PROGRAMA DE PÓS-GRADUAÇÃO
STRICTO SENSU – EDUCAÇÃO FÍSICA

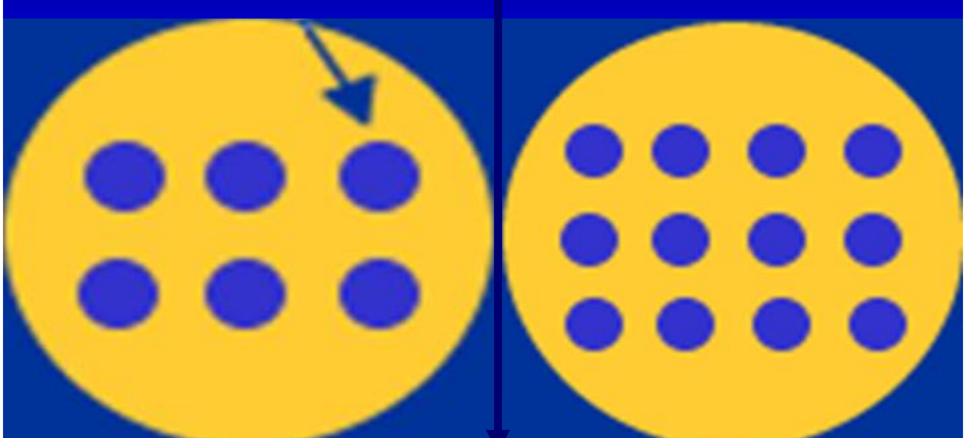
Universidade Católica de Brasília

TREINAMENTO DE FORÇA PARA A SAÚDE E O DESEMPENHO

PROF. DR. JONATO PRESTES

HIPERTROFIA

Transitória/Sarcoplasmática	Crônica/Miofibrilar
Durante a execução do exercício	Mudança estrutural na musculatura esquelética



Pflugers Arch - Eur J Physiol (2008) 456:587–600
DOI 10.1007/s00424-007-0423-z

SKELETAL MUSCLE

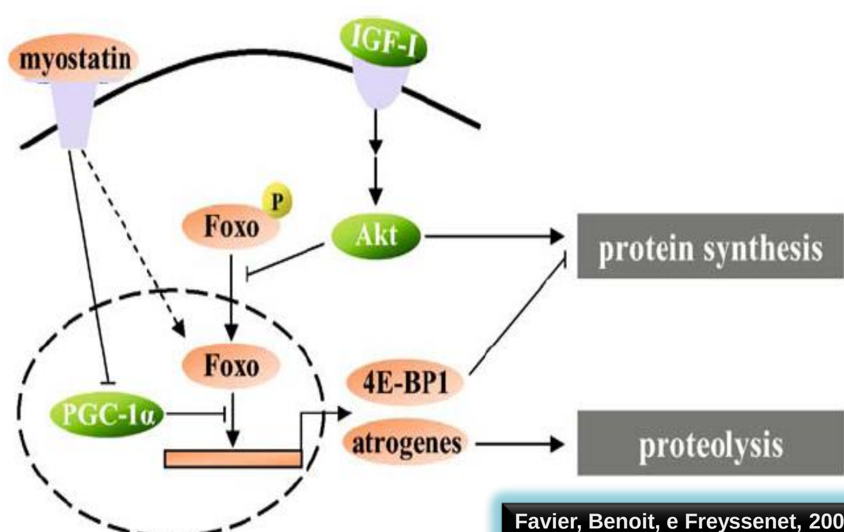
Cellular and molecular events controlling skeletal muscle mass in response to altered use

François B. Favier · Henri Benoit · Damien Freyssenet

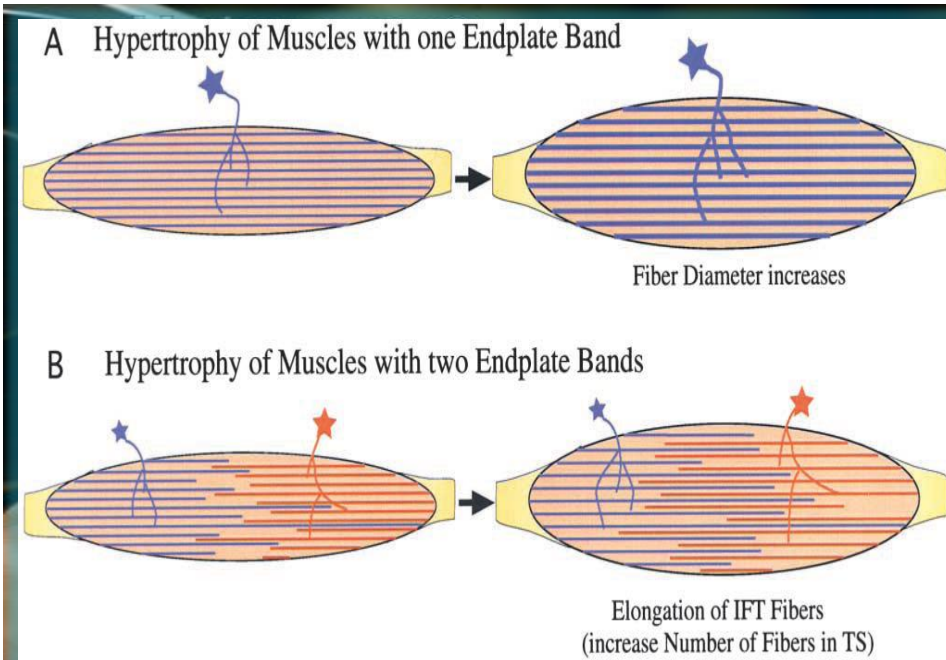
Pflugers Arch - Eur J Physiol (2008) 456:587–600

