

BASES FISIOLÓGICAS DO TREINAMENTO CONCORRENTE

Valéria Leme Gonçalves Panissa

Fisiologia do Esporte – EFE0170

CONTEÚDO DA AULA

- Definição
- Hipóteses para explicar o fenômeno
- Variáveis do treinamento que são importantes

Definição

Treinamento Concorrente (TC)



Associação de exercícios aeróbios e de força em um programa de treinamento



Examinar a interferência

Nosso organismo consegue se adaptar
otimamente para ambas as formas de
treinamento?



Adaptações fisiológicas

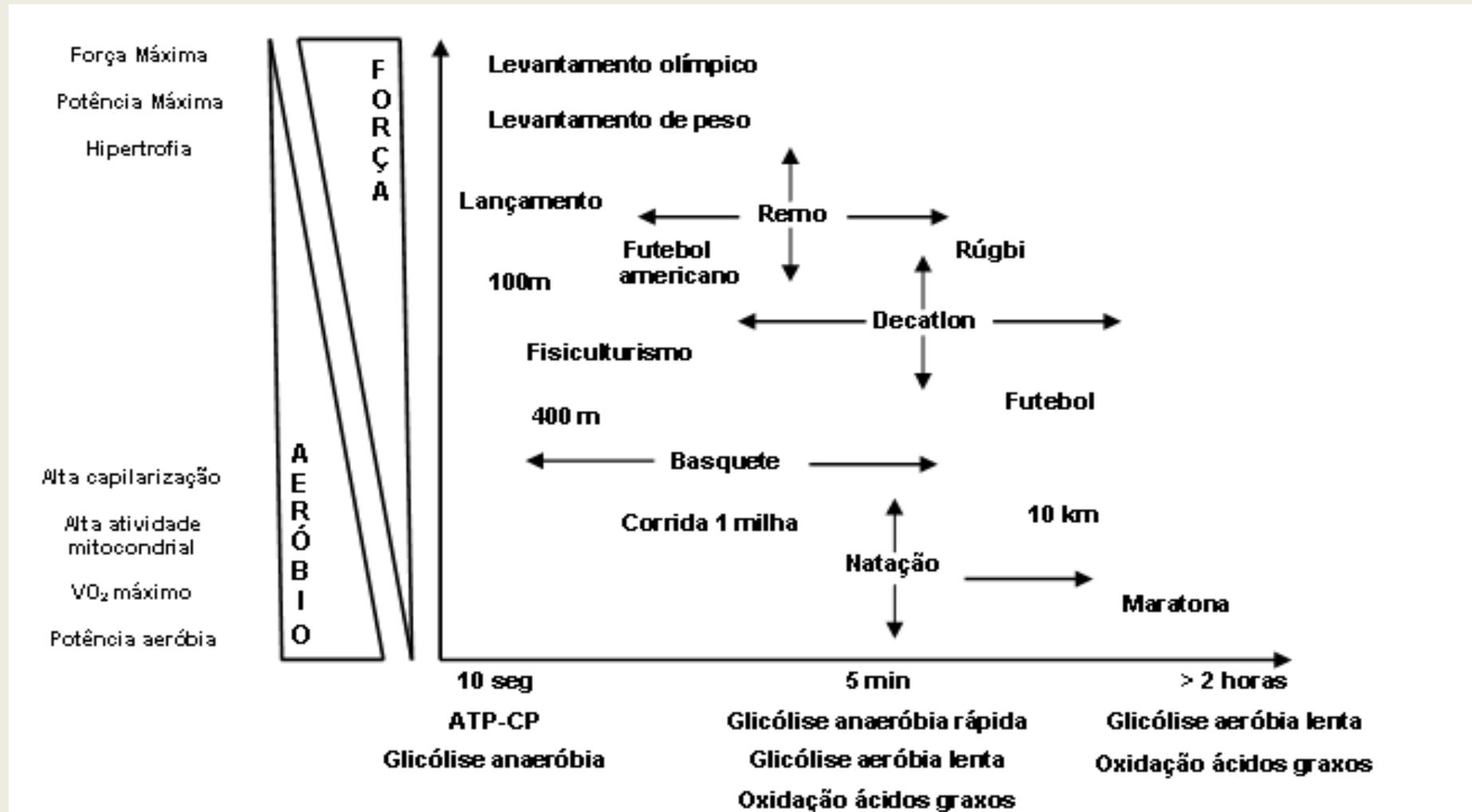
Treinamento Aeróbio

- Aumento da densidade mitocondrial
- Aumento da densidade capilar
- Aumento da atividade das enzimas oxidativas
- Estabilização ou redução da área de secção transversa

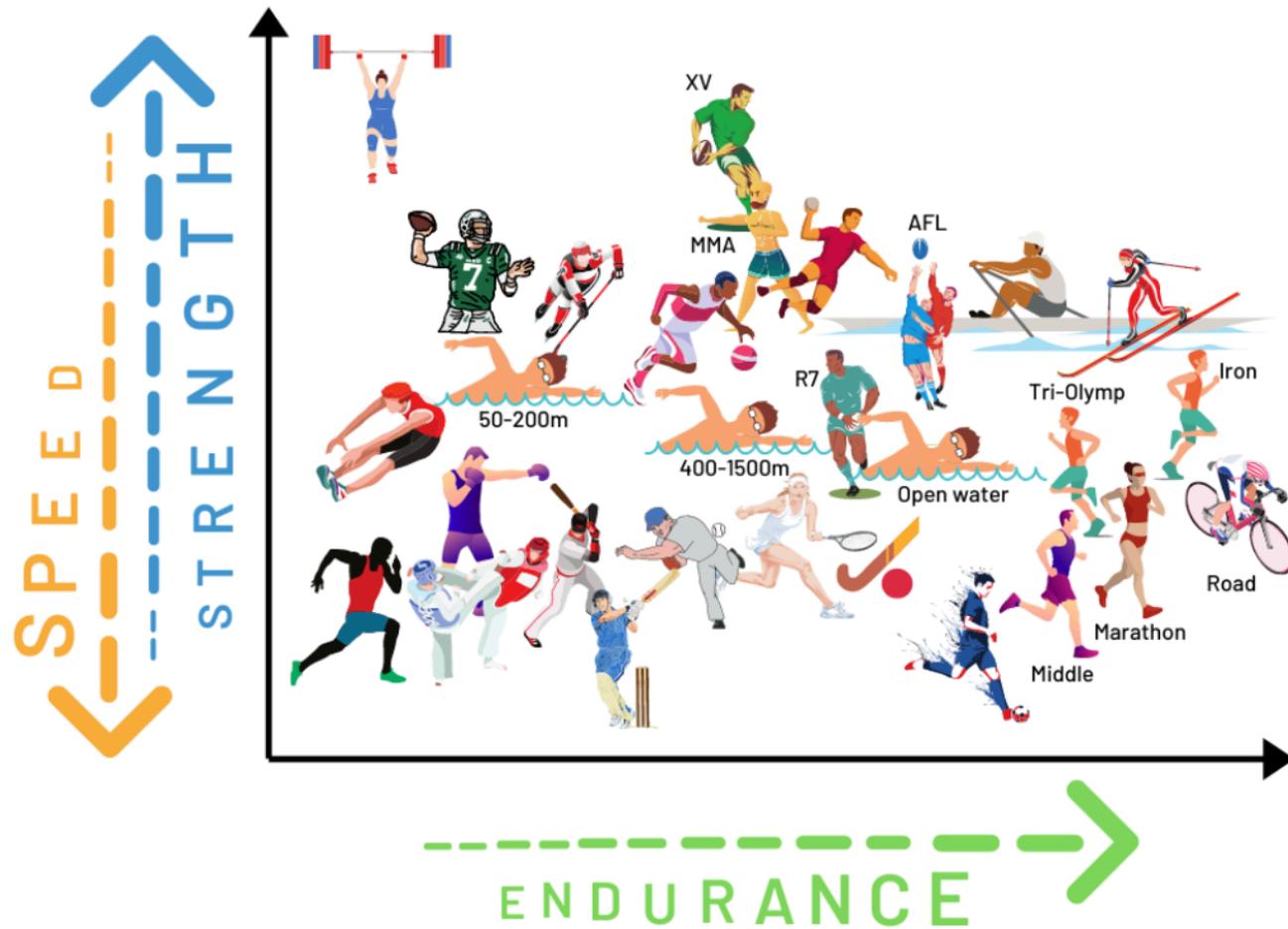
Treinamento de força

- Redução da densidade mitocondrial
- Estabilização ou diminuição densidade capilar
- Diminuição da atividade das enzimas oxidativas
- Aumento da área de secção transversa

Treinamento Concorrente

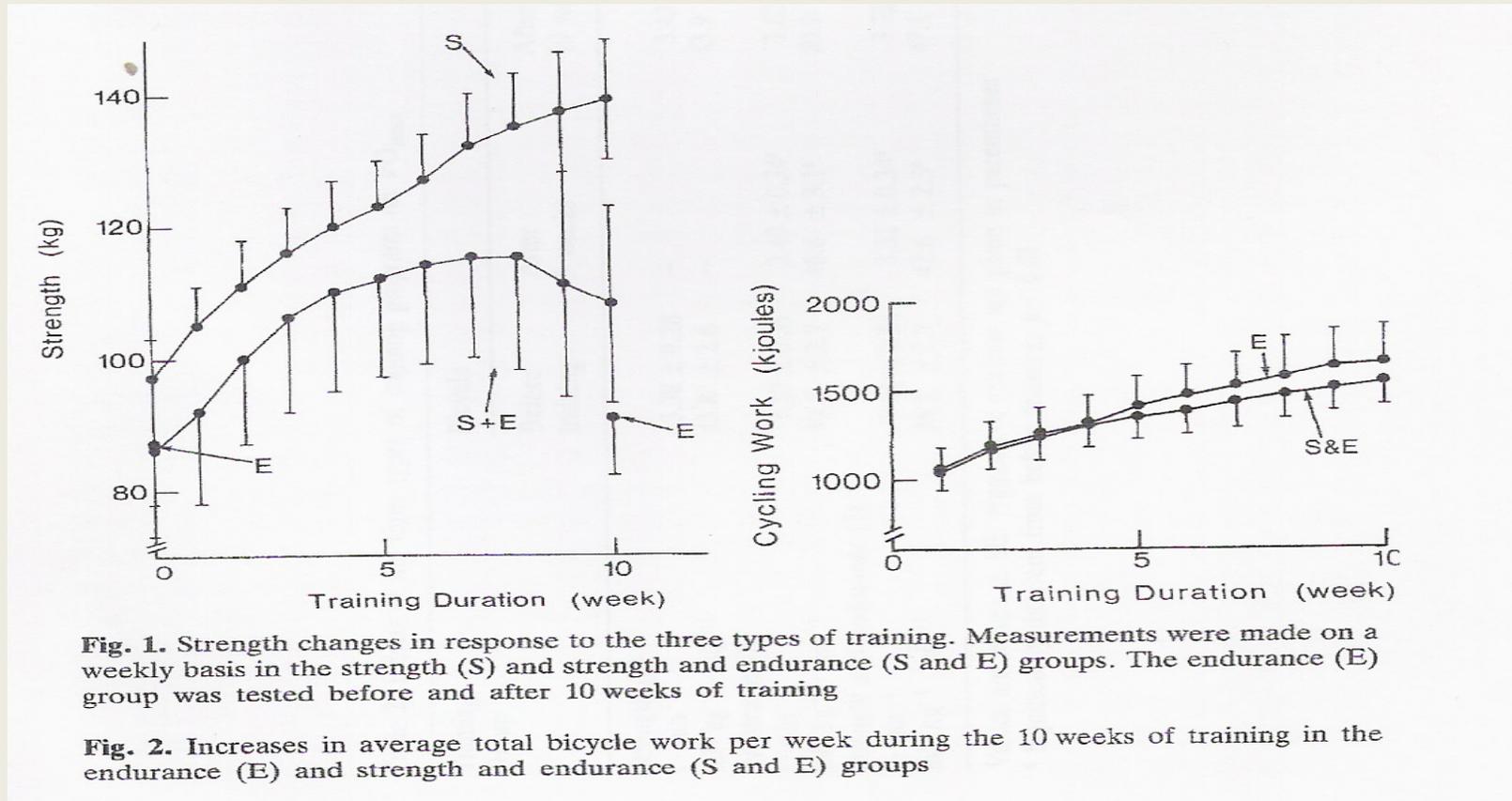


(Adaptado de Nader, 2006)



Um pouco de história

Primeiro estudo a demonstrar os efeitos da interferência



(Hickson et al., 1980)

**Interference of Strength Development
by Simultaneously Training for Strength and Endurance***

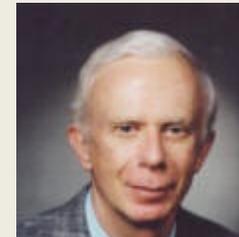
Robert C. Hickson

University of Illinois at Chicago Circle, Department of Physical Education,
Box 4348, Chicago, Il 60680, USA

CURIOSIDADE

Pós doutorado com John Washington Holloszy.

“this should be the first study you do when you have your own lab.” True to his word, the first study that Hickson completed in his new laboratory at the University of Illinois in Chicago was the **seminal** study on concurrent training.



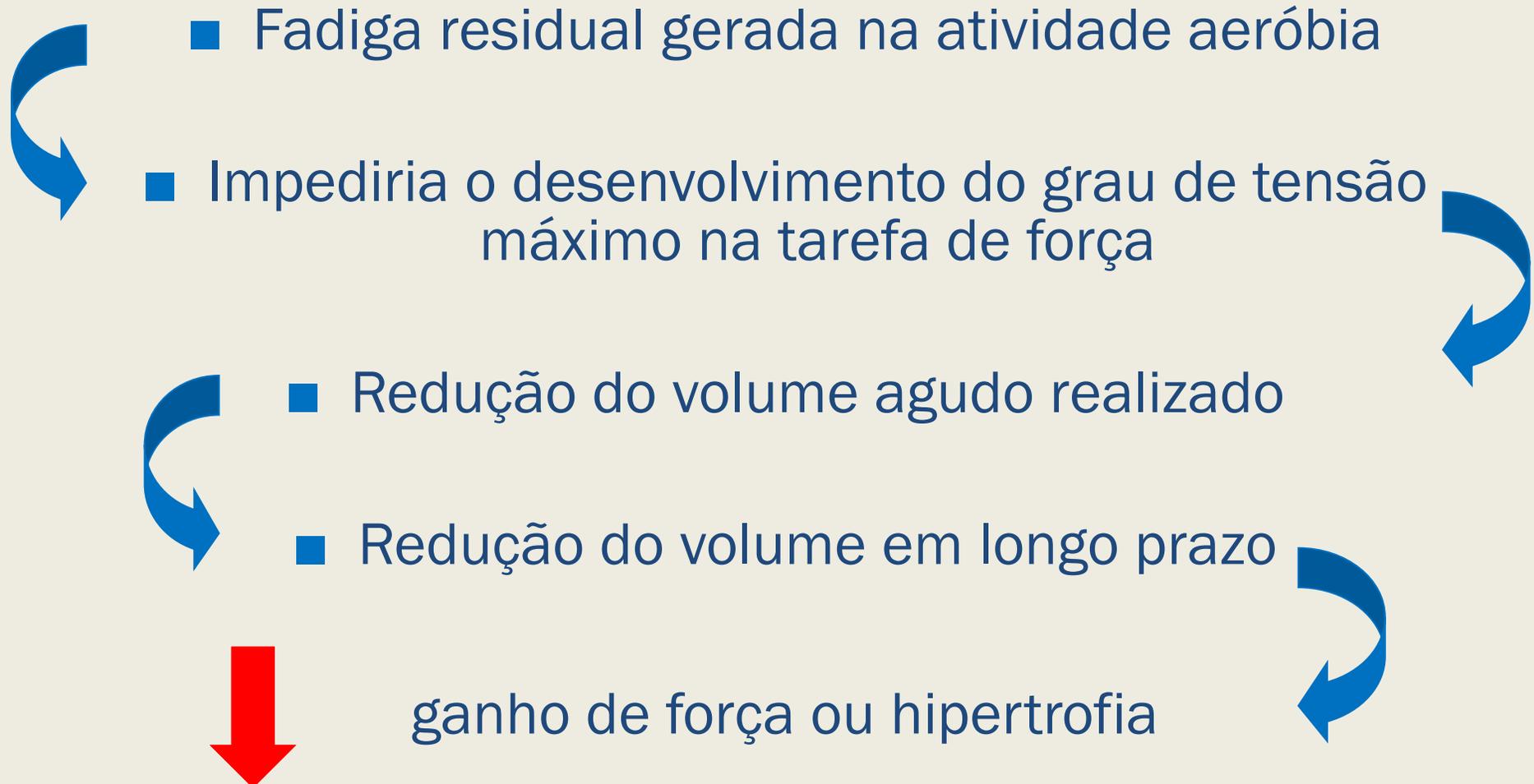
Fenômeno da Interferência

- ❑ inibição do desenvolvimento da força ou hipertrofia (Hickson., 1980; Kraemer al., 1995)
- ❑ inibição no desenvolvimento da aptidão aeróbia (Nelson et al., 1990)
- ❑ sem interferência (Sale et al., 1990; Bell et al., 1991)

HIPÓTESES

- ❑ Hipótese dos efeitos agudos (diminuição de desempenho agudo)
- ❑ Hipótese dos efeitos crônicos (prejuízo na adaptação)

Hipótese Aguda



Hipótese Aguda

Interaction between concurrent strength and endurance training

D. G. Sale, J. D. MacDougall, I. Jacobs, and S. Garner

01 JAN 1990 // <https://doi.org/10.1152/jappl.1990.68.1.260>

©Journal of Sports Science and Medicine (2018) 17, 623-632
<http://www.jssm.org>

Research article

Maximum Strength Development and Volume-Load during Concurrent High Intensity Intermittent Training Plus Strength or Strength-Only Training

Valéria L. G. Panissa¹, David H. Fukuda², Flaviane P. de Oliveira³, Sergio S. Parmezani³, Eduardo Z. Campos⁴, Fabrício E. Rossi⁵, Emerson Franchini^{1,6} and Fabio S. Lira³✉

