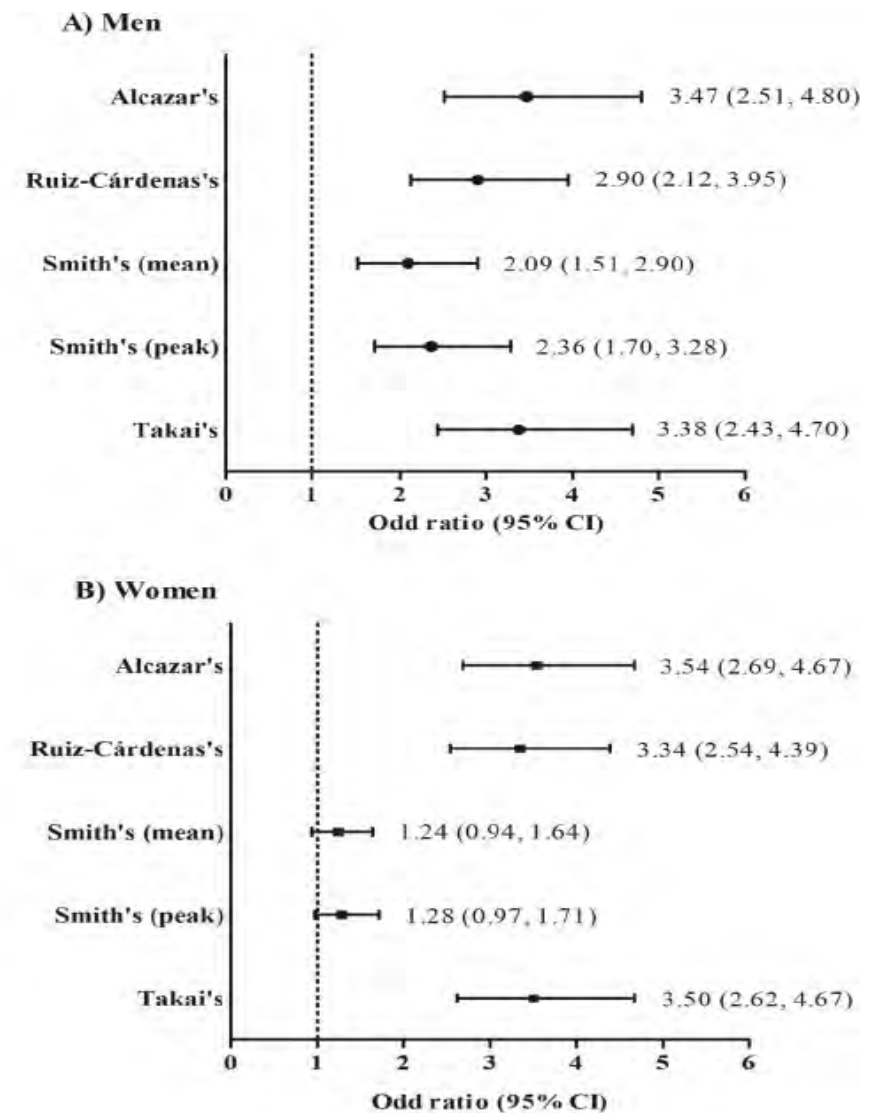


Fig. 5. Pooled effect (combined effect of having both low HGS and frailty) of having low relative STS power according to the equation used.

Upper body power

The Development of a Regression Model to Predict Object Transfer Power in Older Adults.

Castillo, Diana C., Keri L. Strand, Jeonghoon Oh, Moataz Eltoukhy, Matthew C. Totillo, and Joseph F. Signorile. "The Development of a Regression Model to Predict Object Transfer Power in Older Adults." *The Journal of Strength & Conditioning Research* 34, no. 11 (2020): 3086-3093.



- Twenty-one independent-living older women ($74.8 \pm 5.6y$) and men (73.8 ± 4.5) participated in the development phase.
- Our regression models showed that predicted power was best modeled using quadratic equations.

X: Test duration (s):

$$PP = 476.747 + 2.006X^2 - 55.660X$$

$$AP = 444.904 + 2.031X^2 - 54.5398X$$

- Validity was confirmed in a second sample of 30 women ($69.9 \pm 6.4y$) and men ($70.7 \pm 4.3y$).