Eventos moleculares e celulares que controlam a massa muscular

VIAS ANABÓLICAS E CATABÓLICAS



Favier, Benoit, e Freyssenet, 2008



Paul e Rosenthal, 2002

Review : Physiology

Training-Induced Changes in Muscle Architecture

The Effects of Strength Training on Muscle Architecture in Humans

Yasuo Kawakami*

[International Journal of Sport and Health Science Vol.3, 208-217, 2005]

EFEITOS DO TF SOBRE A ARQUITETURA MUSCULAR EM HUMANOS

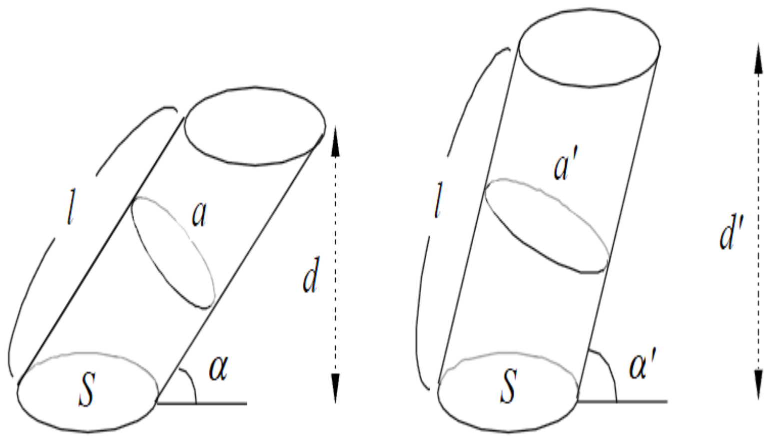


Figure 3 A model of muscle fiber architectural change as a result of hypertrophy (Kawakami, 2002). Left, pre-training, right, post-training. *a*: cross-sectional area of a muscle fiber, *α*: pennation angle, *l*: muscle fiber length, *S*: the area of aponeuroses occupied by the muscle fiber, *d*: distance between aponeuroses

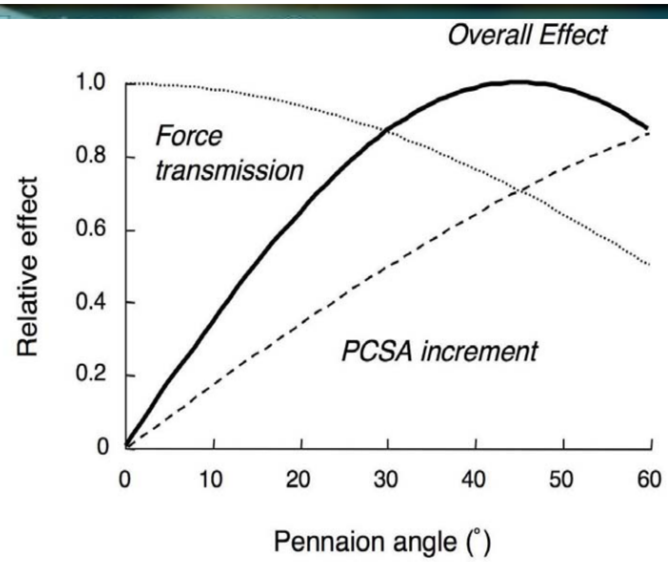
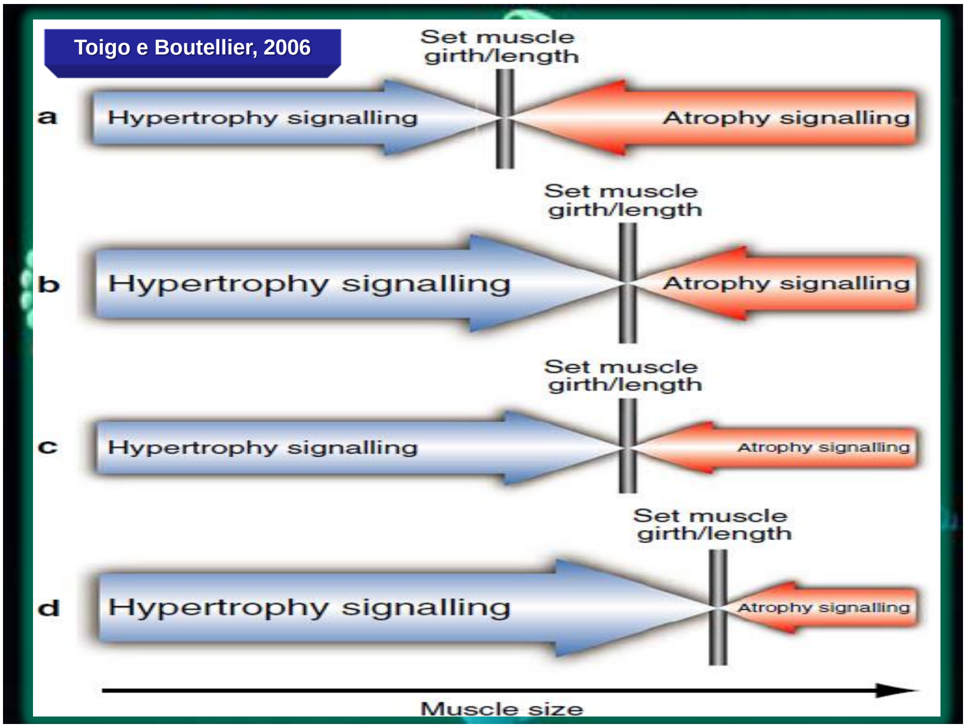


Figure 4 Positive and negative effects of pennation angles (based on Alexander & Vernon, 1975). As the pennation angle increases, the physiological cross-sectional area (PCSA) increases, but force transmission from muscle fibers to tendon decreases. These two factors result in an overall effect.