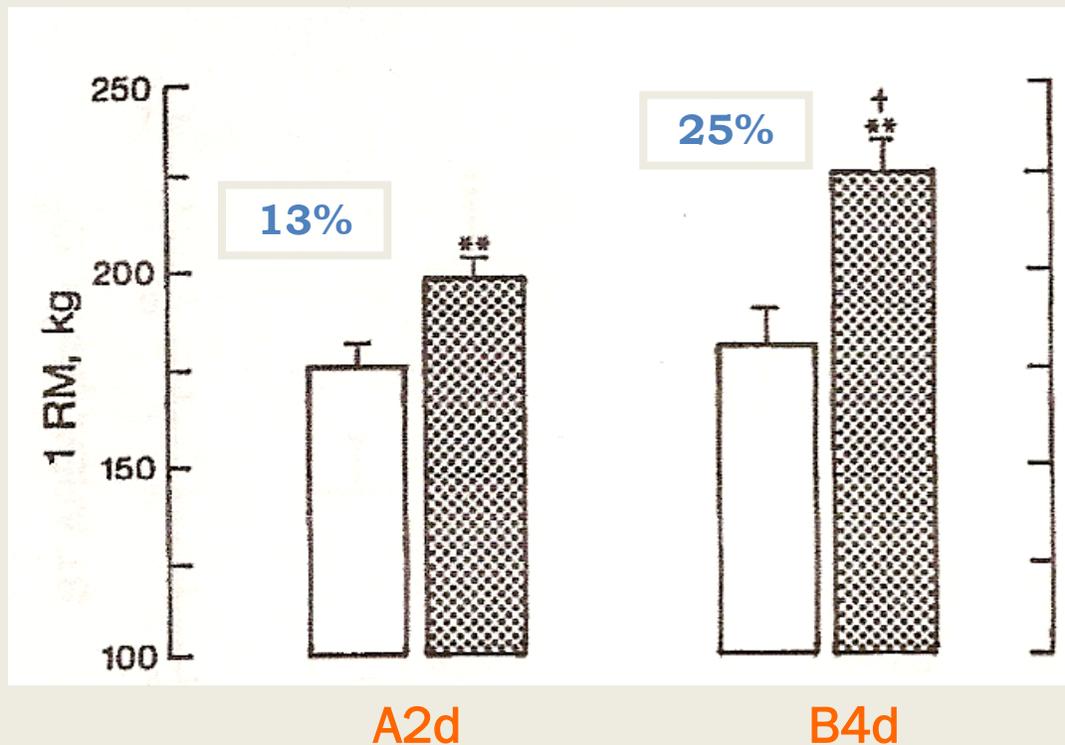
The Effects of Running, Weightlifting and a Combination of Both on Growth Hormone Release

Strength prior to endurance intra-session exercise sequence optimizes neuromuscular and cardiovascular gains in elderly men

Eduardo Lusa Cadore^{a,*}, Mikel Izquierdo^b, Cristine Lima Alberton^{a,d}, Ronei Silveira Pinto^a, Matheus Conceição^a, Giovani Cunha^{a,d}, Régis Radaelli^a, Martim Bottaro^c, Guilherme Treis Trindade^a, Luiz Fernando Martins Kruel^a

Journal of Applied Sport Science Research
1991, Volume 5, Number 4, pp. 198-203

Hipótese Aguda



- B4d realizou maior média de volume total de treino (10,3%) e de número de repetições (2,4%) comparado ao grupo A2d.
- Quando A2d realizava a ordem aeróbio-força havia diminuição (4%) do volume total de treino e do número de repetições em relação à ordem contrária

(Sale et al. 1990)

Research article

Maximum Strength Development and Volume-Load during Concurrent High Intensity Intermittent Training Plus Strength or Strength-Only Training

Valéria L. G. Panissa¹, David H. Fukuda², Flaviane P. de Oliveira³, Sergio S. Parmezani³, Eduardo Z. Campos⁴, Fabrício E. Rossi⁵, Emerson Franchini^{1,6} and Fabio S. Lira³✉

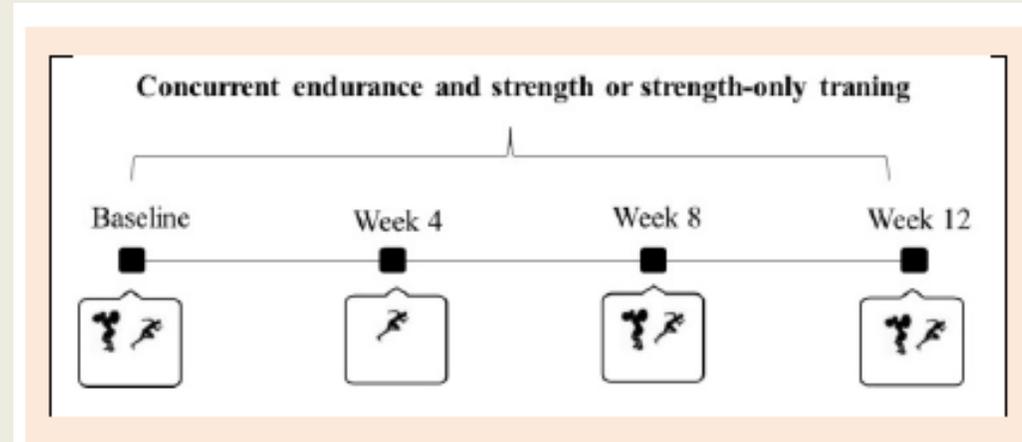
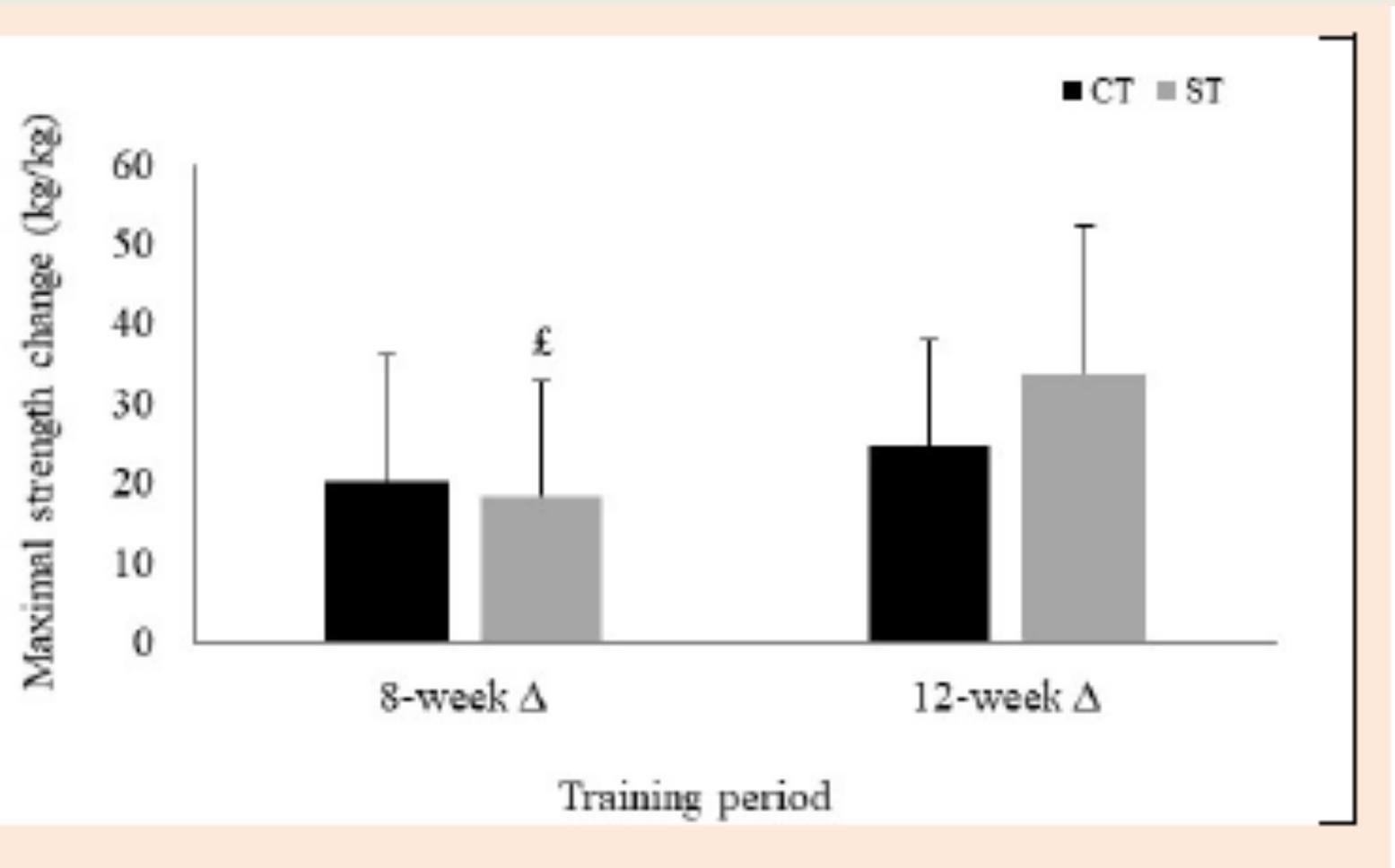


Figure 1. Study design.  anthropometry, maximal strength and isolated acute volume test evaluations;  maximal aerobic speed test.



The physiological effects of concurrent strength and endurance training sequence: A systematic review and meta-analysis

Zsolt Murlasits, Zsuzsanna Kneffel & Lukman Thalib



Journal of Sports Sciences



ISSN: 0264-0414 (Print) 1466-447X (Online) Journal homepage: <https://shapeamerica.tandfonline.com/loi/rjsp20>

Sports Med (2018) 48:177–188
<https://doi.org/10.1007/s40279-017-0784-1>



SYSTEMATIC REVIEW

The Role of Intra-Session Exercise Sequence in the Interference Effect: A Systematic Review with Meta-Analysis

Lee Eddens¹  · Ken van Someren¹ · Glyn Howatson^{1,2} 

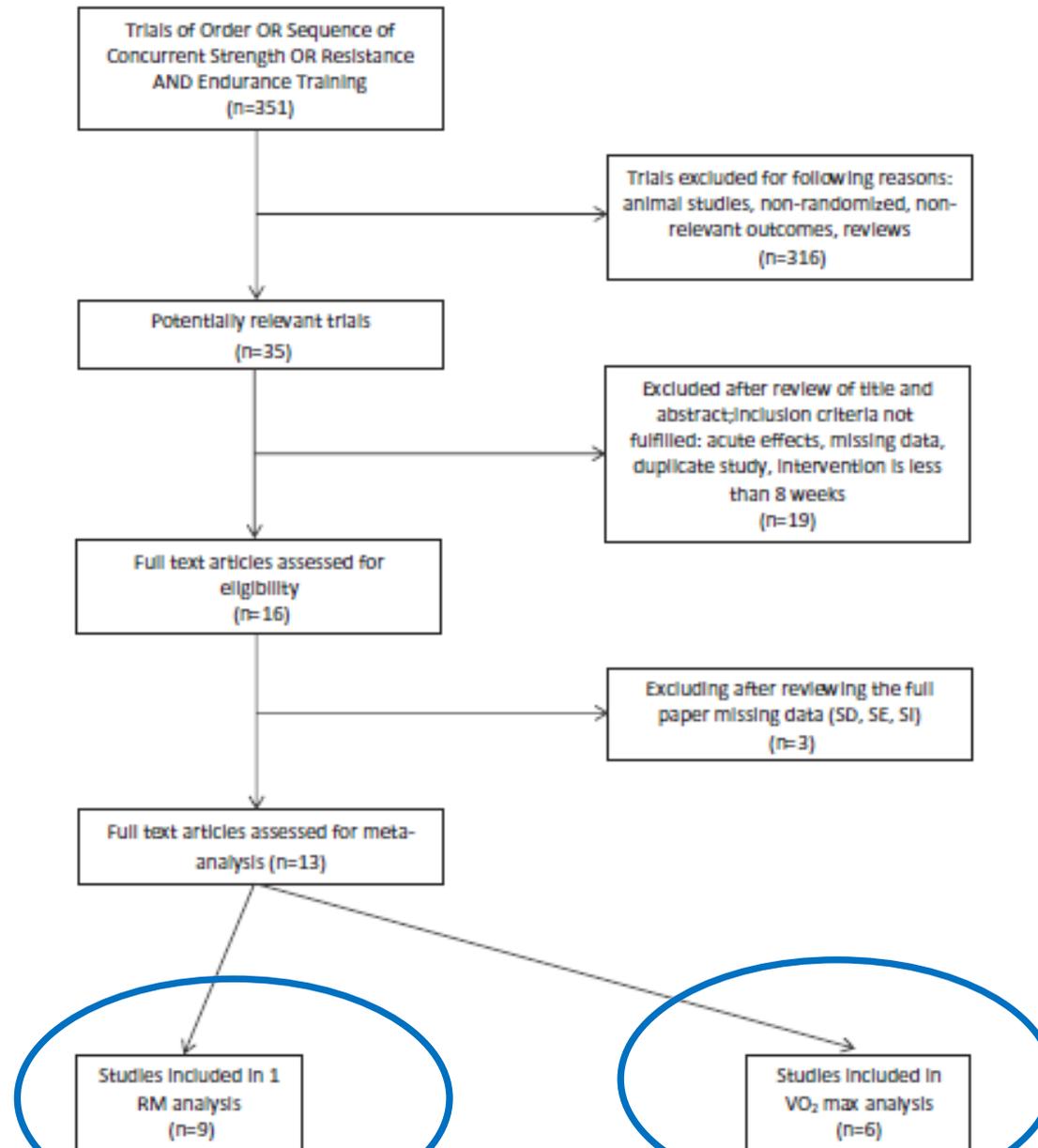
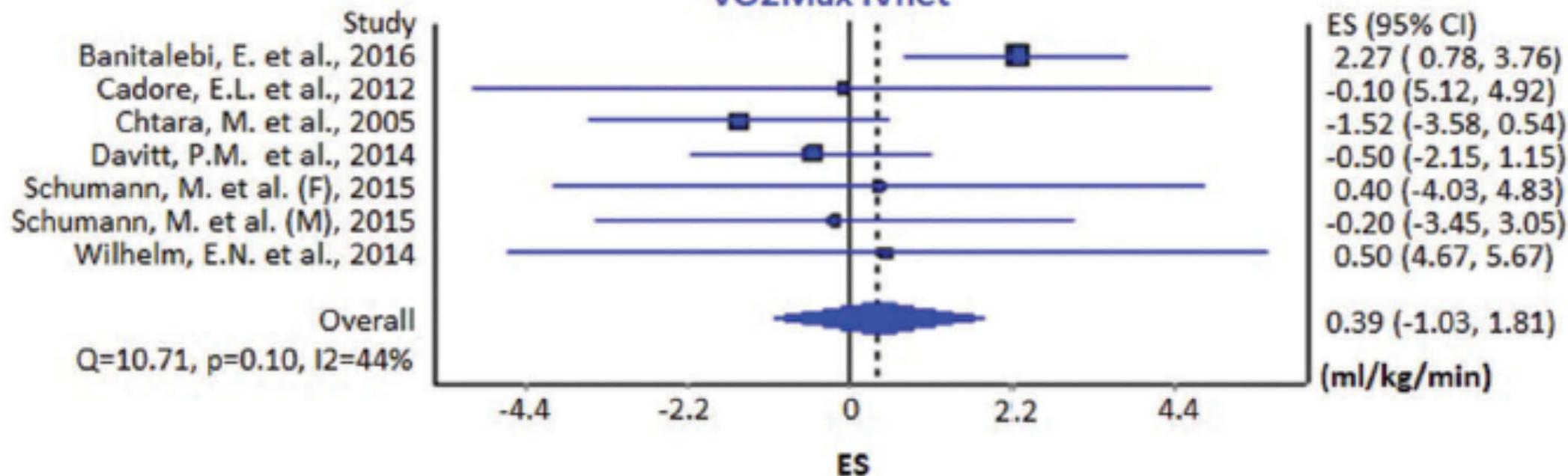


Figure 1. Study selection flow-chart for meta-analysis.

VO2Max IVhet



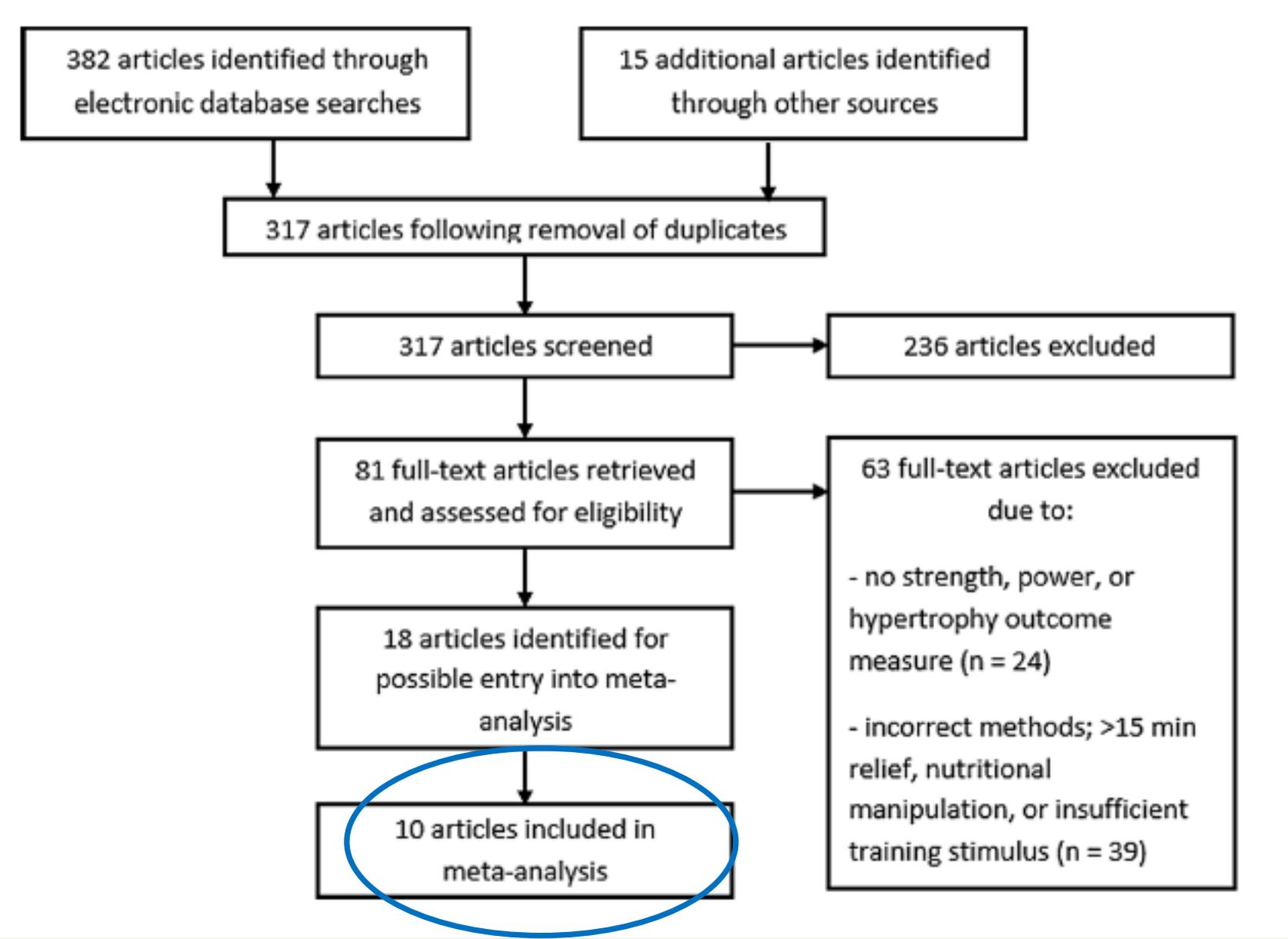
Sports Med (2018) 48:177–188
<https://doi.org/10.1007/s40279-017-0784-1>