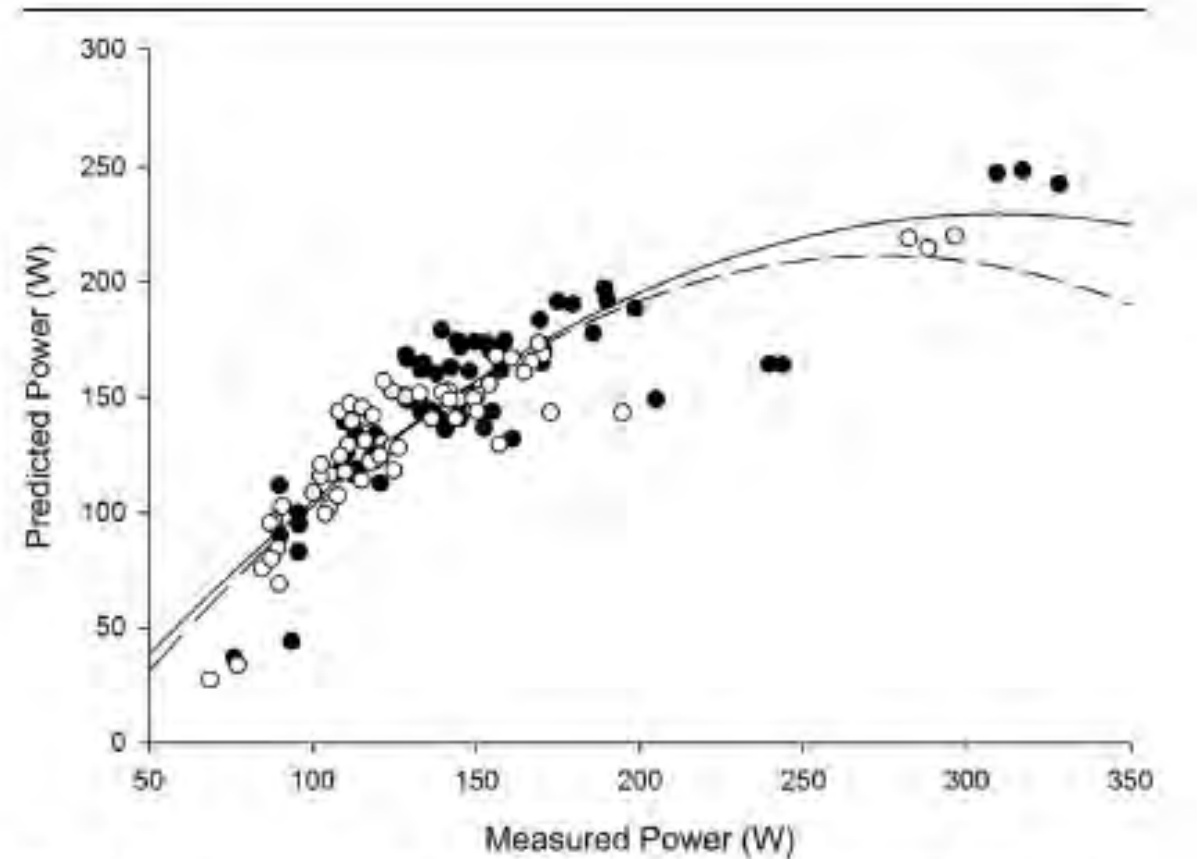


Figure 3. Scatter plot showing the non-linear relationship between predicted and measured power for peak power (●) and average power (○).

Prediction of Upper Body Power during the Seated Medicine Ball Throw in Older Women

Rosalia L. Parrino, Keri L. Strand, Anna San Ly, Sarah S. Barry, Jose A. Liscano, Luca Trebotich, Chimaobim Martin-Diala, Erick Martin, Joseph F. Signorile. "Prediction of Upper Body Power during the Seated Medicine Ball Throw in Older Women." *The Journal of Strength & Conditioning Research* (In Review)



- Thirty-five independent-living older women (75.2 ± 6.4 y) participated in the study.
- Our regression models for peak power (PP) were developed using participants performances on the chest press.

$$\text{UBPP (W)} = 96.719 \cdot \text{SMBT}_D [\text{m}] + 37.164 \cdot \text{MB}_{\text{Mass}} [\text{kg}] - 104.499$$

- Validity was confirmed using face validity, cross-validation was established at 70% and 80% of the sample and Test-retest reliability between days was confirmed.