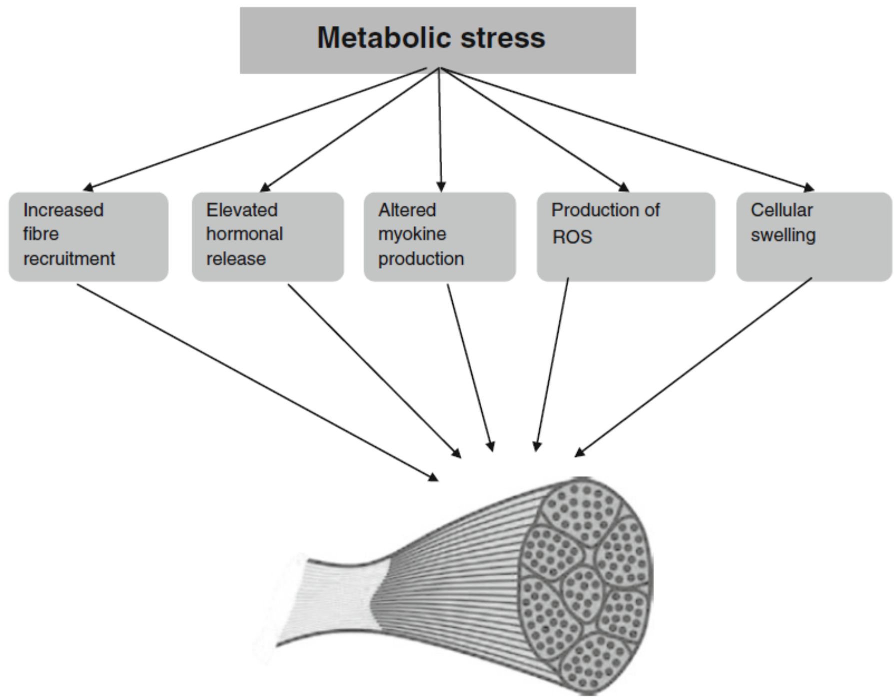
Sports Med (2013) 43:179–194
DOI 10.1007/s40279-013-0017-1

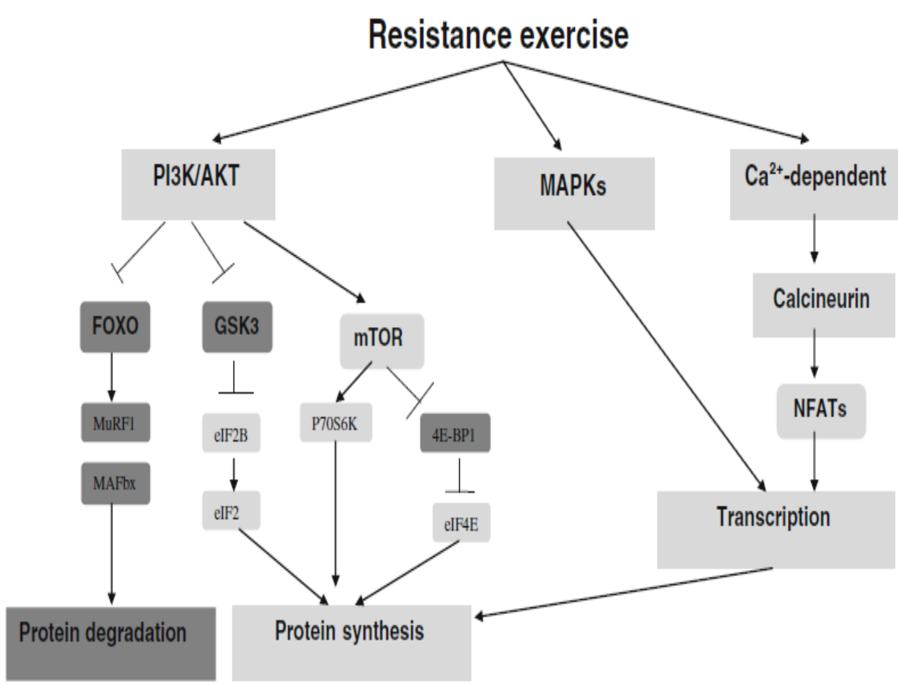
REVIEW ARTICLE

Potential Mechanisms for a Role of Metabolic Stress in Hypertrophic Adaptations to Resistance Training

Brad J. Schoenfeld

POTENCIAIS MECANISMOS SOBRE O PAPEL DO ESTRESSE METABÓLICO NAS ADAPTAÇÕES HIPERTRÓFICAS AO TF


Metabolic stress
Increased fibre recruitment
Elevated hormonal release
Altered myokine production
Production of ROS
Cellular swelling