SYSTEMATIC REVIEW

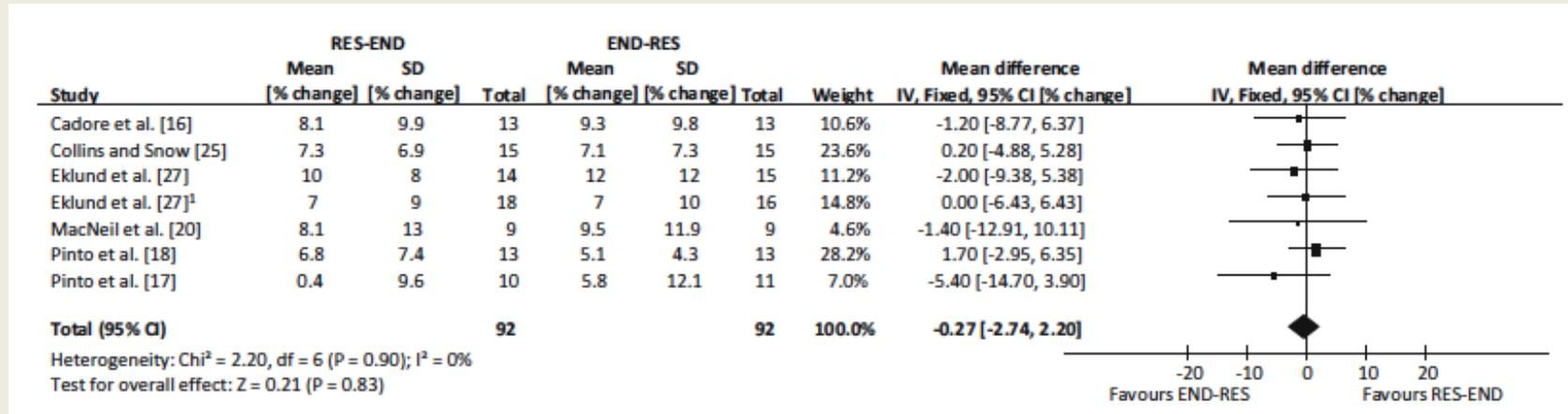
The Role of Intra-Session Exercise Sequence in the Interference Effect: A Systematic Review with Meta-Analysis

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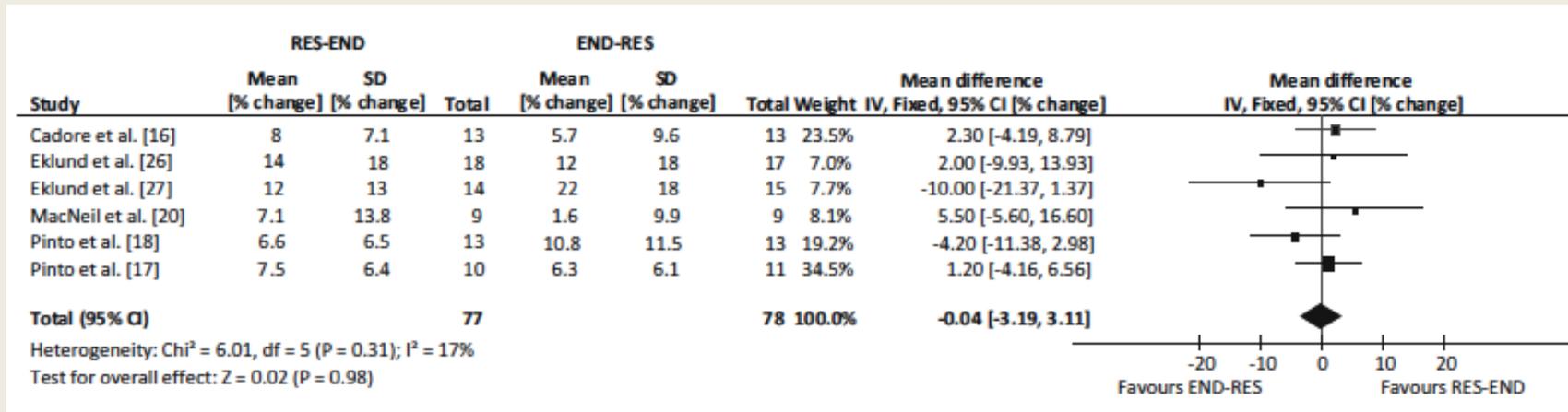


Mínimo de 5 semanas

Consumo máximo de oxigênio



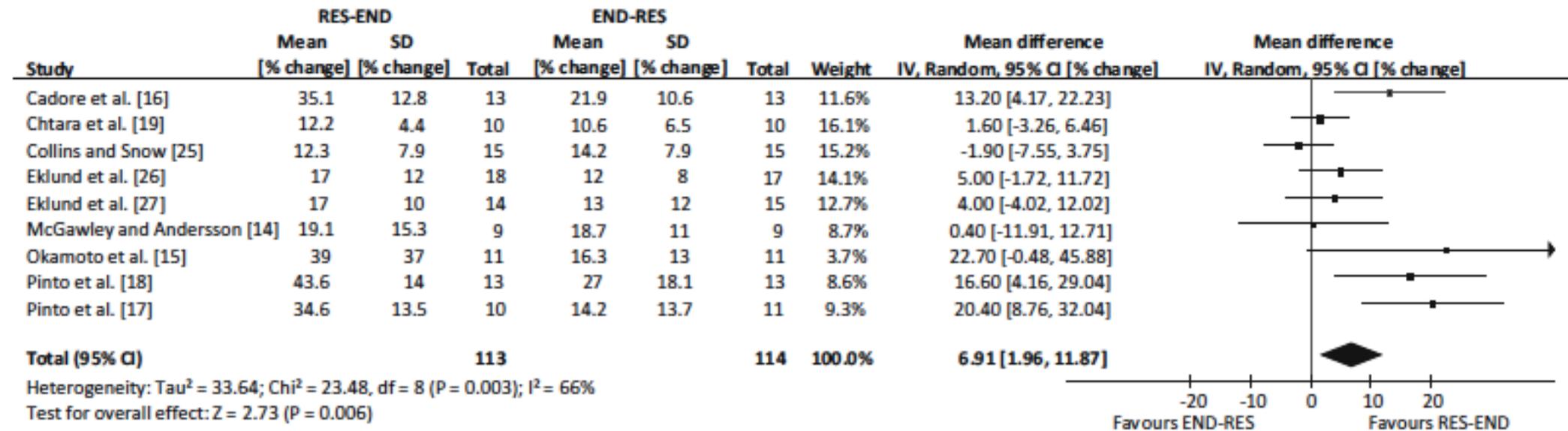
Força estática



Força dinâmica

184

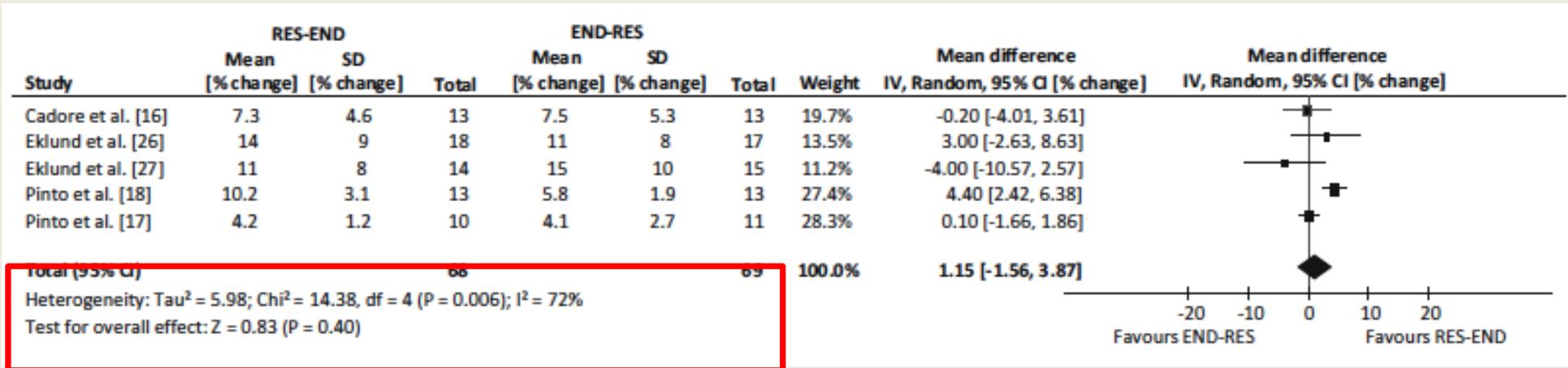
L. Eddens et al.



Dados heterogêneos!

Média de 7% (1,9 a 22%)

Hipertrofia





Todas as vezes que manipulamos uma variável estaremos ignorando outras!

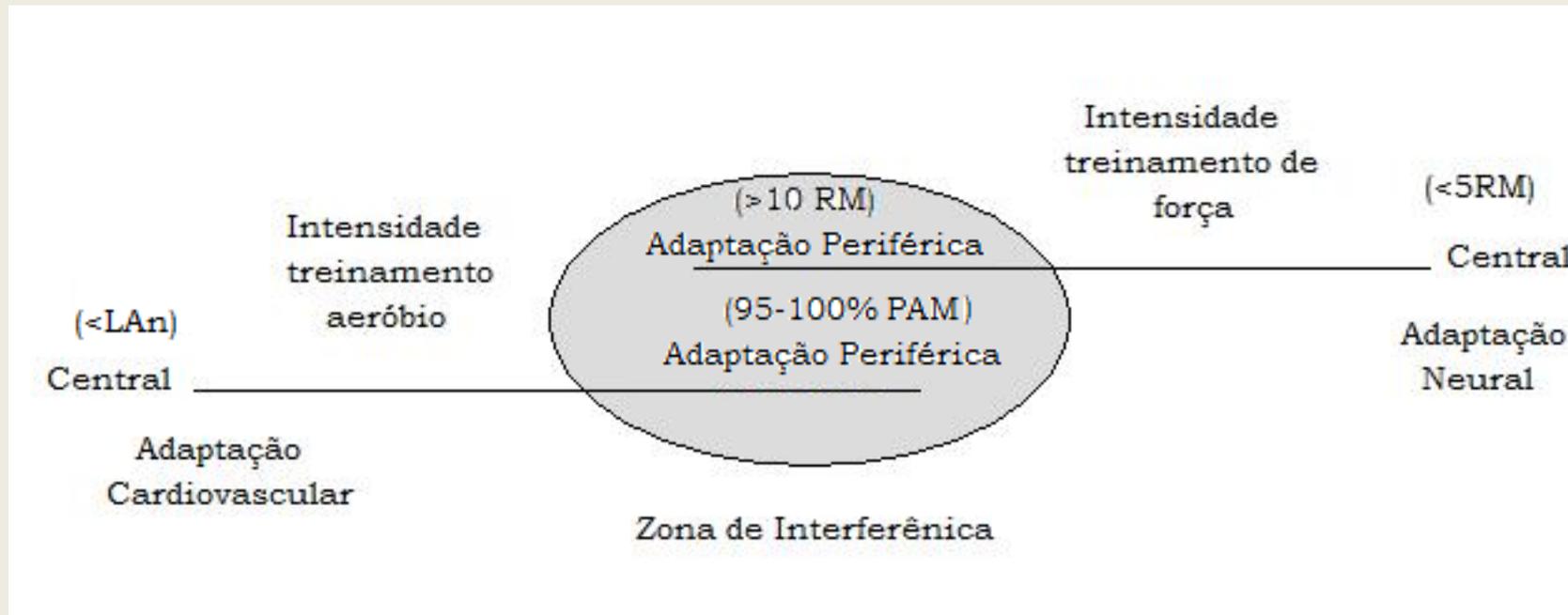
Modelo da interferência baseado na intensidade

A Proposed Model for Examining the Interference Phenomenon between Concurrent Aerobic and Strength Training

David Docherty and Ben Sporer

Sports Med 2000 Dec; 30 (6): 385-394
0112-1642/00/0012-0385/\$20.00/0

Modelo da interferência

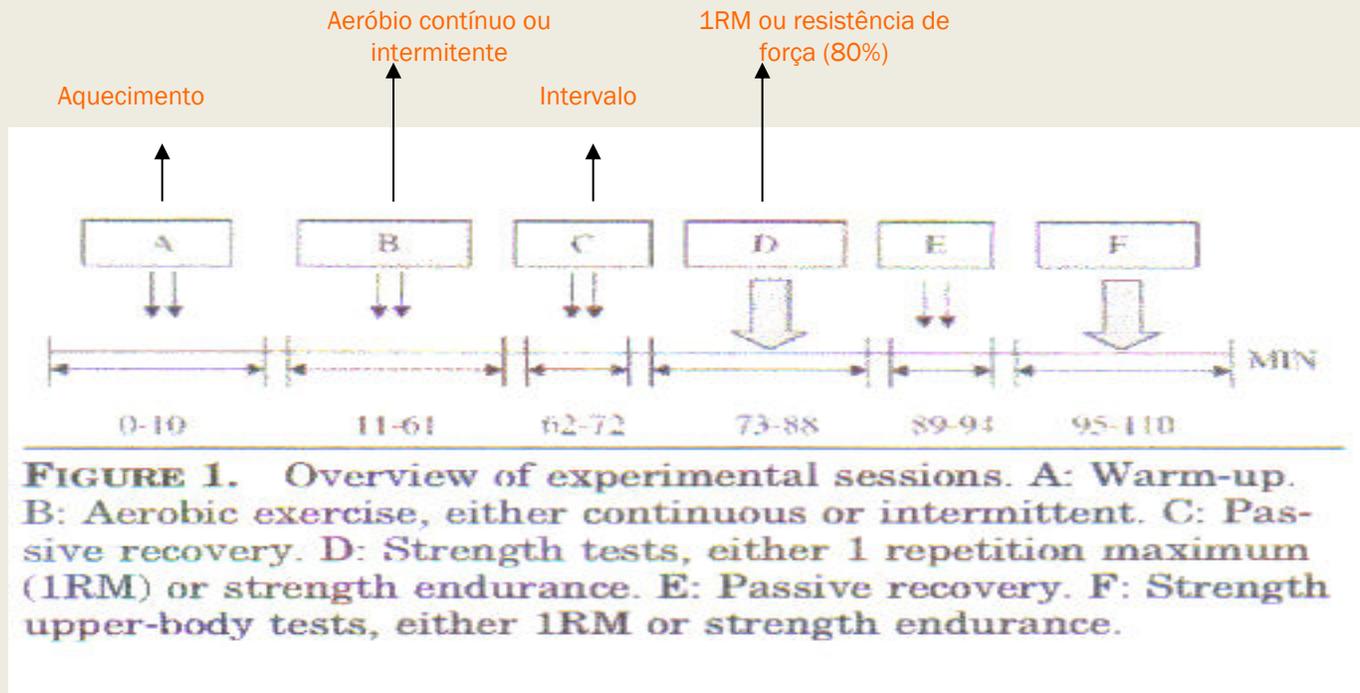


(Docherty e Sporer, 2000)

Intensidade

Utilização do modelo de Docherty e Sporer (2000) para efeitos agudos.

Souza et al., 2007 testaram o modelo:



5KM - 1:1 Vmáx -

90% Lan

(Souza et al. 2007)

Intensidade

	1RM Leg press	80% RM Leg press	1RM Supino	80% RM Supino
Aeróbio Contínuo	X	X	X	X
Aeróbio Intermitente	X		X	X

(Souza et al. 2007)

Musculatura Ativa

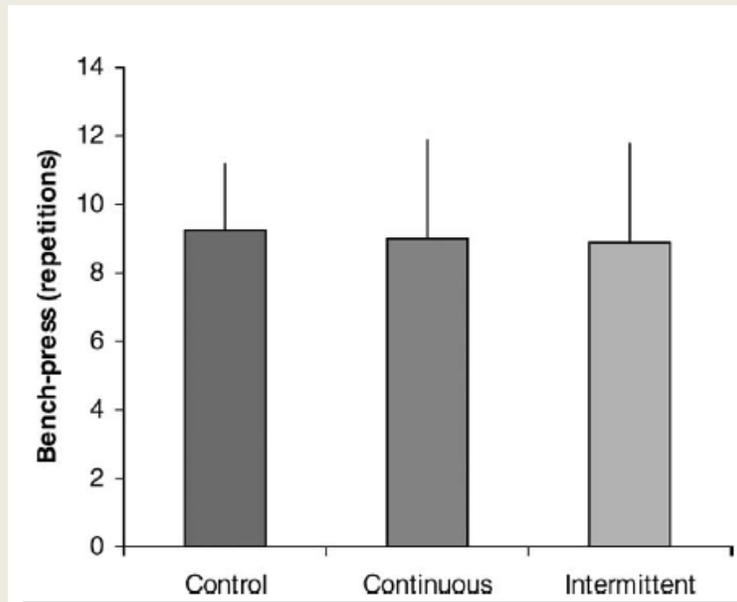


FIGURE 3. Strength endurance (repetitions) for the bench press exercise.

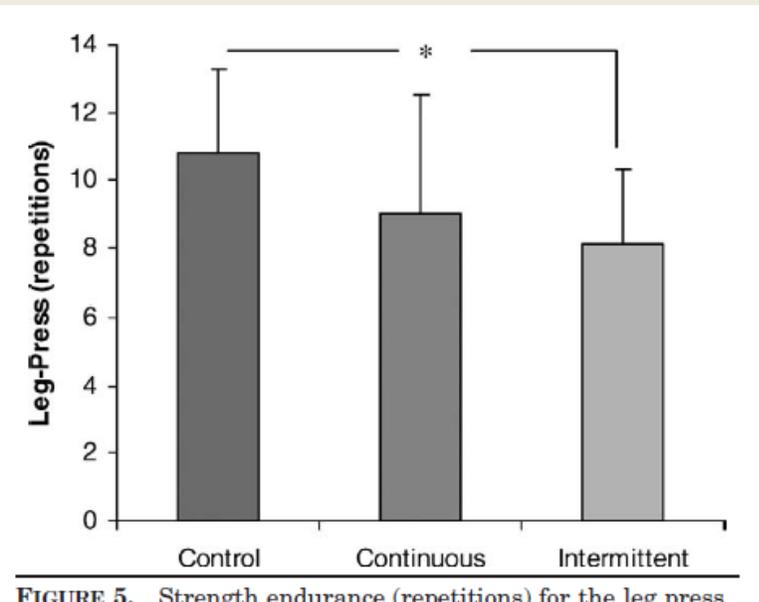


FIGURE 5. Strength endurance (repetitions) for the leg press exercise. * Significantly smaller than control condition ($p = 0.03$).