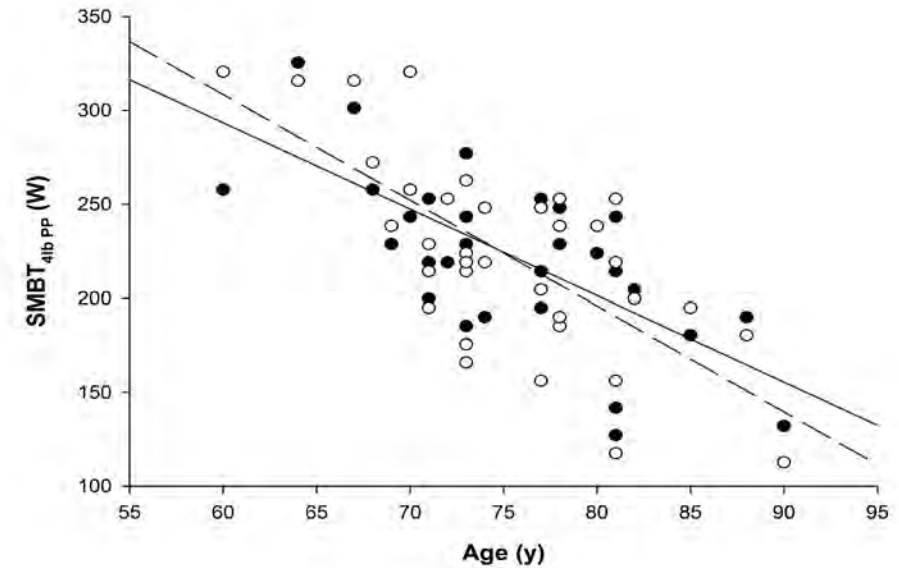
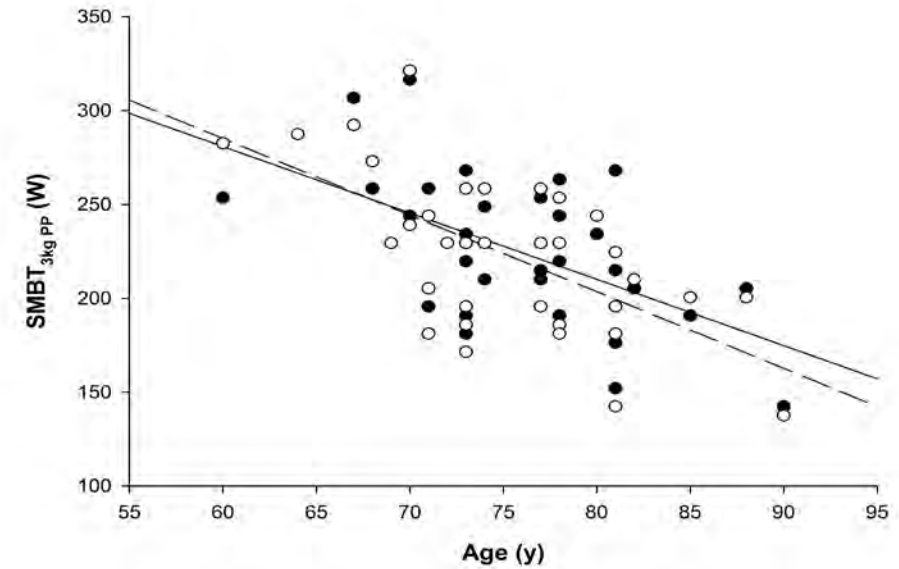


Table 2. Results for between-day reliability for SMBT distance in older women (n = 35).*

	Test	Retest	<i>p</i>	ICC	CV	SEM	MDC
	Mean ± SD (cm)	Mean ± SD (cm)			(%)	(cm)	(cm)
SMBT _{4lb}	223.6 ± 45.9	223.1 ± 51.7	<.001	.951	6.58	10.8	29.9
SMBT _{3kg}	227.2 ± 39.1	223.2 ± 41.7	<.001	.959	5.14	8.2	22.7

*ICC = intra-class correlation; CV = coefficient of variation; SEM = standard error of measurement;

MDC = minimal difference change, SMBT = seated medicine ball throw; SMBT_{4lb} = 4 lb SMBT;