Resistance exercise
PI3K/AKT
MAPKs
Ca2+-dependent
FOXO
GSK3
mTOR
Calcineurin
MuRF1
MAFbx
eIF2B
eIF2
P70S6K
4E-BP1
eIF4E
NFATs
Transcription
Protein degradation
Protein synthesis

OPEN ACCESS Freely available online PLOS ONE

Muscular and Systemic Correlates of Resistance Training-Induced Muscle Hypertrophy

Cameron J. Mitchell[1], Tyler A. Churchward-Venne[1], Leeann Bellamy[1], Gianni Parise[1], Steven K. Baker[2], Stuart M. Phillips[1*]

1 Exercise Metabolism Research Group, Department of Kinesiology, McMaster University, Hamilton, Ontario, Canada, 2 Department of Neurology, School of Medicine, McMaster University, Hamilton, Ontario, Canada

October 2013 | Volume 8 | Issue 10 | e78636

RESPOSTA MUSCULAR E SISTÊMICA CORRELACIONADA A HIPERTROFIA INDUZIDA PELO TREINAMENTO DE FORÇA

METODOLOGIA

- **23 sujeitos jovens destreinados em força a pelo menos um ano**
- **16 semanas de TF para o corpo todo, 4 x semana, 4 blocos de 4 semanas – 3 x 12 reps depois 3 x 10, 4 x 8 reps e 4 x 6 reps.**

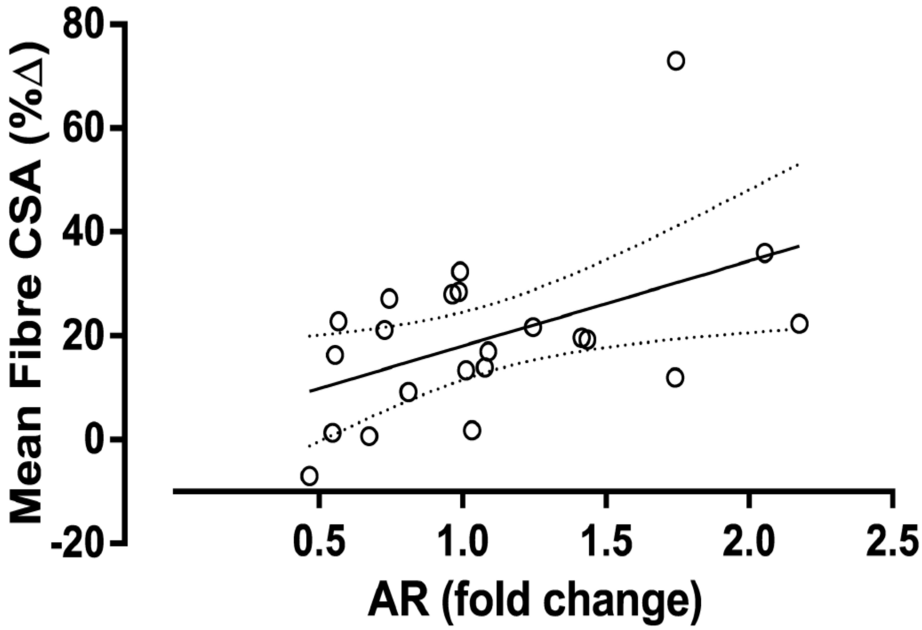


Figure 1. Correlation between the fold change in muscle AR protein content and changes in skeletal muscle fibre area following 16 weeks of resistance training. r = 0.60, P=0.003.

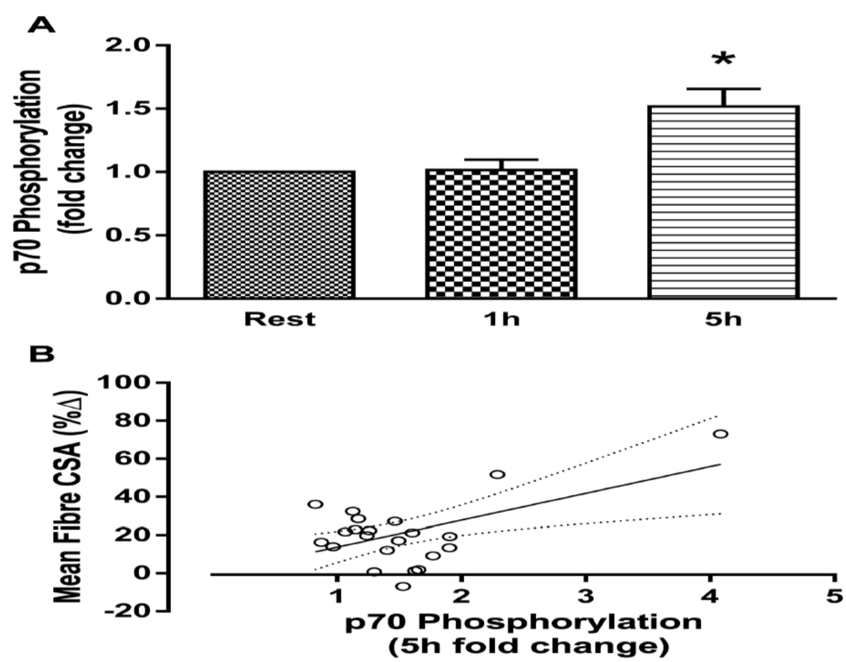


Figure 2. Phosphorylation of p70S6K following an acute bout of resistance exercise before 16 weeks of resistance training and the percentage change in skeletal muscle mean fibre area following the training * P < 0.05. A) Fold change in P70S6K phosphorylation. B) Correlation between 5h fold change in P70S6K phosphorylation and the percentage change in skeletal muscle mean fibre area following the training period. r = 0.54, P = 0.007.