(Souza et al., 2007)

Intervalo de Recuperação

	10m	30m	60m	4h	6h	8h	24h	32h
Bentley et al. (2000)	↓				↓			
Leveritt, MacLaughlin, e Abernethy (2000)						→		→
Sporer e Wenger (2003)				↓		↓	→	
Panissa et al. (2012)		↓	↓	→		→	→	

Tipo de ergômetro

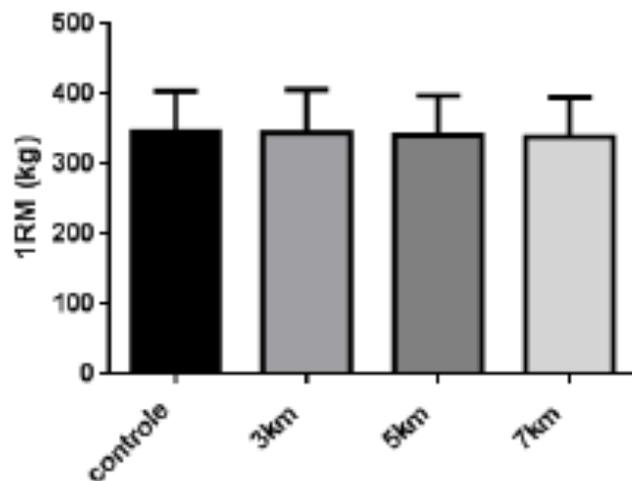
ACUTE EFFECT OF HIGH-INTENSITY AEROBIC EXERCISE PERFORMED ON TREADMILL AND CYCLE ERGOMETER ON STRENGTH PERFORMANCE

VALÉRIA L.G. PANISSA,¹ VALMOR A.A. TRICOLI,¹ URSULA F. JULIO,¹ NATALIA RIBEIRO,¹ RAYMUNDO M.A. DE AZEVEDO NETO,² EVERTON C. CARMO,¹ AND EMERSON FRANCHINI¹

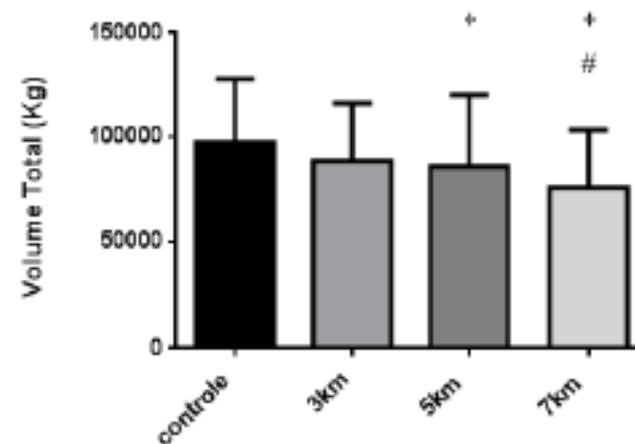
Table 1: Maximum number of repetitions and total volume performed (kg) in four sets at 80% 1RM in the half-squat exercise in the control condition (S) and after the running (RS) and cycling exercises (CS).

	Set 1^d	Set 2	Set 3	Set 4	Total
Maximum number of repetitions					
S ^c	10 ± 4	7 ± 5	6 ± 3	6 ± 3	29 ± 13
RS	6 ± 3 ^a	6 ± 3	6 ± 2	5 ± 2	23 ± 9
CS	4 ± 5 ^a	5 ± 4 ^b	5 ± 2	4 ± 2	18 ± 13
Total volume (kg)					
S ^c	1432 ± 593	1052 ± 624	873 ± 472	891 ± 363	4248 ± 1818
RS	921 ± 351 ^a	805 ± 405	742 ± 258	717 ± 311	3185 ± 1191
CS	756 ± 605 ^a	668 ± 573 ^b	623 ± 332	592 ± 233	2639 ± 1643

Volume de Exercício Aeróbico



Não houve diferença significativa entre as condições ($p = 0,0720$)



*significamente menor que a condição controle ($p < 0,05$)

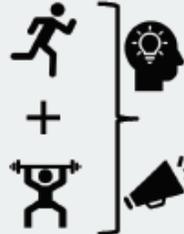
significamente menor que as condições 3km e 5km ($p < 0,05$)

Concurrent Training and the Acute Interference Effect on Strength: Reviewing the Relevant Variables

Valéria Leme Gonc, alves Panissa,¹ Camila C. Greco, PhD,² Natalia Ribeiro, MSc,³ Ursula F. Julio, PhD,¹ Valmor Tricoli, PhD,³ and Emerson Franchini, PhD¹

¹High-intensity Intermittent Exercise Physiology Research Group, Department of Sport, School of Physical Education and Sport, University of São Paulo, São Paulo, Brazil; ²Human Performance Laboratory, Department of Physical Education, São Paulo State University, Rio Claro, Brazil; and ³School of Physical Education and Sport, University of São Paulo, São Paulo, Brazil

Concurrent training



For whom and why is it prescribed?

Performed by athletes of several sports and physically active individuals for aerobic fitness and strength development AND/OR to reduce body fat AND/OR to increase muscle mass.

What could be a potential limitation?

Strength performance may be impaired when an aerobic session is performed before strength, consequently, the reduced exercise volume can potentially harm maximal strength and hypertrophy development (acute hypothesis).

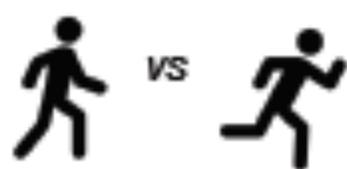


How to manipulate acute aerobic exercise session followed by strength session, to minimize the impairment on strength performance?

vs Aerobic exercise intensity	High-intensity interval exercise results in more pronounced negative effects on strength-endurance exercise but not in maximum strength compared with moderate intensity exercise.
vs Aerobic exercise mode	Cycling results in more negative effects on strength-endurance performance than running.
Duration of recovery interval between exercises	Generally after 4- to 8-hours recovery interval strength-endurance performance is not affected.
vs Muscles groups involved in both exercises	Reduction in strength-endurance performance is located in muscle groups involved in both exercises.
vs Aerobic exercise volume	Low volume of running (3km; 18 min) does not diminish strength-endurance whereas higher volumes (6 and 7km; 30 and 42 minutes) generate impairments.
Ergogenic aids	Creatine and capsaicin analog supplementation are able to revert the deleterious effect on strength-endurance performance, whereas caffeine, carbohydrate and beta-alanine are not.

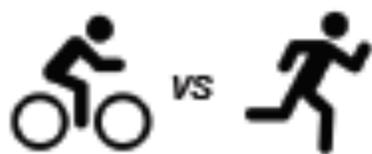


- Avoiding the acute impairments on strength will not necessarily nullify possible long-term effect in strength and hypertrophy development, since the acute hypothesis is only part of other possible factors that may culminate in interference effects
- Conclusions made in this present review are limited due to the lack of a number of studies with a systematic changing of variables



Aerobic exercise intensity

High-intensity interval exercise results in more pronounced negative effects on strength-endurance exercise but not in maximum strength compared with moderate intensity exercise.



Aerobic exercise mode

Cycling results in more negative effects on strength-endurance performance than running.



Duration of recovery interval between exercises

Generally after 4- to 8-hours recovery interval strength-endurance performance is not affected.



Muscles groups involved in both exercises

Reduction in strength-endurance performance is located in muscle groups involved in both exercises.



Aerobic exercise volume

Low volume of running (3km; 18 min) does not diminish strength-endurance whereas higher volumes (5 and 7km; 30 and 42 minutes) generate impairments.



Ergogenic aids

Creatine and capsaicin analog supplementation are able to revert the deleterious effect on strength-endurance performance, whereas caffeine, carbohydrate and beta-alanine are not.

Original Article

Effects of interval time between high-intensity intermittent aerobic exercise on strength performance: analysis in individuals with different training background

VALÉRIA LEME GONÇALVES PANISSA  , URSULA FERREIRA JULIO, CLAUDIO MACHADO PINTO E SILVA, LEONARDO VIDAL ANDREATO, FELIPE HARDT, EMERSON FRANCHINI

Table 1. Age, body mass, height, maximum strength, peak oxygen uptake ($\dot{V}O_{2peak}$) and peak velocity (V_{peak}) in athletes of the aerobic group (AG), strength group (SG) and concurrent group (CG).

	AG (n = 10)	CG (n = 9)	SG (n = 8)
Age (years)	29 ± 6	26 ± 7	26 ± 4
Body mass (kg)	70 ± 8 ^{b c}	84 ± 7	83 ± 4
Height (cm)	177 ± 6	181 ± 5	175 ± 3
Training experience (years)	8 ± 6	7 ± 6	5 ± 3
Half-squat 1RM (kg)	163 ± 19 ^{b c}	211 ± 25 ^{a c}	247 ± 15 ^{a b}
V_{peak} (km/h)	21.4 ± 1.4 ^{b c}	18.9 ± 1.5 ^{a c}	16.3 ± 1.1 ^{a b}
$\dot{V}O_{2peak}$ (ml/kg/min)	61.1 ± 5.2 ^{b c}	51.0 ± 7.6	44.0 ± 3.8

Data are mean ± SD; 1RM = one repetition-maximum; ^a = different from AG ($P < 0.05$); ^b = different from CG ($P < 0.05$); ^c = different from SG ($P < 0.05$).

Table 2. Maximum number of repetitions in four sets at 80% 1RM in the half-squat in the control condition and after 5km running with different time interval between the aerobic exercise and the strength exercise in athletes with different training backgrounds (aerobic group - AG , concurrent group - CG , and strength group - SG).

	C ^a	30 min	60 min	4 hours	8 hours	24 hours
AG (n = 10) ^b	46 ± 16	41 ± 17	42 ± 17	48 ± 16	39 ± 14	49 ± 20
CG (n = 9)	38 ± 5	28 ± 8	34 ± 9	36 ± 5	37 ± 10	36 ± 9
SG (n = 8)	30 ± 9	18 ± 12	20 ± 12	25 ± 8	29 ± 8	26 ± 11
All groups	38 ± 13	30 ± 15	33 ± 16	37 ± 14	35 ± 12	38 ± 17

Data are mean ± SD; C = control; min = minutes; ^a = different from 30 and 60 min ($P < 0.05$); ^b = different from SG ($P < 0.05$).

Hipótese Crônica – Efeitos na Força e hipertrofia

- Impossibilidade do organismo adaptar-se a ambas as atividades
- Muitos estudos demonstram comprometimento dos ganhos de força/hipertrofia a longo prazo comparado com a situação do treinamento da força isolada, no entanto não analisaram as respostas adaptativas

Hipótese Crônica – Efeitos na força e hipertrofia

- No caso do esporte de alto rendimento não existe grandes possibilidades de submeter atletas a diferentes treinamentos
- Apresentar o que tem maior consistência ou meta-análises com desfecho na força ou hipertrofia

Hipertrofia

4 grupos (militares)

C = força e aeróbio

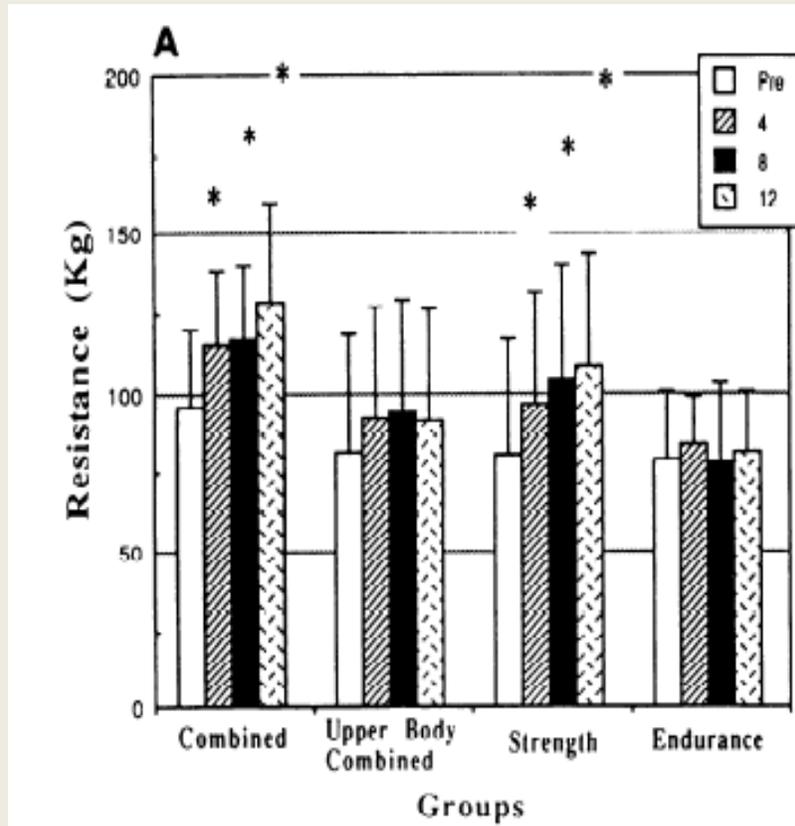
S = força

E = aeróbio

12 semanas

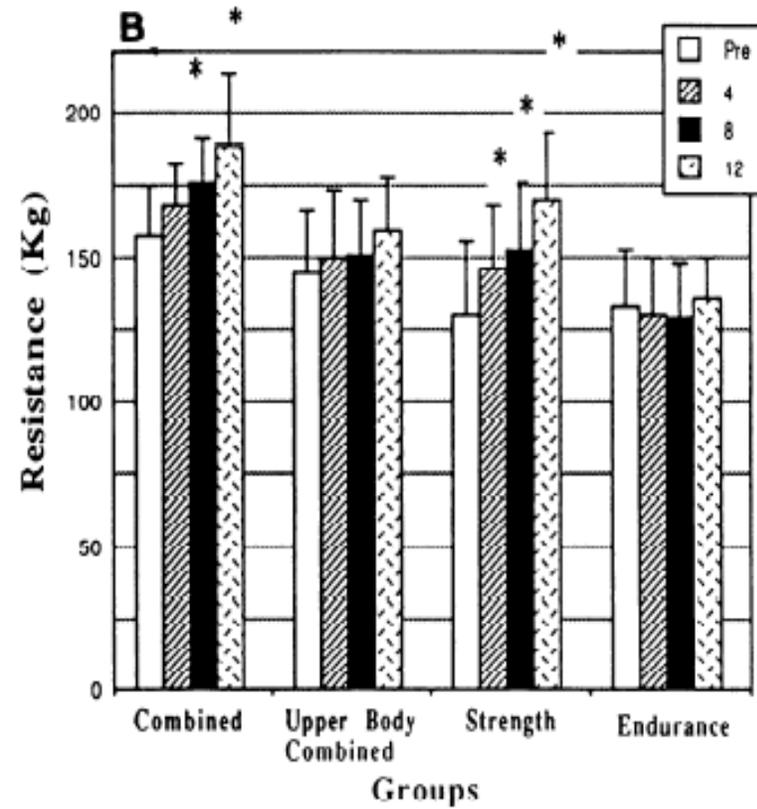
Distance Workouts (Monday/Thursday)	Interval Workouts (Tuesday/Friday)
Warm-up Maximum distance in 40 min 80–85% $\dot{V}O_{2\max}$	Warm-up 200- to 800-m intervals 95–100+% $\dot{V}O_{2\max}$ Exercise-to-rest ratio went from 1:4 to 1:0.5

Monday/Thursday H Workout		Tuesday/Thursday S Workout	
Exercise	No. of sets × RM	Exercise	No. of sets × RM
<i>Upper body</i>			
Bench press*	3 × 10 RM	Bench press	5 × 5 RM
Fly*	3 × 10 RM		
Military press*	2 × 10 RM	Military press	5 × 5 RM
Upright row*	2 × 10 RM		
Latissimus pull down*	3 × 10 RM	Arm curl	5 × 5 RM
Seated row*	3 × 10 RM		
Arm curl	3 × 10 RM	Latissimus pull down	5 × 5 RM
Sit-up	2 × 25 RM	Obliques (twists)	5 × 5 RM
		Sit-up	5 × 5 RM
<i>Lower body</i>			
Single knee extension*	3 × 10 RM	Calf raise	3 × 10 RM
Single leg curl*	3 × 10 RM		
Calf raise	3 × 15 RM	Double knee extension	5 × 5 RM
Split squat	3 × 10 RM	Leg press	5 × 5 RM
		Dead lift	4 × 6 RM



A – extensão de joelho

Aumento em ambos após 4, 8, e 12 semanas



B – leg press

Aumento C até 8 semanas e no ST até 12 semanas

Mudanças nas fibras

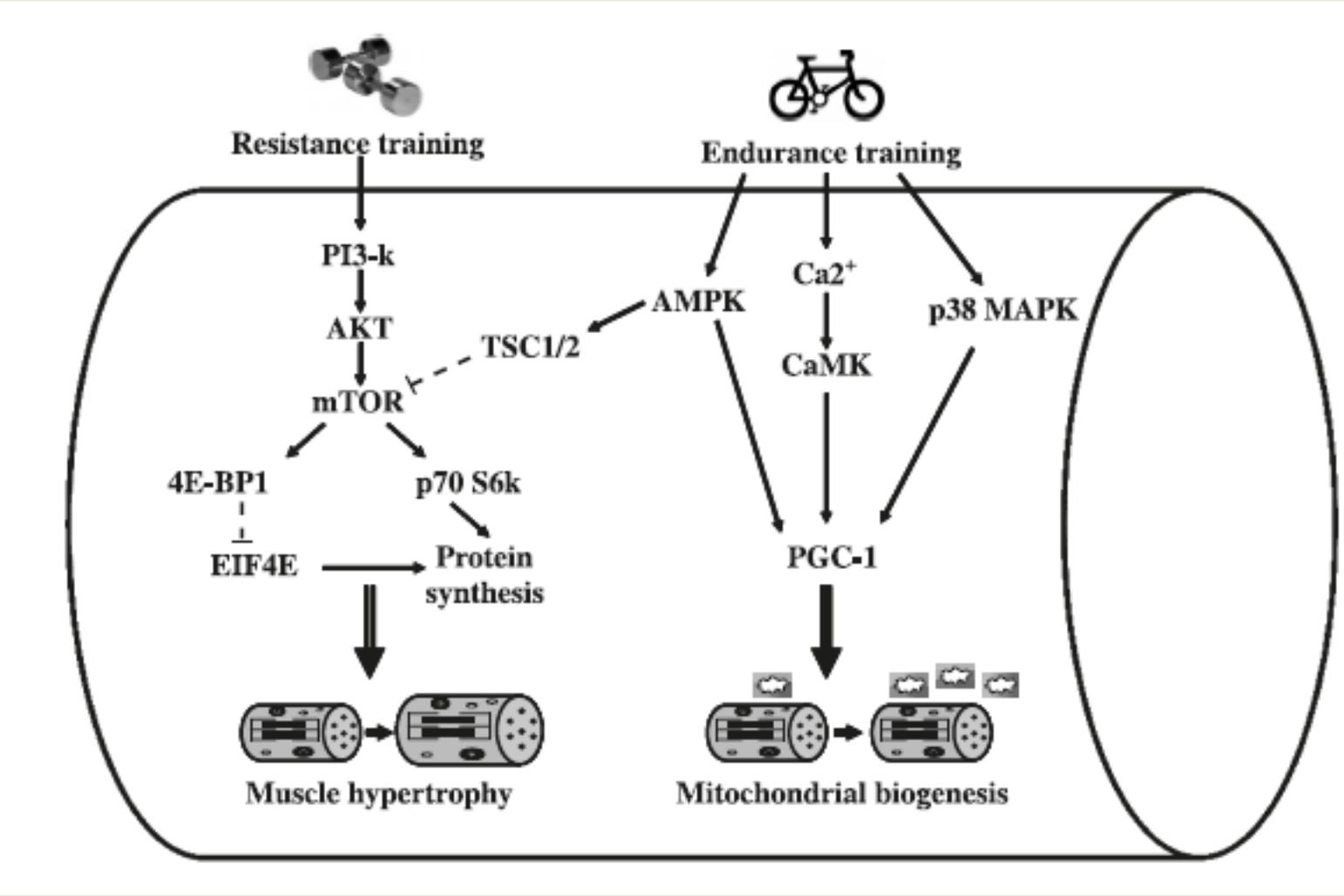
C: transição do IIb para IIa;  área nas fibras IIa