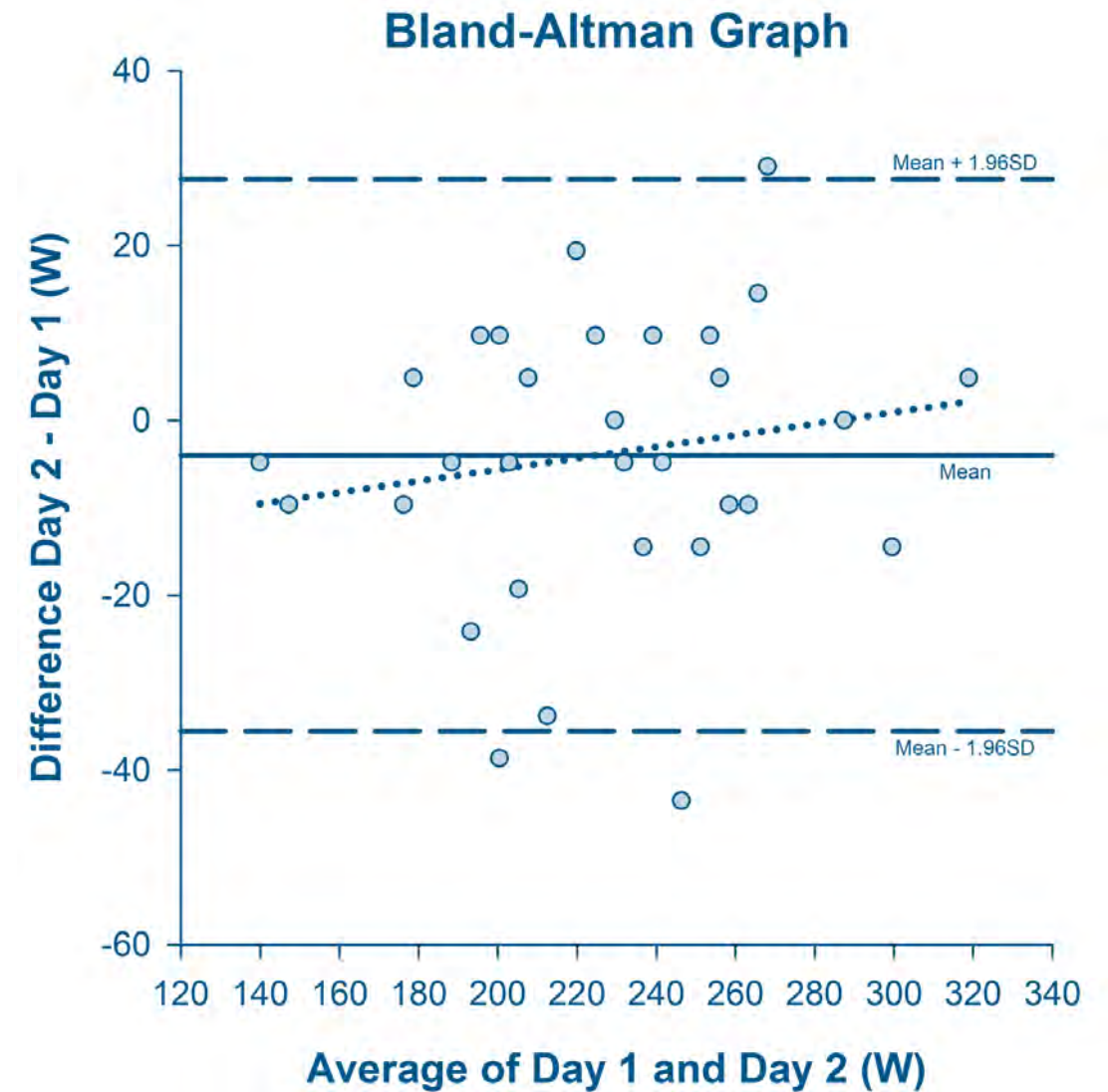
SMBT_{3kg} = 3 kg SMBT.

Table 3. Results for bias and LOA test-retest for the SMBT Power in older women (n = 35).*

Comparison to BP _{PP}	Bias ± SD	Bias, 95% CI	LOA	Lower LOA, 95% CI	Upper LOA, 95% CI
SMBT _{4lb} Day 1(W)	-0.4 ± 44.7	-14.9 to 15.7	-87.3 to 88.1	-113.8 to -60.7	61.5 to 114.6
SMBT _{4lb} Day 2(W)	-0.2 ± 39.6	-13.7 to 13.4	-77.8 to 77.5	-101.3 to -54.2	53.9 to 101.0
SMBT _{3kg} Day 1(W)	-4.0 ± 42.8	-10.7 to 18.7	-79.8 to 87.9	-105.3 to -54.4	62.4 to 113.3
SMBT _{3kg} Day 2(W)	0.0 ± 42.6	-14.6 to 14.6	-82.4 to 83.4	-108.7 to -58.1	58.1 to 108.7

*LOA = limits of agreement; SMBT = seated medicine ball throw; CI = confidence intervals;

SMBT_{4lb} = 4 lb SMBT; SMBT_{3kg} = 3 kg SMBT.





Thank You!