doi: 10.1371/journal.pone.0078636.g002

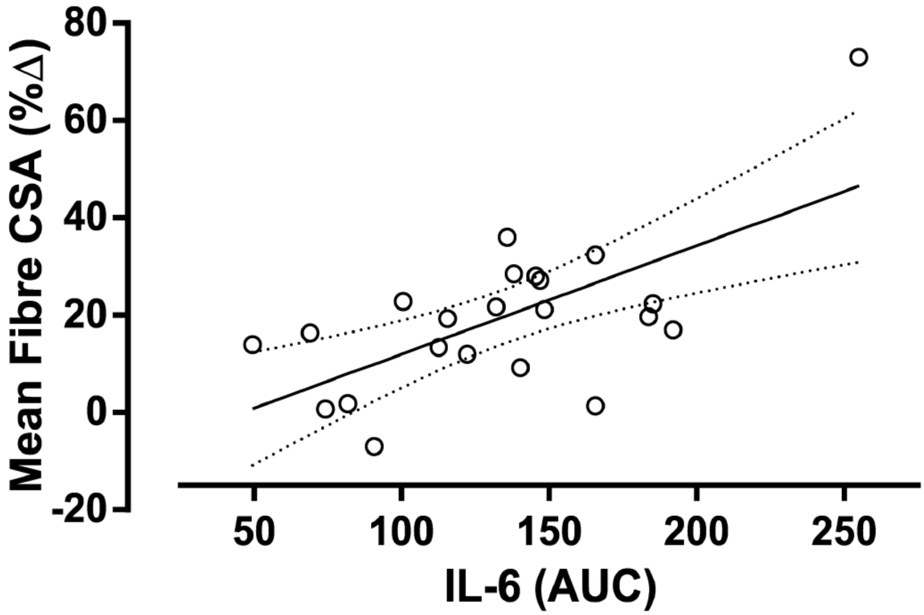


Figure 3. Correlation between the AUC of the acute IL-6 response to resistance exercise before 16 weeks of resistance training and the percentage change in skeletal muscle mean muscle fibre area following 16 weeks of resistance training. r=0.48, P = 0.019.

Biochemical and Biophysical Research Communications 450 (2014) 1089–1094

Contents lists available at ScienceDirect

Biochemical and Biophysical Research Communications

journal homepage: www.elsevier.com/locate/ybbrc

ELSEVIER

The myokine decorin is regulated by contraction and involved in muscle hypertrophy

CrossMark

Timo Kanzleiter [a,b], Michaela Rath [a,b], Sven W. Görgens [b,c], Jørgen Jensen [d], Daniel S. Tangen [d], Anders J. Kolnes [e], Kristoffer J. Kolnes [d,e], Sindre Lee [f], Jürgen Eckel [b,c], Annette Schürmann [a,b], Kristin Eckardt [b,c,f,*]

[a] Department of Experimental Diabetology, German Institute of Human Nutrition, Potsdam-Rehbrücke, Germany
[b] German Center for Diabetes Research, Germany
[c] Paul-Langerhans-Group for Integrative Physiology, German Diabetes Center, Düsseldorf, Germany
[d] Department of Physical Performance, Norwegian School of Sport Sciences, Oslo, Norway
[e] Third Faculty of Medicine, Charles University, Prague, Czech Republic
[f] Department of Nutrition, Institute for Basic Medical Sciences, University of Oslo, Oslo, Norway

The Muscle Pump: Potential Mechanisms and Applications for Enhancing Hypertrophic Adaptations

VOLUME 0 | NUMBER 0 | MONTH 2013

Brad J. Schoenfeld, MSc, CSCS, CSPS, NSCA-CPT[1] and Bret Contreras, MA[2]
[1]Department of Health Sciences, Program of Exercise Science, City University of New York, Lehman College, New York, New York; and
[2]Department of Sport Performance, Auckland University of Technology, Auckland, New Zealand

Strength and Conditioning Journal | www.nsca-scj.com

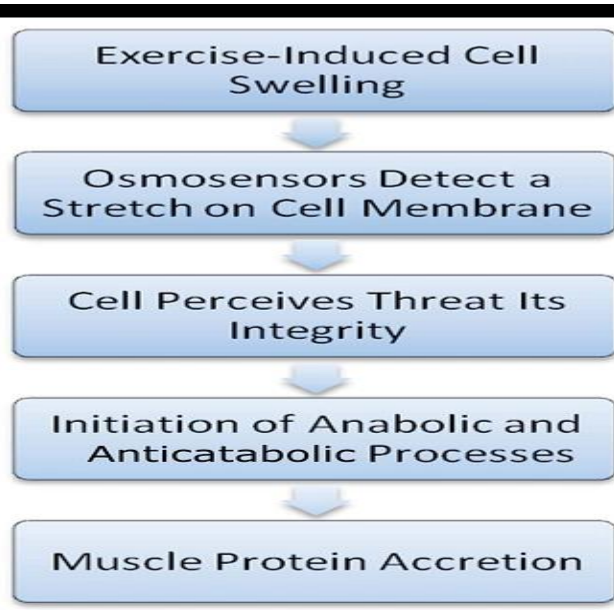


Figure. Theoretical schematic for cellular swelling mechanisms of action on muscle hypertrophy.