S: transição do IIb para IIa;  área IIa, IIc e I

E: transição do IIb para IIa;  área I e IIc

Vasto lateral

TC e biologia molecular



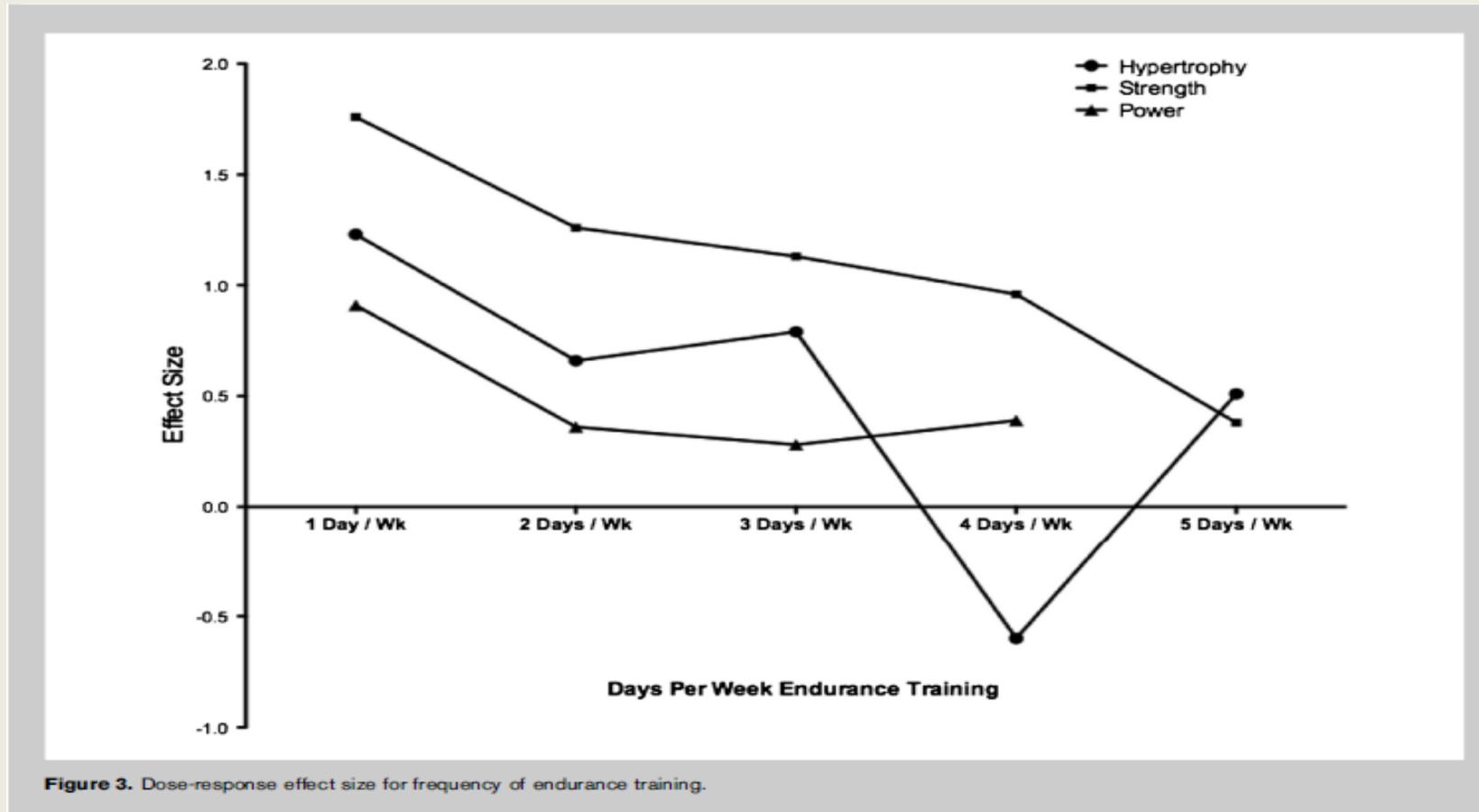
(Hawley, 2009)

CONCURRENT TRAINING: A META-ANALYSIS EXAMINING INTERFERENCE OF AEROBIC AND RESISTANCE EXERCISES

**JACOB M. WILSON,¹ PEDRO J. MARIN,^{2,3} MATTHEW R. RHEA,⁴ STEPHANIE M.C. WILSON,¹
JEREMY P. LOENNEKE,⁵ AND JODY C. ANDERSON¹**

¹Department of Health Sciences and Human Performance, The University of Tampa, Tampa, Florida; ²Laboratory of Physiology, European University Miguel de Cervantes, Valladolid, Spain; ³Research Center on Physical Disability, Valladolid, Spain; ⁴Human Movement Program, A. T. Still University, Mesa, Arizona; ⁵Department of Health and Exercise Science, The University of Oklahoma, Norman, Oklahoma

Frequência de treino

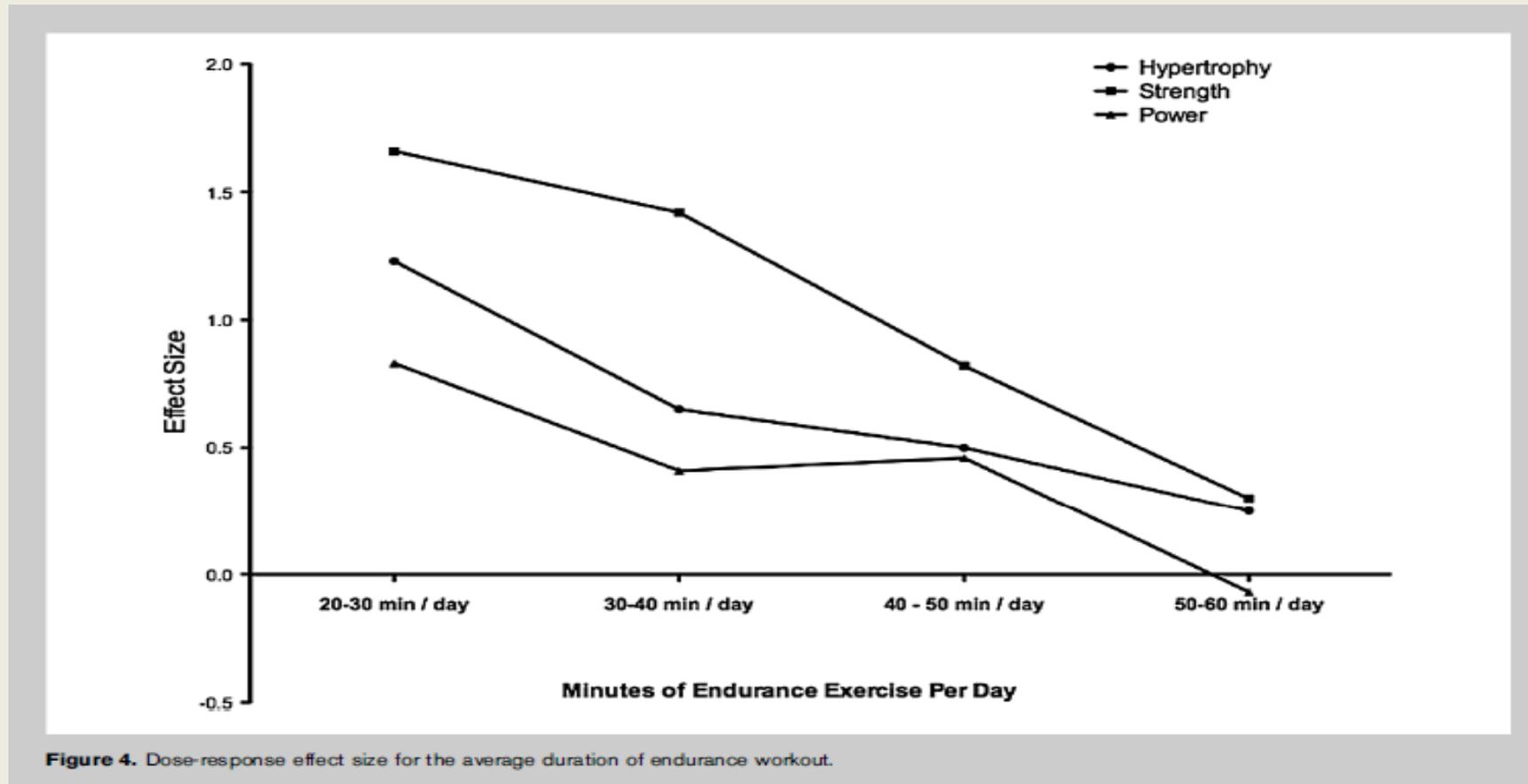


Frequência e hipertrofia ($r = -0,26$; $p < 0,05$)

Frequência e força ($r = -0,31$; $p < 0,05$)

Frequência potência ($r = -0,35$; $p < 0,05$)

Volume de Treino



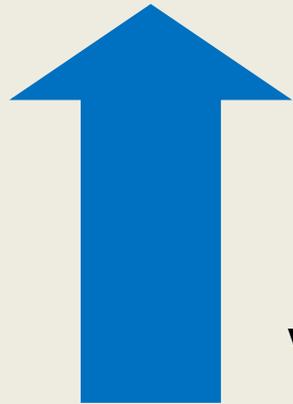
Volume e hipertrofia ($r = -0,75$; $p < 0,05$)

Volume e força ($r = -0,34$; $p < 0,05$)

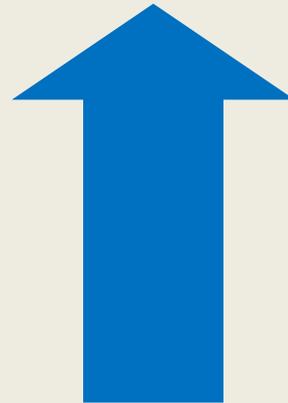
Volume potência ($r = -0,29$; $p < 0,05$)

(Wilson et al., 2012)

Volume de treino aeróbico



Volume de treino



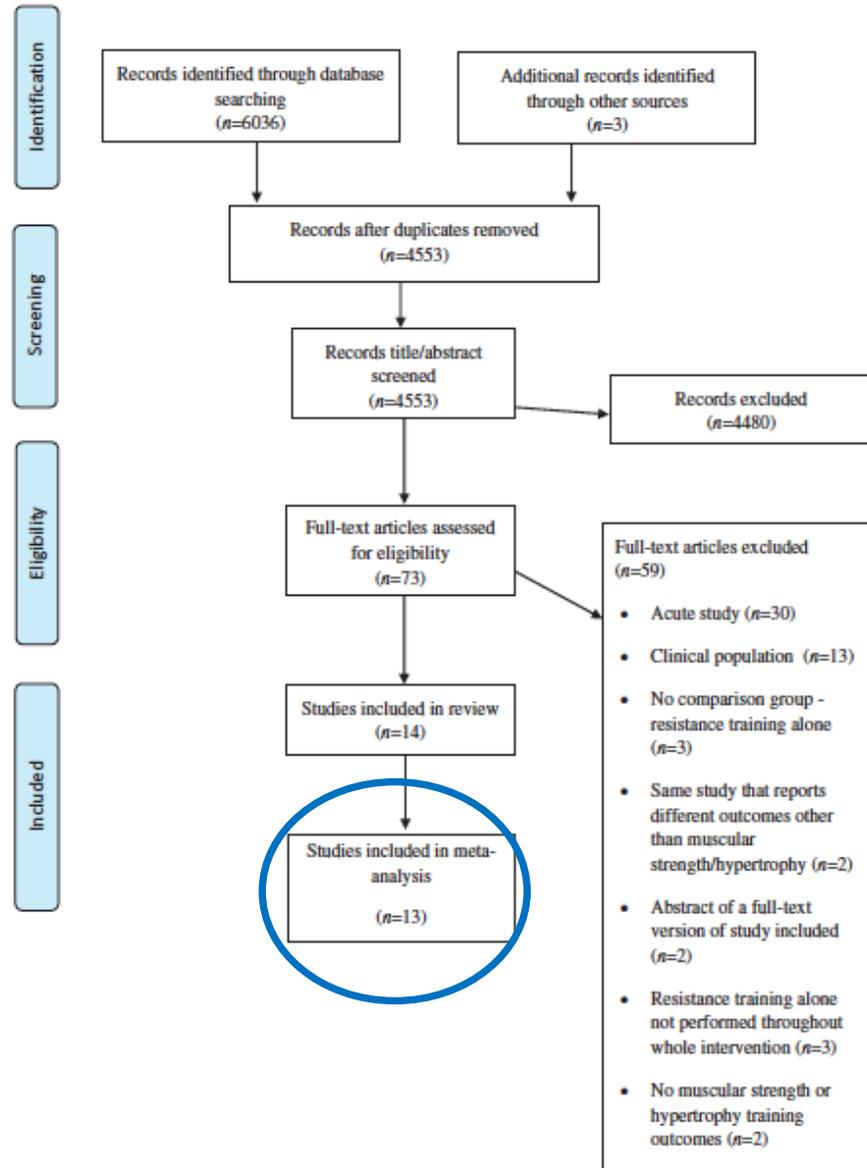
Chance de interferência
na força, hipertrofia e na
potência

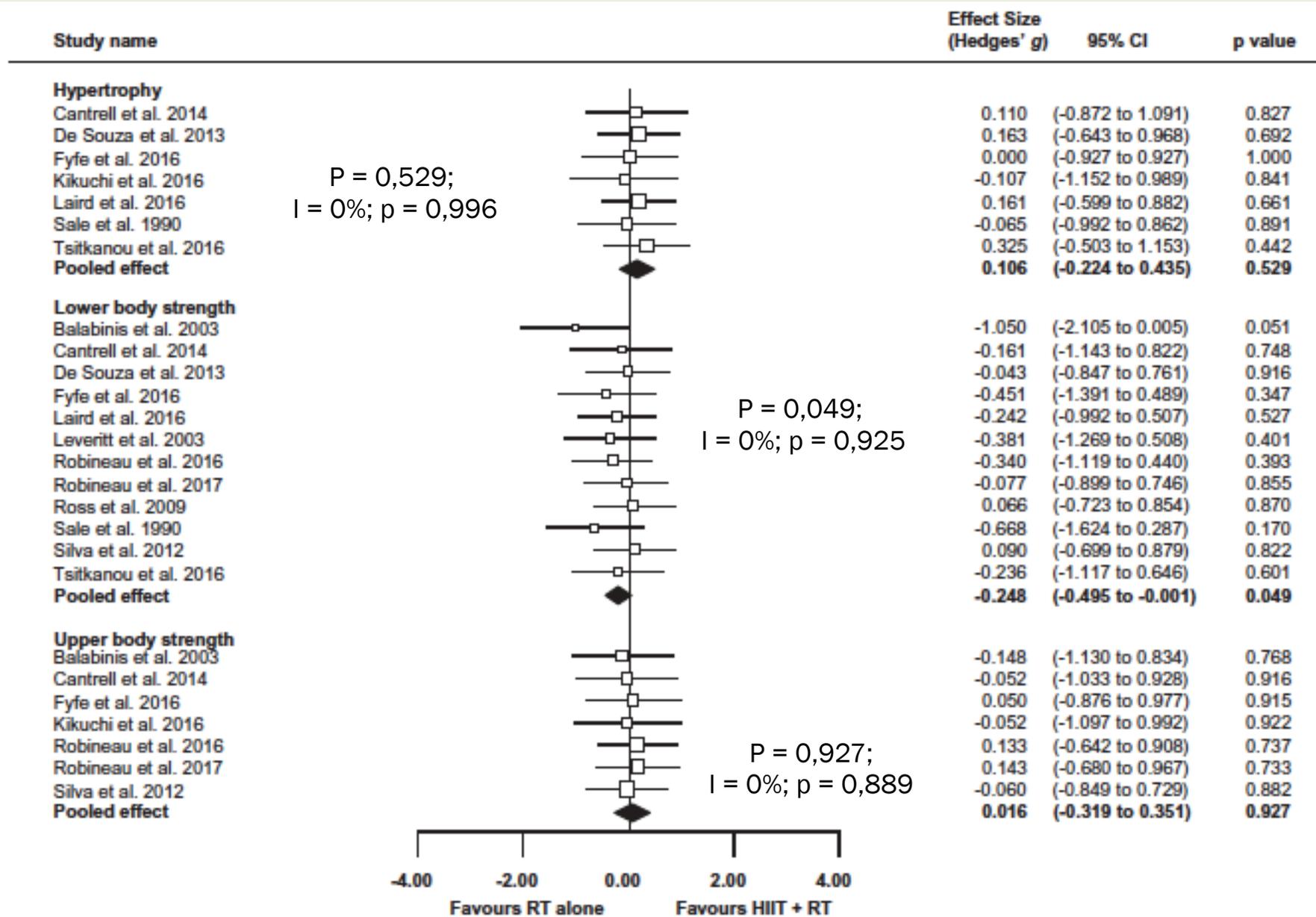
The compatibility of concurrent high intensity interval training and resistance training for muscular strength and hypertrophy: a systematic review and meta-analysis

Angelo Sabag, Abdolrahman Najafi, Scott Michael, Tuguy Esgin, Mark Halaki & Daniel Hackett

To cite this article: Angelo Sabag, Abdolrahman Najafi, Scott Michael, Tuguy Esgin, Mark Halaki & Daniel Hackett (2018) The compatibility of concurrent high intensity interval training and resistance training for muscular strength and hypertrophy: a systematic review and meta-analysis, Journal of Sports Sciences, 36:21, 2472-2483, DOI: [10.1080/02640414.2018.1464636](https://doi.org/10.1080/02640414.2018.1464636)

To link to this article: <https://doi.org/10.1080/02640414.2018.1464636>





Análises de sub-grupo – efeito na força

- Modo do exercício de *endurance*: tendência a efeito negativo no HIIT+cycling do que força isolada, sem diferença com HIIT+running
- Tendência para efeito mais negativo quando as sessões tinham intervalo de recuperação menor que 24h

Sports Medicine (2021) 51:991–1010

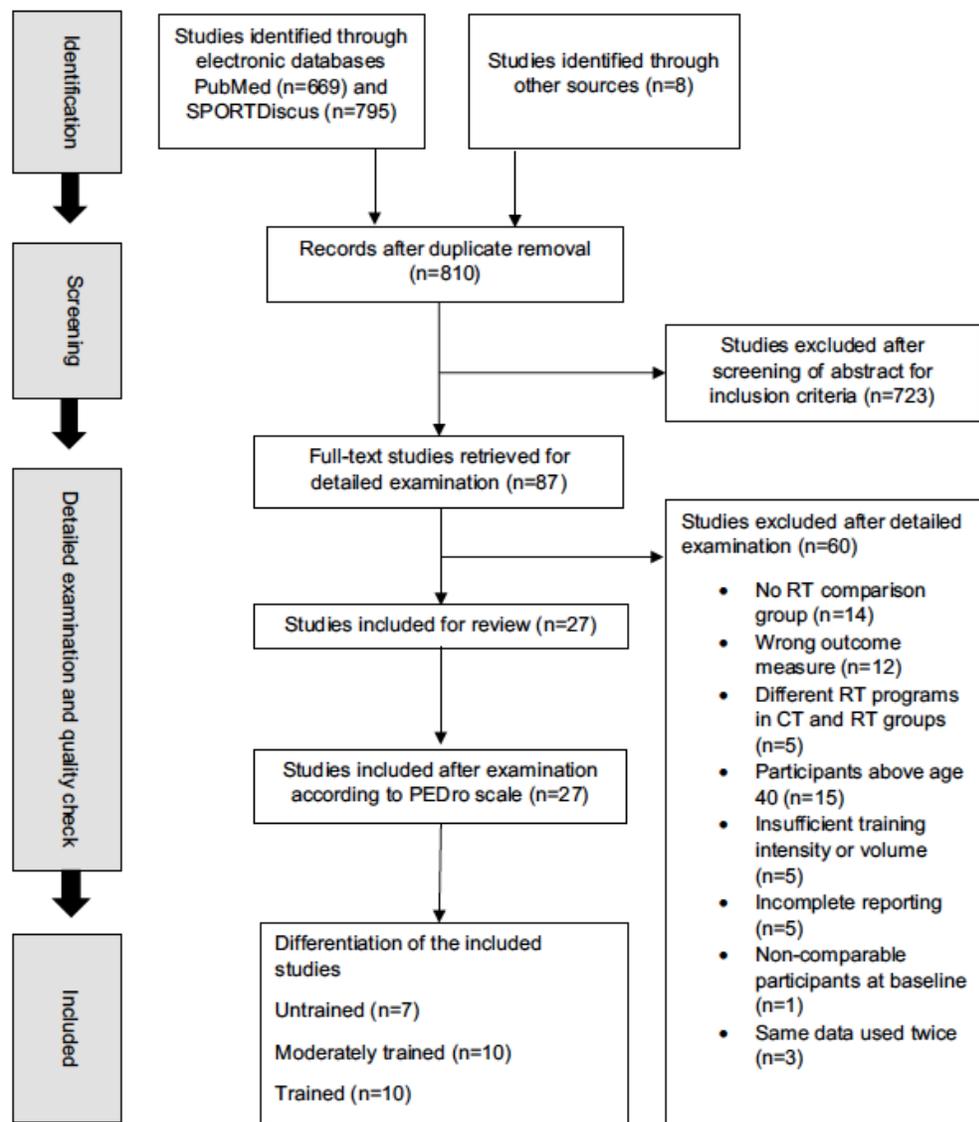
<https://doi.org/10.1007/s40279-021-01426-9>