Eur J Appl Physiol
DOI 10.1007/s00421-015-3243-4

ORIGINAL ARTICLE

Published online: 18 August 2015

Early resistance training-induced increases in muscle cross-sectional area are concomitant with edema-induced muscle swelling

Felipe Damas[1] · Stuart M. Phillips[2] · Manoel E. Lixandrão[1] · Felipe C. Vechin[1] · Cleiton A. Libardi[3] · Hamilton Roschel[1] · Valmor Tricoli[1] · Carlos Ugrinowitsch[1]

O aumento inicial na área de secção-transversal induzido pelo treinamento está associado com o inchaço muscular

10 homens jovens fisicamente ativos

Treinamento de 10 sem - 2 x sem:

3 x leg press 45º e 3 x extensão dos joelhos bilateral

9-12RM – 1 min e 30 s de intervalo

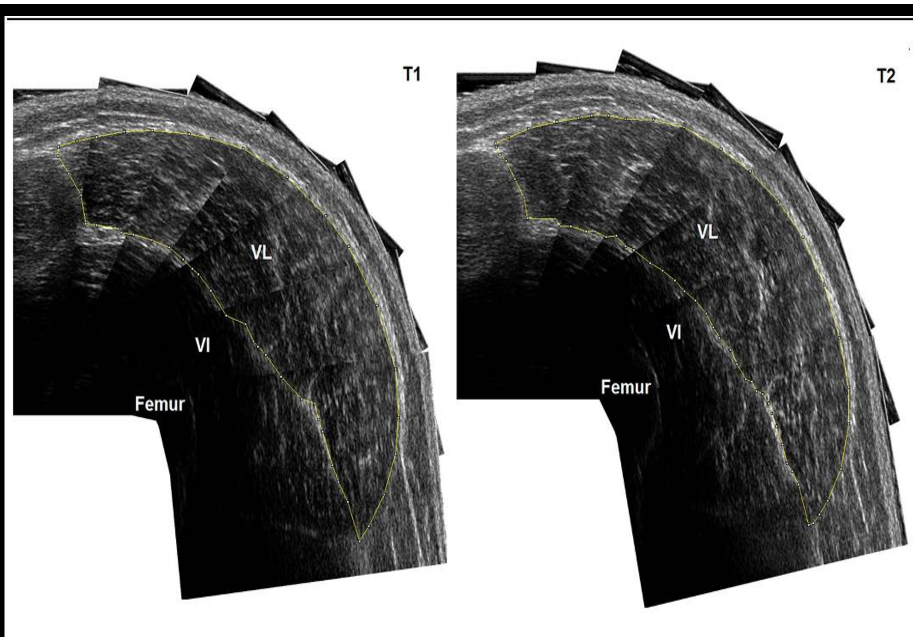
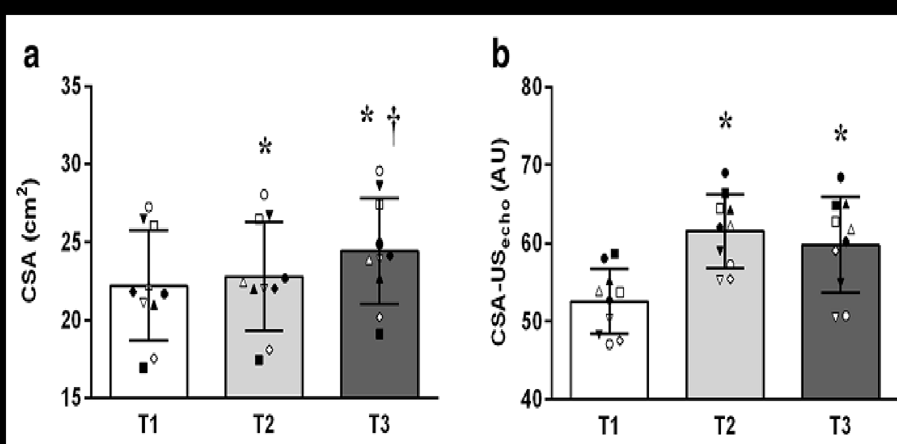


Fig. 1 Representative images from the vastus lateralis (VL) muscle used for cross-sectional area and ultrasound echo-intensity measurements assessed at the first week (T1) and third week (T2) of the training period. *VI* vastus intermedius muscle



conditioning fundamentals

German Volume Training: An Alternative Method of High Volume-Load Training For Stimulating Muscle Growth

Daniel Baker, PhD, CSCS

nsca's performance training journal • www.nsca-lift.org • volume 8 issue 1

GVT complex #1 (Bench press emphasis)		
Exercise	**Sets x Reps**	**Intensity**
1a. Bench press	10 x 10	Start at 60% 1RM Rest 20 – 30 s
1b. Incline Dumbbell row	10 x 10	20RM Rest 20-30 s
1c. Abdominal curl-up	10 x 10	Bodyweight, take 3-s for each rep Rest till 3-minute mark and repeat complex.
GVT complex #2 (Pull-up emphasis)		
1a. Pull-up	10 x 10	Bodyweight Rest 20 – 30 s
1b. Dumbbell press	10 x 10	20RM Rest 20 – 30 s
1c. Reverse curl-up	10 x 10	Bodyweight, take 3-s for each rep Rest till 3-minute mark and repeat complex.
GVT complex #3 (Squat emphasis)		
1a. Squat	10 x 10	Start at 60% 1RM SQ Rest 20 – 30 s
1b. Leg curl	10 x 10	20RM
No abdominals. Rest till 3-minute mark and repeat complex.		

FASCIAL STRETCH TRAINING - FST-7

Proposto por Hany Rambod, um dos melhores treinadores de fisiculturismo do mundo

Ao realizar 7 séries de 8-12 repetições c/ intervalo de 30-45 s a fáscia seria aumentada "inflada" e abriria mais espaço para a fibras musculares crescerem

SARCOPLASMA STIMULATING TRAINING (SST)

Proposto por Patrick Tuor, aplicado em Dennis Wolf

Carga de 8 repetições c/ intervalo de 10 s mesma carga até 1 repetição

Remove-se 20% da carga até chegar a 1 repetição e repete-se novamente

Pode-se chegar até 30 séries em 10 minutos, treinamento de no máximo 30 minutos

Maximizing Hypertrophy: Possible Contribution of Stretching in the Interset Rest Period

Nur Ikhwan Mohamad, MSc,[1,3] Kazunori Nosaka, PhD,[1] and John Cronin, PhD[1,2]
[1]School of Exercise, Biomedical and Health Sciences Edith Cowan University, Perth, Western Australia;
[2]Sport Performance Research Institute New Zealand, AUT University, Auckland, New Zealand; and
[3]Faculty of Sports Science & Coaching, Perak, Malaysia

VOLUME 33 | NUMBER 1 | FEBRUARY 2011

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Research in Sports Medicine: An International Journal

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gspm20

Acute Effects of Antagonist Static Stretching in the Inter-Set Rest Period on Repetition Performance and Muscle Activation

Humberto Miranda[b], Marianna de Freitas Maia[a], Gabriel Andrade Paz[b] & Pablo B Costa[c]

[a] Federal University of Rio de Janeiro, School of Physical Education and Sports, Rio de Janeiro, Brazil

[b] Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

[c] California State University - Fullerton, Exercise Physiology Laboratory, Department of Kinesiology, Fullerton, USA

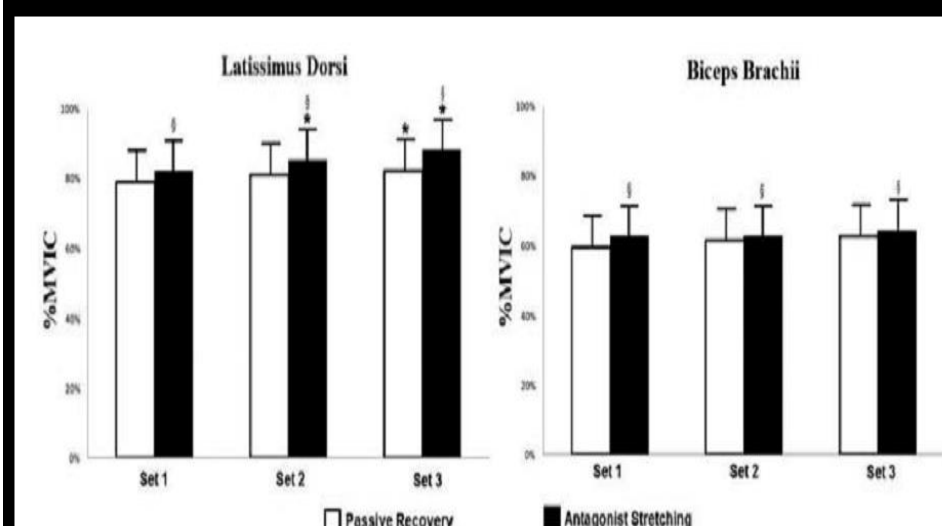
Published online: 29 Jan 2015.

To cite this article: Humberto Miranda, Marianna de Freitas Maia, Gabriel Andrade Paz & Pablo B Costa (2015) Acute Effects of Antagonist Static Stretching in the Inter-Set Rest Period on Repetition Performance and Muscle Activation, Research in Sports Medicine: An International Journal, 23:1, 37-50, DOI: 10.1080/15438627.2014.975812

METODOLOGIA

10 jovens treinados realizaram 40 s de alongamento passivo do peitoral maior no período de descanso entre as séries.

O exercício utilizado foi a remada sentada na máquina com a pegada aberta, sendo realizadas 3 séries até a falha na intensidade referente a 10RM.