SYSTEMATIC REVIEW



Development of Maximal Dynamic Strength During Concurrent Resistance and Endurance Training in Untrained, Moderately Trained, and Trained Individuals: A Systematic Review and Meta-analysis

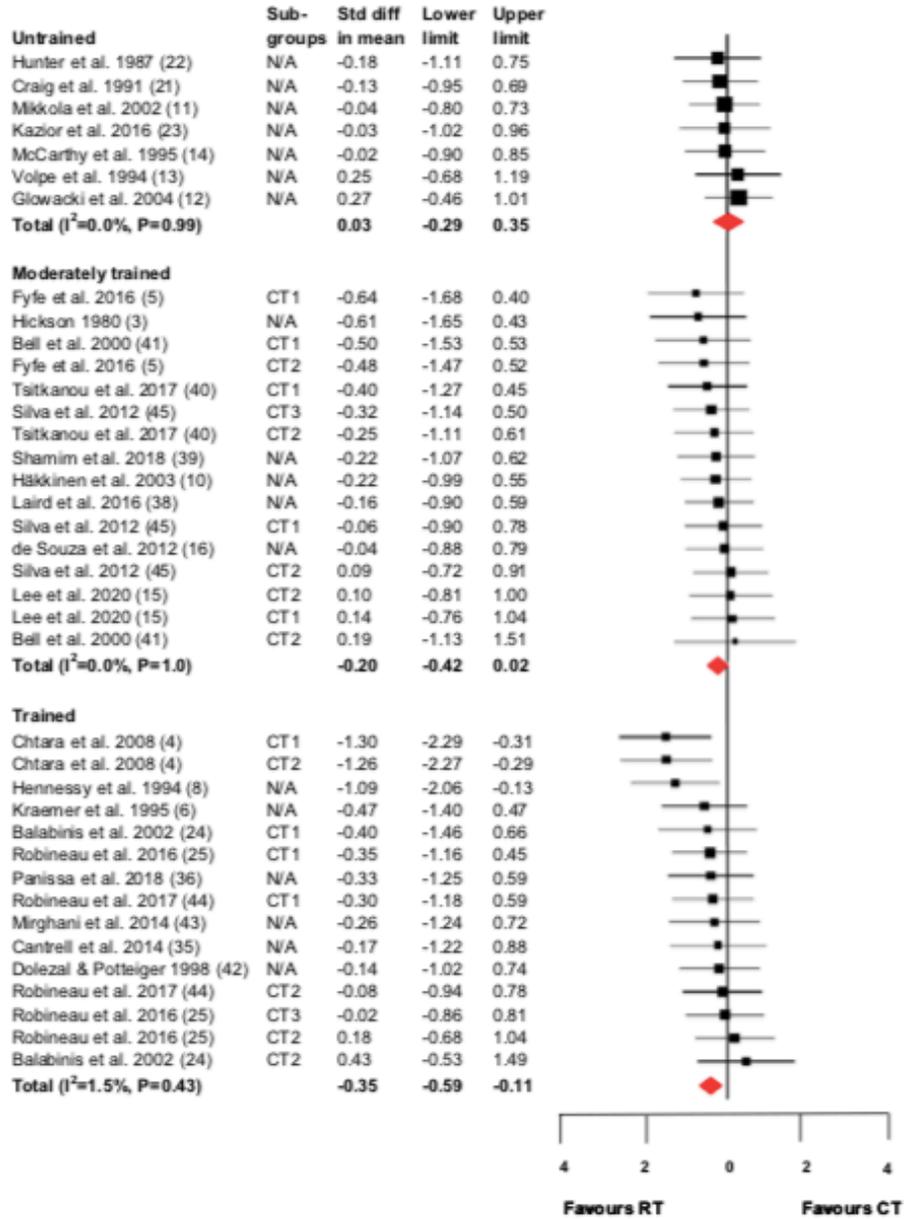
Henrik Petré¹ · Erik Hemmingsson² · Hans Rosdahl¹ · Niklas Psilander¹



- **Untrained:** individuals classified as untrained or sedentary by the author or who reported no involvement in regular physical activity for at least 3 months prior to the intervention period.
- **Moderately trained:** individuals classified as recreationally or physically active but not involved in a regular structured training programme for at least 3 months prior to the intervention period.
- **Trained:** individuals classified as athletes or individuals who participated in regular structured training programmes for at least 3 months prior to the intervention period.

Study

Std diff in mean and 95% CI



TC - Força

TC - Força

2kg

1%

4kg

3%

6kg

5%

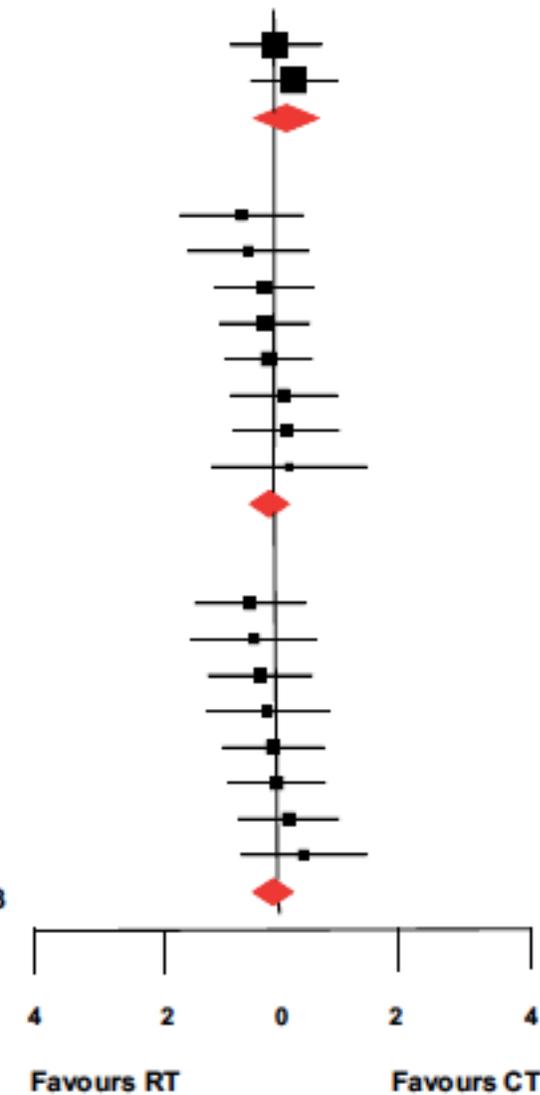
Destreinado

Treinado

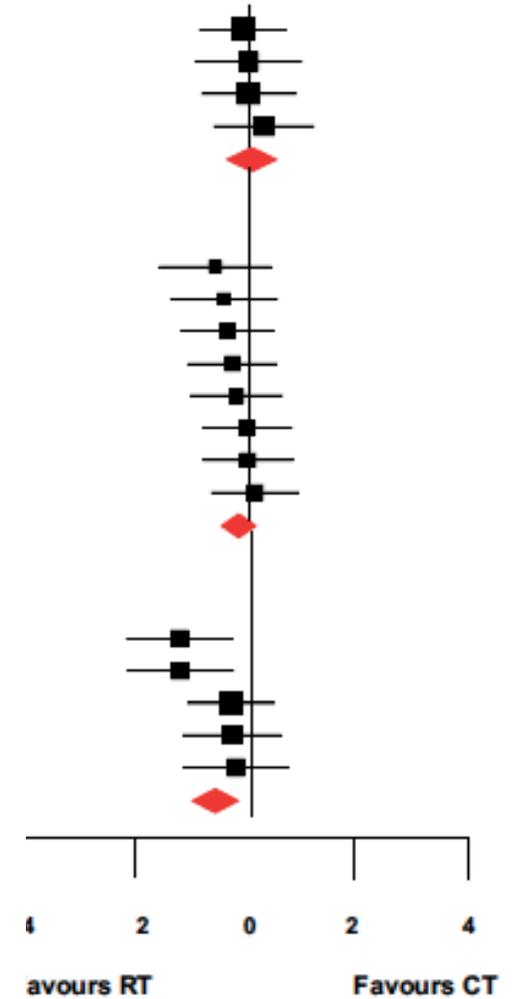
Study

	Sub-groups	Std diff in mean	Lower limit	Upper limit
Untrained				
Mikkola et al. 2002 (11)	N/A	-0.04	-0.80	0.73
Glowacki et al. 2004 (12)	N/A	0.27	-0.46	1.01
Total ($I^2=0.0\%$, $P=0.57$)		0.12	-0.41	0.65
Moderately trained				
Hickson 1980 (3)	N/A	-0.61	-1.65	0.43
Bell et al. 2000 (41)	CT1	-0.50	-1.53	0.53
Shamim et al. 2018 (39)	N/A	-0.22	-1.07	0.62
Häkkinen et al. 2003 (10)	N/A	-0.22	-0.99	0.55
Laird et al. 2016 (38)	N/A	-0.16	-0.90	0.59
Lee et al. 2020 (15)	CT2	0.10	-0.81	1.00
Lee et al. 2020 (15)	CT1	0.14	-0.76	1.04
Bell et al. 2000 (41)	CT2	0.19	-1.13	1.51
Total ($I^2=0.0\%$, $P=0.95$)		-0.16	-0.48	0.16
Trained				
Kraemer et al. 1995 (6)	N/A	-0.47	-1.40	0.47
Balabinis et al. 2002 (24)	CT1	-0.40	-1.46	0.66
Robineau et al. 2017 (44)	CT1	-0.30	-1.18	0.59
Cantrell et al. 2014 (35)	N/A	-0.17	-1.22	0.88
Robineau et al. 2017 (44)	CT2	-0.08	-0.94	0.78
Robineau et al. 2016 (25)	CT3	-0.02	-0.86	0.81
Robineau et al. 2016 (25)	CT2	0.18	-0.68	1.04
Balabinis et al. 2002 (24)	CT2	0.43	-0.53	1.49
Total ($I^2=0.0\%$, $P=0.93$)		-0.10	-0.43	-0.23

Std diff in mean and 95% CI



Std diff in mean and 95% CI



Sports Medicine (2021) 51:599–605
<https://doi.org/10.1007/s40279-020-01421-6>

LEADING ARTICLE

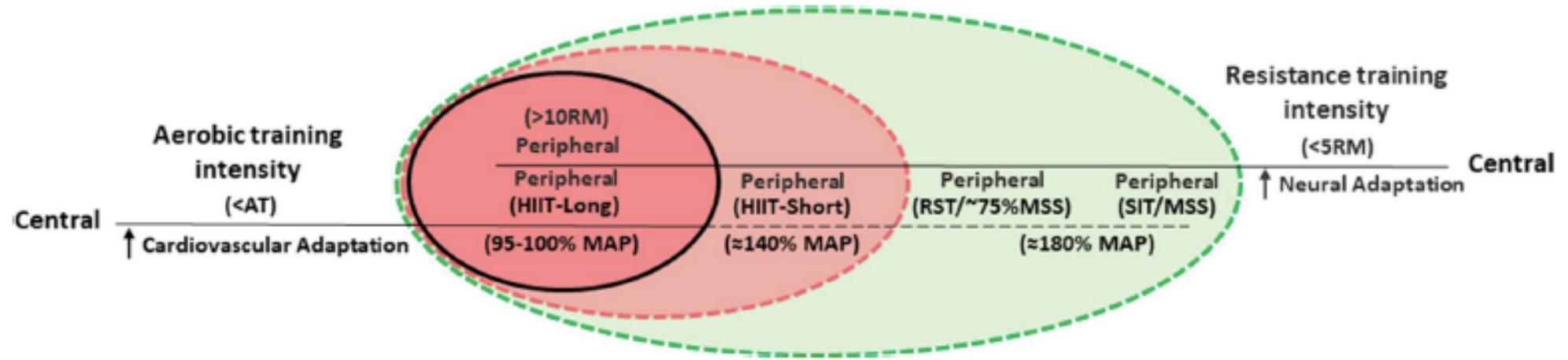


Interference Phenomenon with Concurrent Strength and High-Intensity Interval Training-Based Aerobic Training: An Updated Model

Felipe C. Vechin^{1,2}  · Miguel S. Conceição¹ · Guilherme D. Telles¹ · Cleiton A. Libardi² · Carlos Ugrinowitsch¹

Accepted: 20 December 2020 / Published online: 6 January 2021

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Concluindo sobre efeito crônico

- O volume de treinamento “aeróbio/resistência” apresenta consistência como importante influenciador na interferência do desenvolvimento da força e hipertrofia
- **Baixa quantidade de estudos com hipertrofia**
- Ordem de execução e intervalo de recuperação são importantes
- Prioridade na adaptação aeróbia
- Mais treinados estão mais suscetíveis

Treinamento concorrente

O fenômeno da interferência do exercício **AERÓBIO** nos ganhos de **FORÇA MÁXIMA** existe?

SIM

Porque isso acontece?

Efeitos agudos

Efeitos crônicos

Quando o exercício aeróbio é realizado primeiro que o força o desempenho diminui e em longo prazo pode ocasionar atenuação dos ganhos de força

A interferencia pode ocorrer pois o organismo pode ter competição nas adaptações

Como eliminar esse efeito ?

O que parece maximizar esse efeito?

Fazer a força primeiro

Volume aeróbio alto

Só vai ocorrer nos músculos que participarem de ambas atividades

Caso não seja possível e o aeróbio tenha que ser realizado primeiro existem algumas maneiras de atenuar a interferencia aguda no desempenho tais como:

Intervalo de recuperacao 4h

Creatina e Capsaicina

Pessoas mais treinadas são mais suscetíveis

Aeróbio com baixo volume

Aeróbio intensidade moderada

Correr é melhor que pedalar

Não há interferencia de braço com perna

Estudos de síntese apresentam atenuação 2 a 6kg na força máxima após 10 sem de TC





RUGBY



STRENGTH AND CONDITIONING AND CONCURRENT TRAINING PRACTICES IN ELITE RUGBY UNION

THOMAS W. JONES,¹ ANDREW SMITH,^{2,3} LINDSAY S. MACNAUGHTON,⁴ AND DUNCAN N. FRENCH^{5,6}

¹Department of Sports Science, ASPIRE Academy for Sports Excellence, Doha, Qatar; ²A S Strength and Conditioning Ltd, United Kingdom; ³Nottingham Rugby Club, Nottingham, United Kingdom; ⁴Health and Exercise Sciences Research Group, University of Stirling, Stirling, United Kingdom; ⁵Department of Sport, Exercise and Rehabilitation, Northumbria University, Newcastle upon Tyne, United Kingdom; and ⁶English Institute of Sport, Sportcity, Manchester, United Kingdom

Características do estudo

- Exigência de força e potência absoluta e relativa a massa corporal; jogadores correm aproximadamente 7km;
- Informações sobre testes e estrutura de treinamento envolvendo força e aeróbio a partir dos treinadores e outras pessoas ligadas ao treinamento;
- 43 de 54 responderam sendo apenas 2 do sexo feminino;

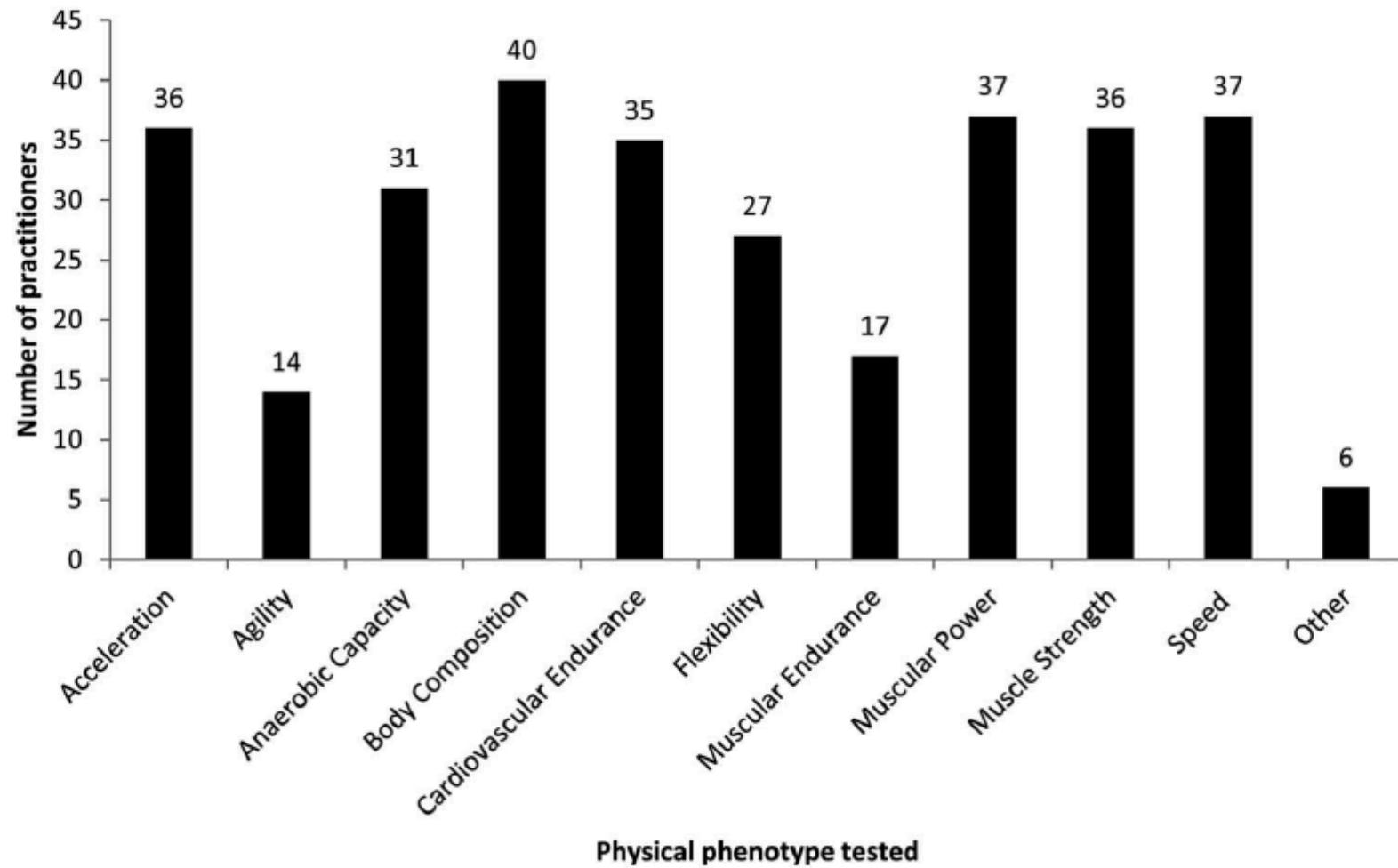


Figure 2. Physical phenotypes tested.

Treinamento de força na temporada

- Treinamento de força e potência é importante ?
 - *Sim*
- Utiliza estilo de levantamento olímpico?
 - *sim*
- Treinamento na temporada: Quantos dias por semana os atletas treinam força?
 - *35 reportaram 3 dias na semana*
- Volume de treino
 - *26 responderam 45 a 60 minutos*

Características do treino de velocidade

TABLE 7. Training methods used by coaches for speed development.

Higher-order themes	No. responses	Select raw data representing responses to this question
Unresisted (free) sprinting	25	Actual max speed running. Sprinting on a track. Free sprinting.
Plyometrics	13	Plyos. Plyometrics. Plyometric movements.
Sprint mechanics and technique	13	Running mechanics. Technical delivery. Technique development.
Resisted sprinting	13	Weighted sleds. Resisted accelerations. Sled and Bungee cord work.
Improving max strength	9	Max strength development. Increasing strength and power through weight training. Creating a high strength base.
Olympic lifts	4	Olympic lifts. Hang cleans.

Many respondents detailed more than 1 training method.

Concorrência é importante?

TABLE 9. Order of importance of programme variables when attempting to avoid any muting effect of endurance stimulus on strength/hypertrophic development (1 = most important, 5 = least important).

Programme variable	Order of importance, 1 = most important, 5 = least important (no. responses)				
	1	2	3	4	5
Periodization	18	4	3	3	11
Order of strength and endurance training	11	11	9	7	1
Volume of endurance training	6	12	11	6	4
Volume of strength training	2	2	8	16	11
Time between strength and endurance training	2	10	8	7	12

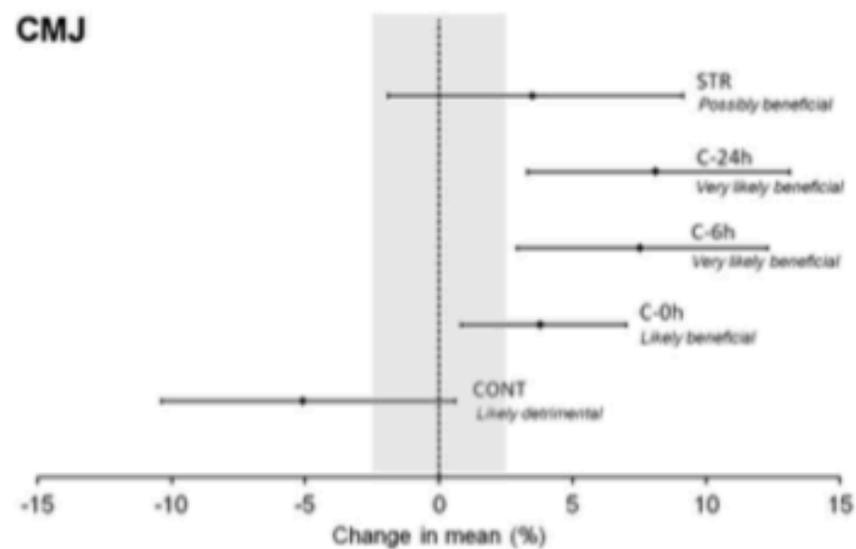
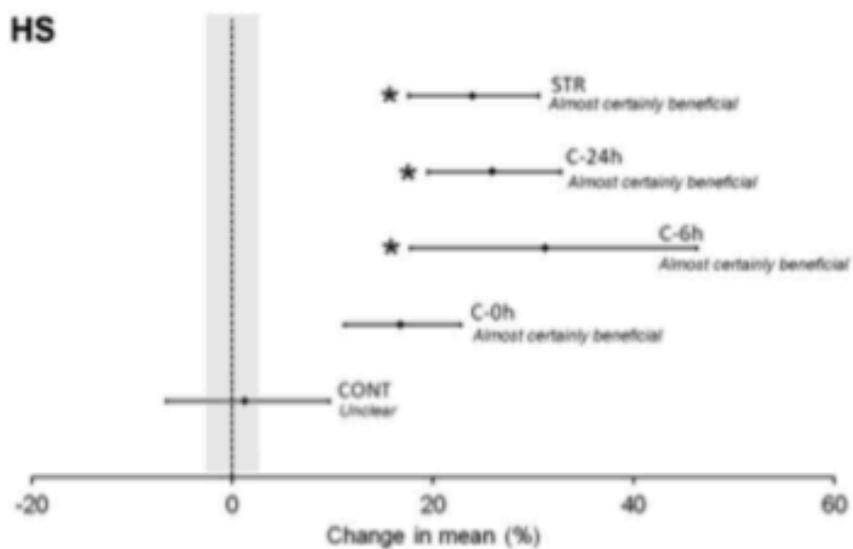
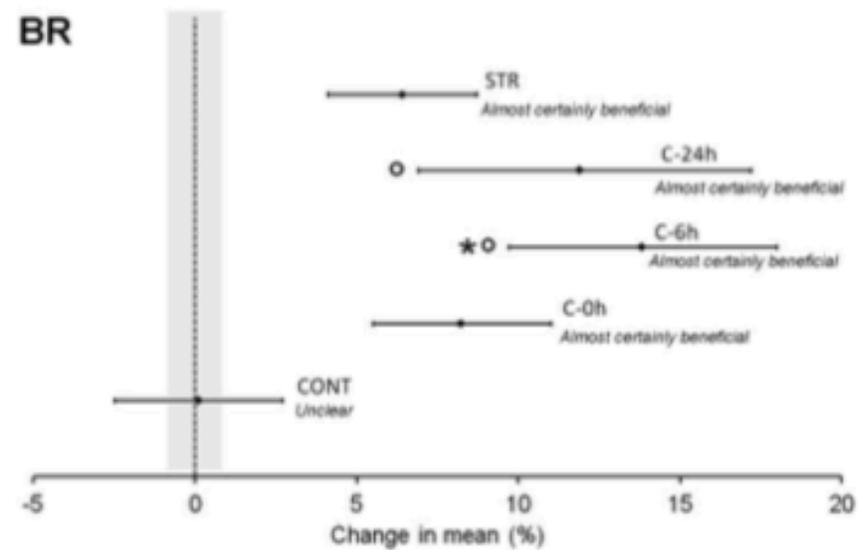
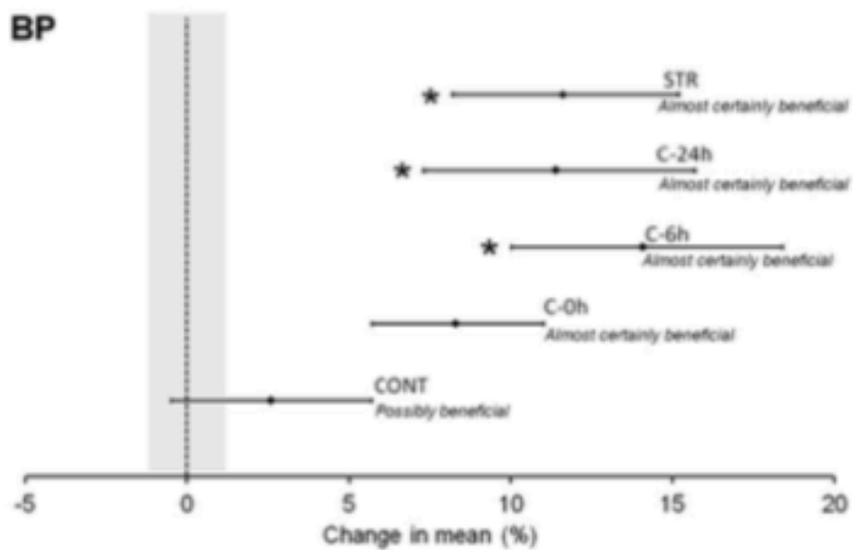
TABLE 4. Recovery time prescribed between strength training and rugby training and competitive matches.

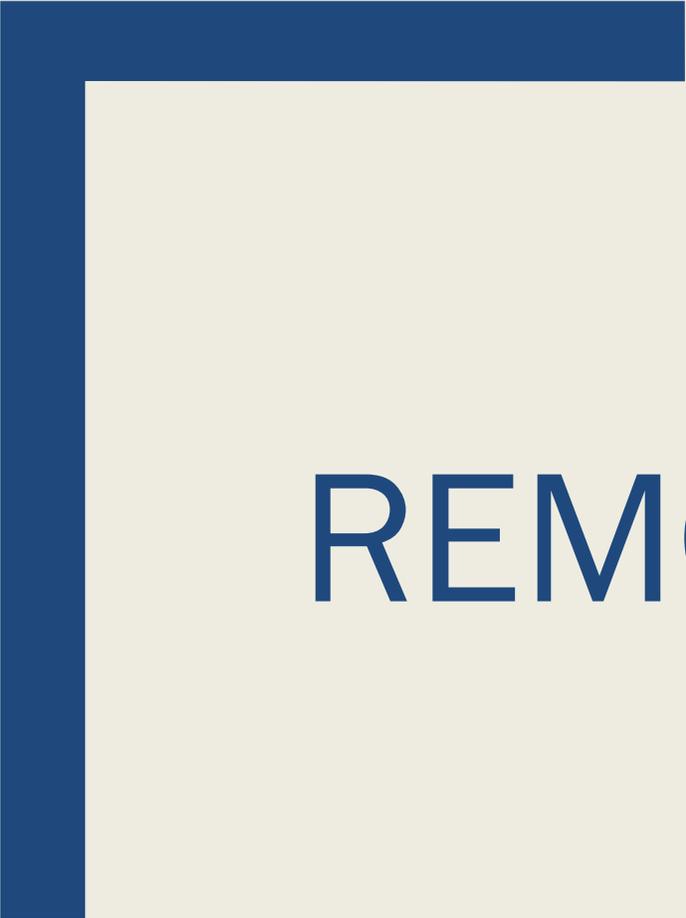
Question	Same day	24 h	36 h	48 h	>48 h
Time prescribed between Olympic style lifting session and high-quality rugby session	34	9	2	2	1
Time prescribed between general strength session and high-quality rugby session	31	8	4	5	0
Time prescribed between Olympic style lifting session and competitive rugby match	4	6	11	22	9
Time prescribed between general strength session and a competitive rugby match	1	4	11	20	14

SPECIFIC TRAINING EFFECTS OF CONCURRENT AEROBIC AND STRENGTH EXERCISES DEPEND ON RECOVERY DURATION

**JULIEN ROBINEAU,¹ NICOLAS BABAULT,^{2,3} JULIEN PISCIONE,¹ MATHIEU LACOME,¹ AND
ANDRÉ X. BIGARD⁴**

¹French Federation of Rugby Union, Department of research and development, Marcoussis, France; ²INSERM U1093, Faculty of Sport Sciences, Dijon, France; ³Center for performance and expertise, Dijon, France; and ⁴French Antidoping Agency, Paris, France





REMO E CANOAGEM



Strategies to Optimize Concurrent Training of Strength and Aerobic Fitness for Rowing and Canoeing

Jesús García-Pallarés^{1,2} and Mikel Izquierdo³

Periodização

Eur J Appl Physiol

DOI 10.1007/s00421-009-1061-2

ORIGINAL ARTICLE

Endurance and neuromuscular changes in world-class level kayakers during a periodized training cycle

**Jesús García-Pallarés · Luis Sánchez-Medina ·
Luis Carrasco · Arturo Díaz · Mikel Izquierdo**

Características

- 12 world-class, flat-water kayak paddlers (all of whom were finalists at the World Championships, including two Olympic gold-medalists)
- 12 anos de experiência (342 km volume anual)
- 12 semanas
- Teste incremental (VO₂max, PAM, VT₂)
- 1 RM e potência (maior velocidade com 45% de 1RM)
- Fase 1 = VTA e hipertrofia (5 semanas)
- Fase 2 = PAM, 1RM e velocidade em 45% de 1RM
- Fase 3 = treinos específico de ritmo de prova e esforço máximo
- Força primeiro ou intervalo de 6 a 8h entre as sessões

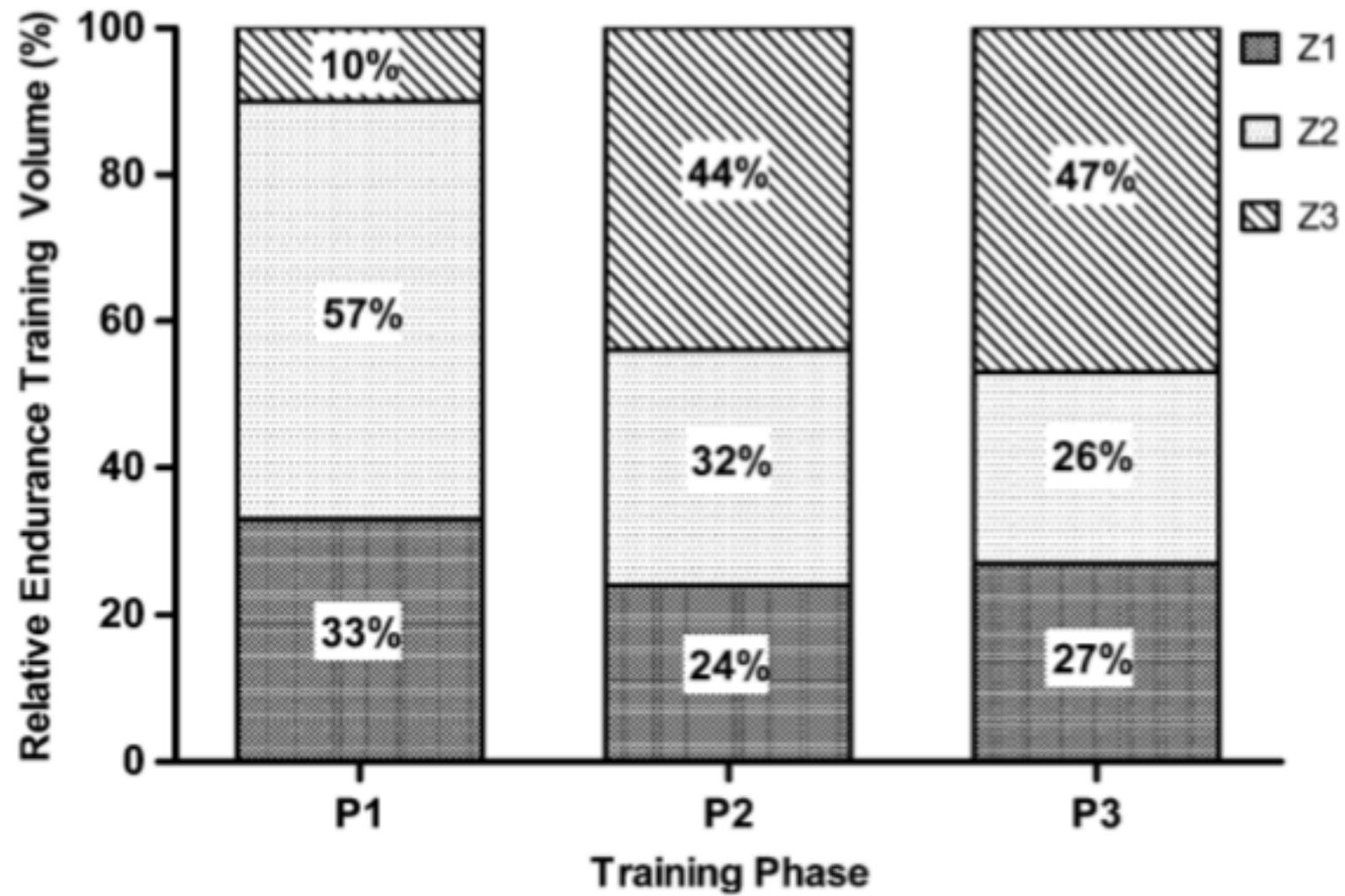
Table 2 Types and characteristics of resistance training

	Exercises	Sets	Repetitions	Load (%1RM)	Rest (min)
Hypertrophy	Bench press, prone bench pull, squat, shoulder press, pull ups	4–5	8–10	70–75	2
Maximal strength	Bench press, prone bench pull, squat	3–4	3–4	85–90	4
Maximal power	Bench press, prone bench pull	4–5	5–8 ^a	45	4

^a Each subject performed the maximum possible number of repetitions until mean concentric velocity dropped by more than 10% of the fastest repetition velocity within that set

Table 1 Description of the endurance training modes used for each intensity zone

Intensity zone	Total volume (min)	Sets	Repetitions	Work period (min)	Rest period (min)	Intensity (%VO _{2max})
Z1	70–120	1	1–3	20–90	1–3	70–80
Z2	40–90	1–4	1–10	5–20	1–4	80–90
Z3	20–60	2–5	4–8	1–8	2–8	90–100



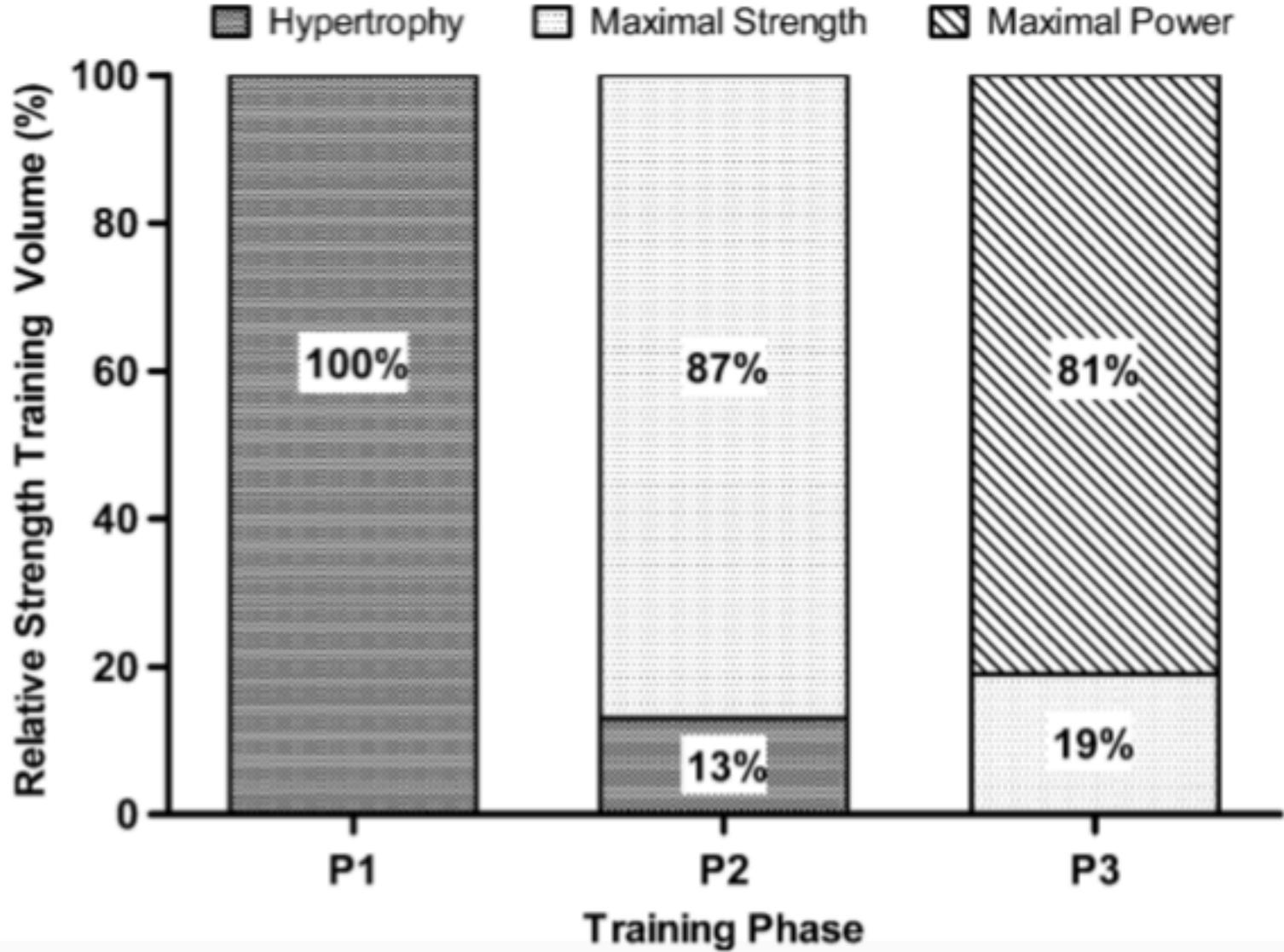


Table 4 Changes in selected physiological and performance variables across the 12-week training programme

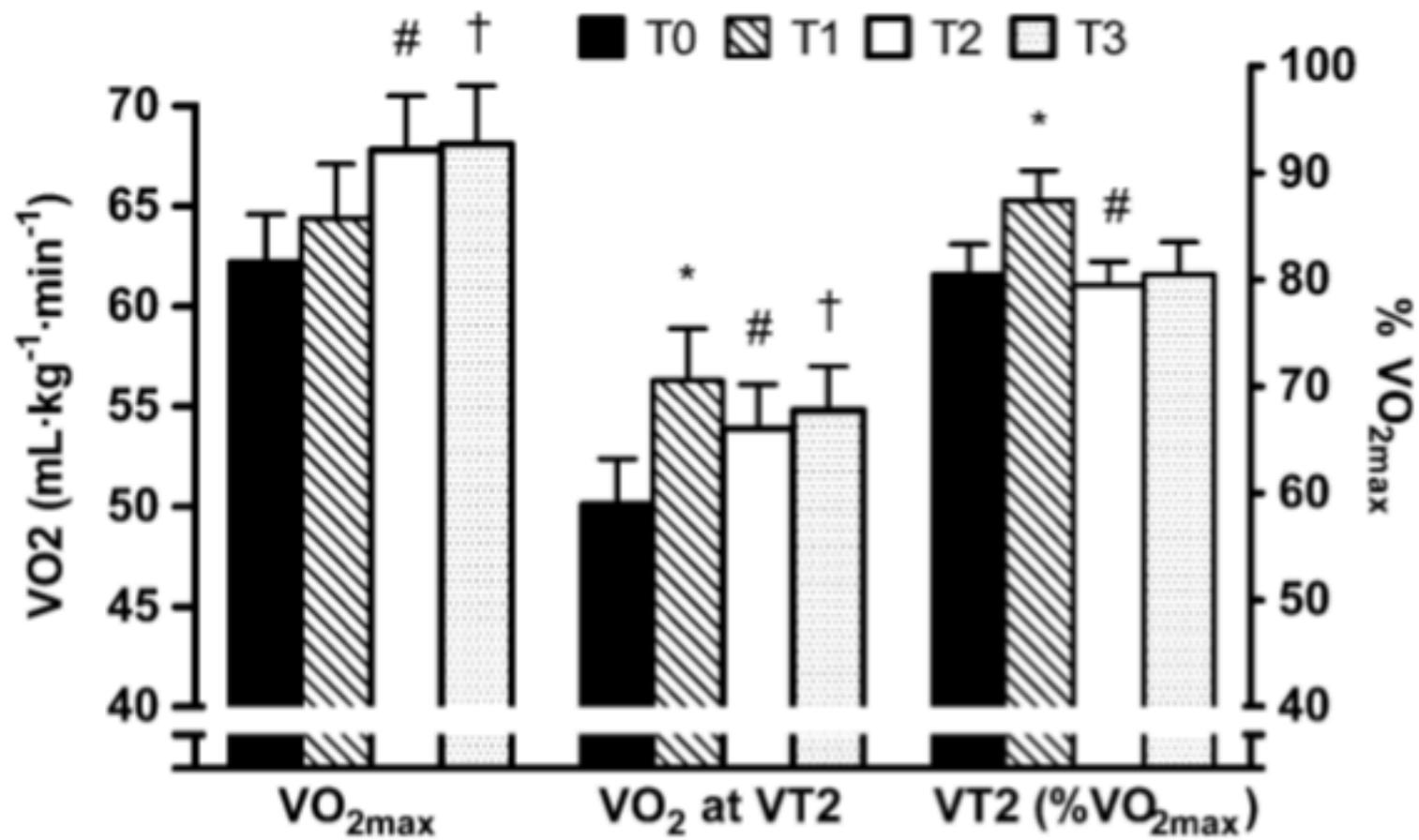
	T0	T1	T2	T3
PS _{max} (km h ⁻¹)	14.5 ± 0.3	14.8 ± 0.2*	15.1 ± 0.3	15.4 ± 0.2 ^{£†}
PS _{VT2} (km h ⁻¹)	13.6 ± 0.2	13.9 ± 0.2*	14.1 ± 0.2	14.2 ± 0.3 [†]
[La ⁻] _{peak} (mmol L ⁻¹)	12.5 ± 3.3	11.8 ± 2.5	12.8 ± 2.2	13.0 ± 2.8
HR _{max} (beats min ⁻¹)	194 ± 8	188 ± 8	189 ± 10	189 ± 7
HR _{VT2} (beats min ⁻¹)	175 ± 7	172 ± 7	171 ± 6	172 ± 6
SR _{max} (strokes min ⁻¹)	104 ± 5	101 ± 9	101 ± 7	103 ± 8
SR _{VT2} (strokes min ⁻¹)	88 ± 4	84 ± 6	85 ± 5	85 ± 7

Data is expressed as mean ± SD

* Significantly different ($P < 0.05$) when comparing T0 to T1

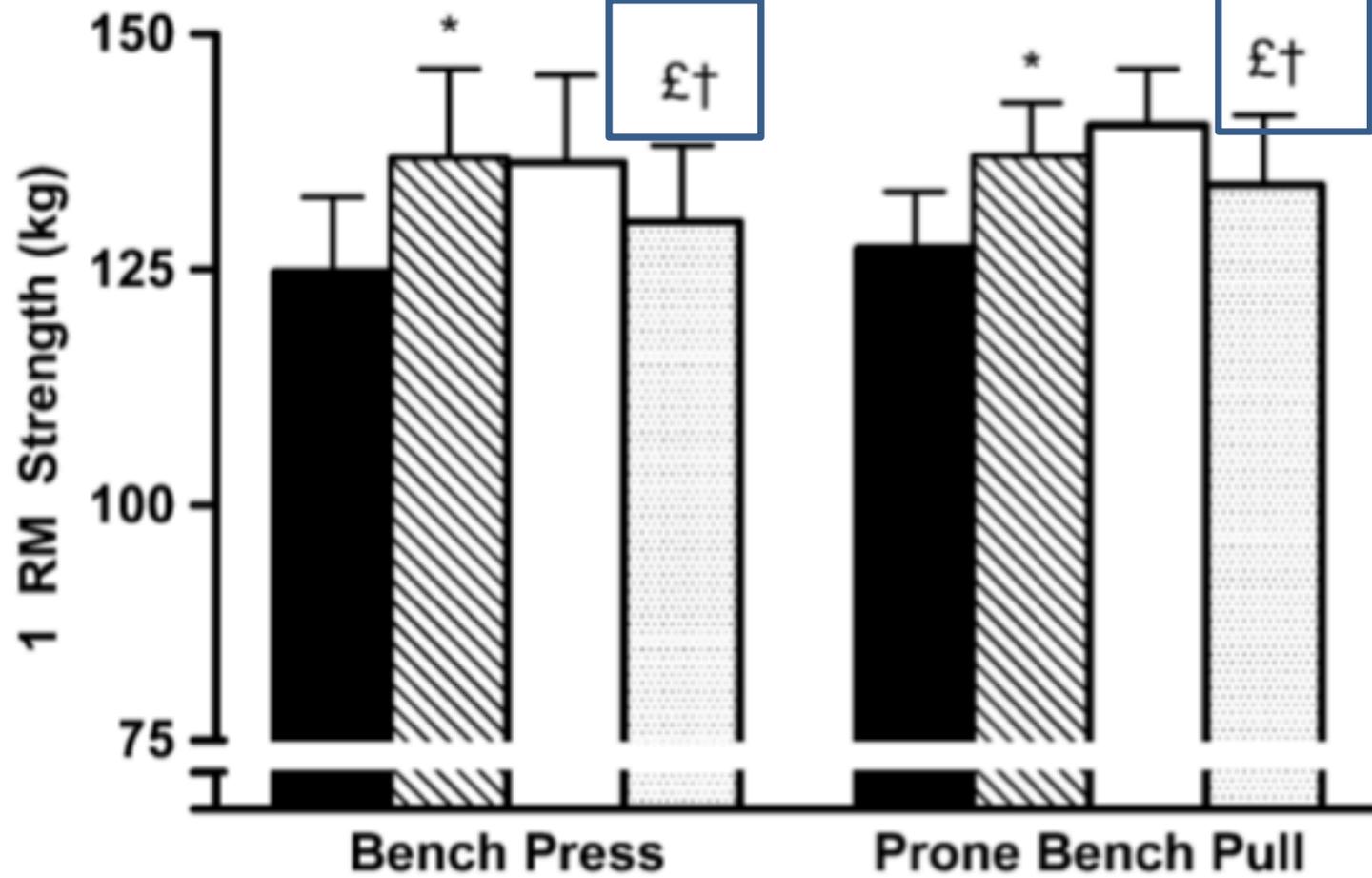
£ Significantly different ($P < 0.05$) when comparing T2 to T3

† Significantly different ($P < 0.05$) when comparing T0 to T3



(a)

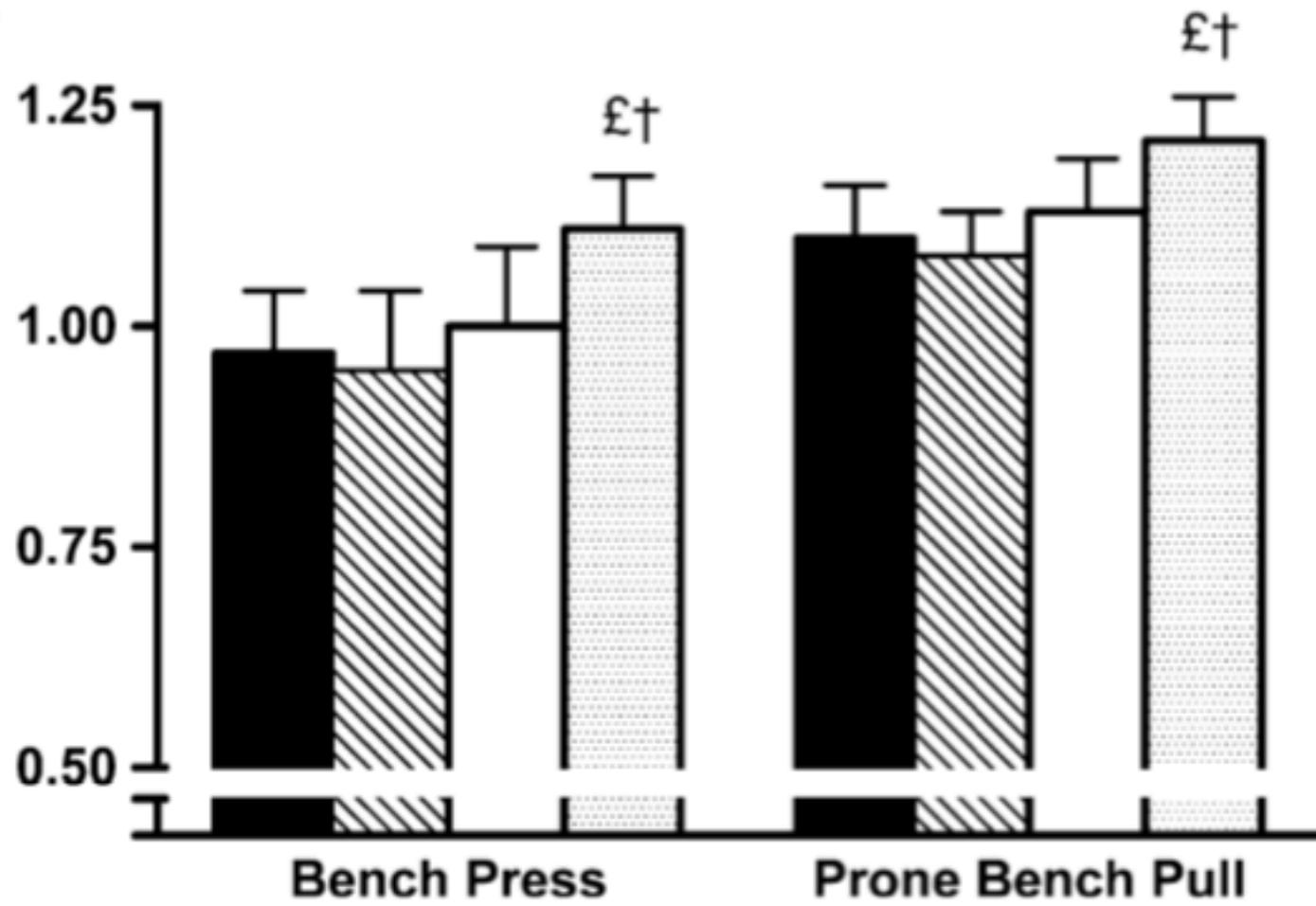
■ T0 ▨ T1 □ T2 ▩ T3



4,5%

(b)

Velocity with 45% 1RM ($\text{m}\cdot\text{s}^{-1}$)

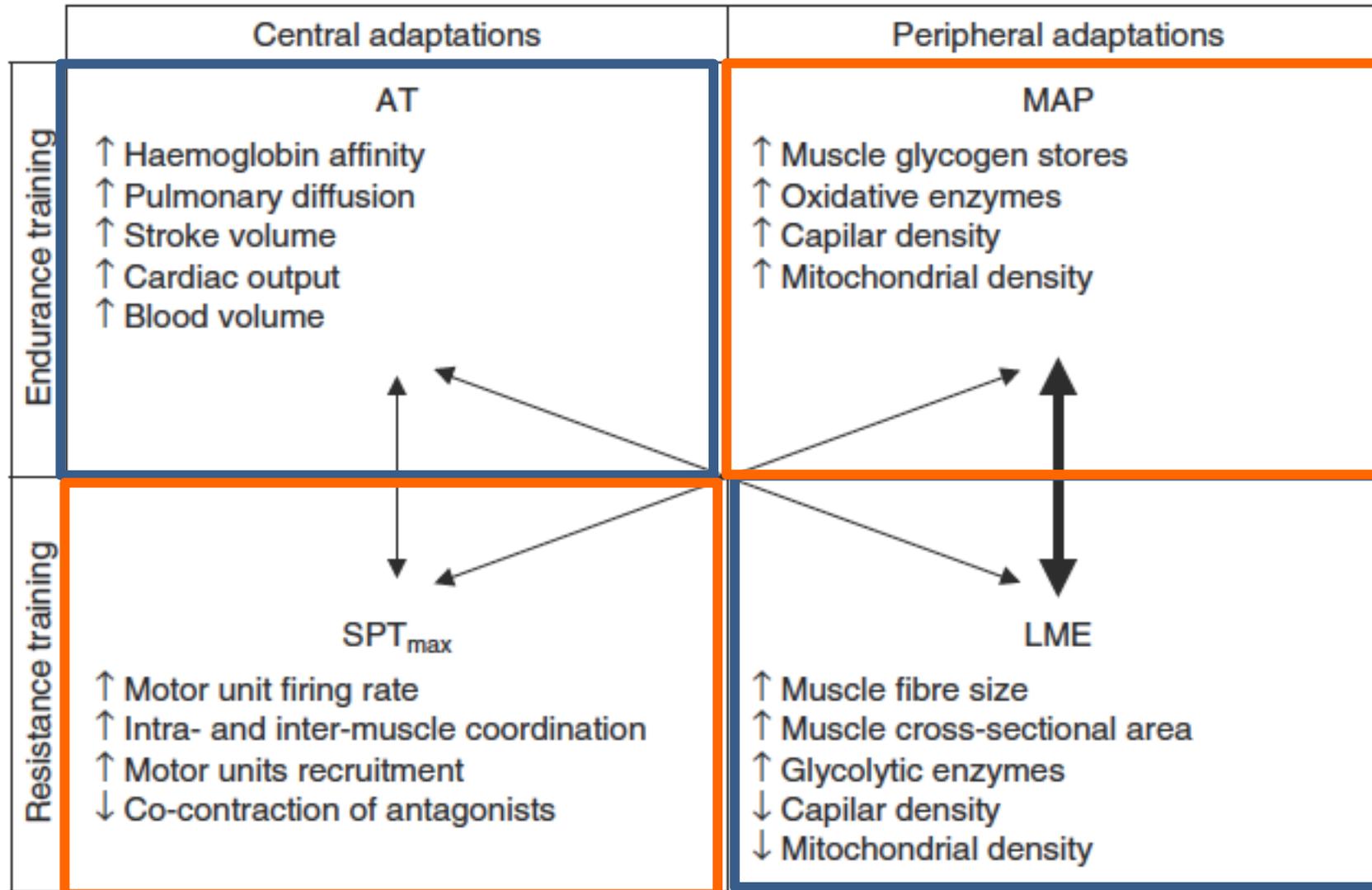


Volume e frequência de treino

- Não exceder 3 treinos por semana
- 3 a 5 séries
- 4 a 6 exercícios específicos e multiarticulares
- Ciclo de 10 a 12 semanas

Combinação ótima

5 semanas
para cada
combinação



Sequência

- As sessões de força devem ser colocadas antes do treinamento aeróbio ou pelo menos separando dois tipos de treinamento por um intervalo de pelo menos 8 horas
- Realizando sessões de exercício aeróbio em intensidades submáximas principalmente sem focar em grupos específicos pode permitir que atletas alcancem adaptações centrais, enquanto os grupos musculares se recuperam para sessões subsequentes



OBRIGADA!

valeriapanissa@usp.br