Latissimus Dorsi
Biceps Brachii
%MVIC
Set 1
Set 2
Set 3
Passive Recovery
Antagonist Stretching

	Treinamento isométrico baixa intensidade	Treinamento isométrico alta intensidade	Treinamento isométrico de intensidade máxima
Seleção do exercício	Mono/Multi articulares	Mono/Multi articulares	Mono/Multi articulares
Nível de torque	30-50% da CIVM	70-80% da CIVM	100% da CIVM
Repetições	1	1	10
Séries	2-6 por exercício Progressão de 2 para 4-6 p/ grupo muscular	2-6 por exercício Progressão de 2 para 4-6 p/ grupo muscular	1-3 por exercício Progressão de 1 para 3 p/ grupo muscular
Duração por repetição	40-60s, até a falha nas 1-2 séries finais	15-20s, até a falha nas 1-2 séries finais	3-5s
Descanso entre as séries e repetições	30-60s	30-60s	25-30s, 60s
Freqüência	3-4 sessões p/ grupo muscular/semana	3-4 sessões p/ grupo muscular/semana	3 sessões p/ grupo muscular/semana

CIVM = contração isométrica voluntária máxima

Wernborn et al., 2007

Isométrico baixa intensidade: interessante para indivíduos que não toleram altas forças e c/ restrição de angulação de movimento devido a dor e/ou lesão

Isométrico alta intensidade: interessante para indivíduos que não toleram forças próximas do máximo

Isométrico de intensidade máxima: tomar cuidado com respiração excessivamente interrompida e elevação na pressão arterial

Wernborn et al., 2007

ARTICLE

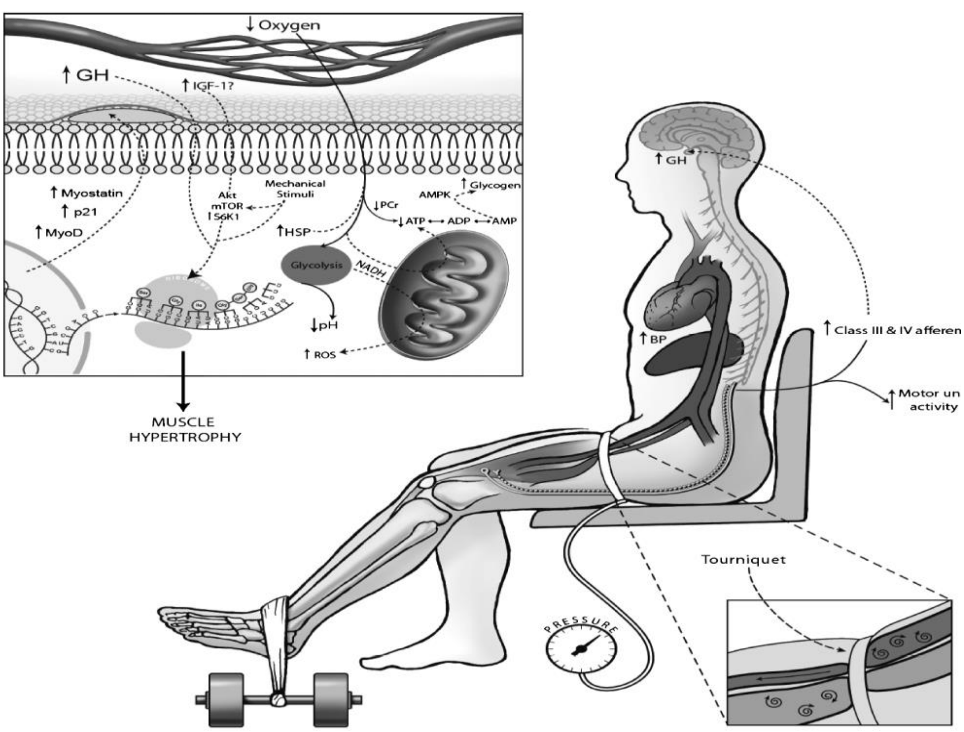
Blood Flow Restricted Exercise and Skeletal Muscle Health

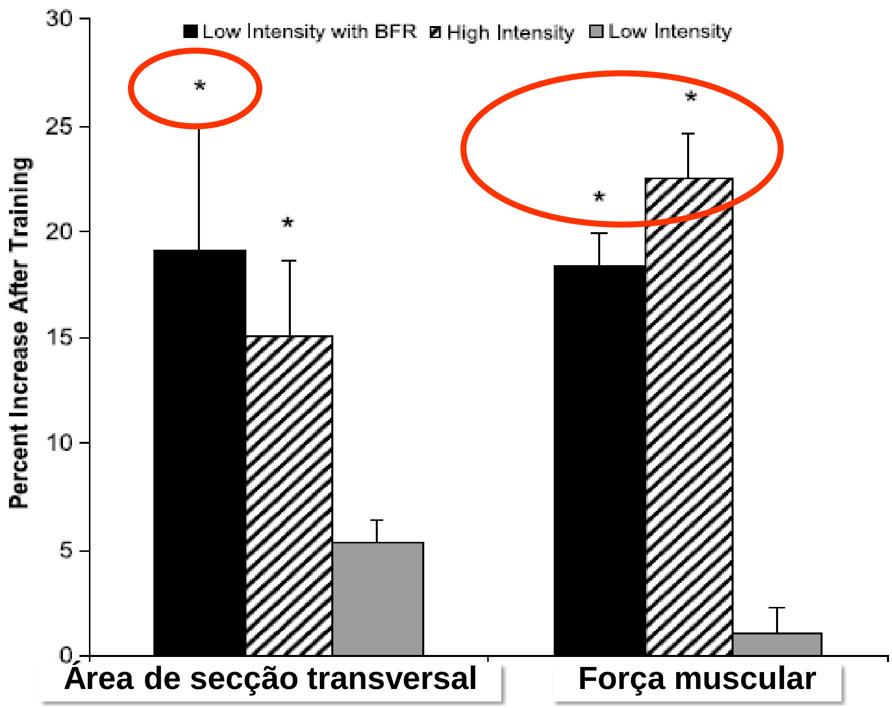
Todd M. Manini[1] *and Brian C. Clark*[2]

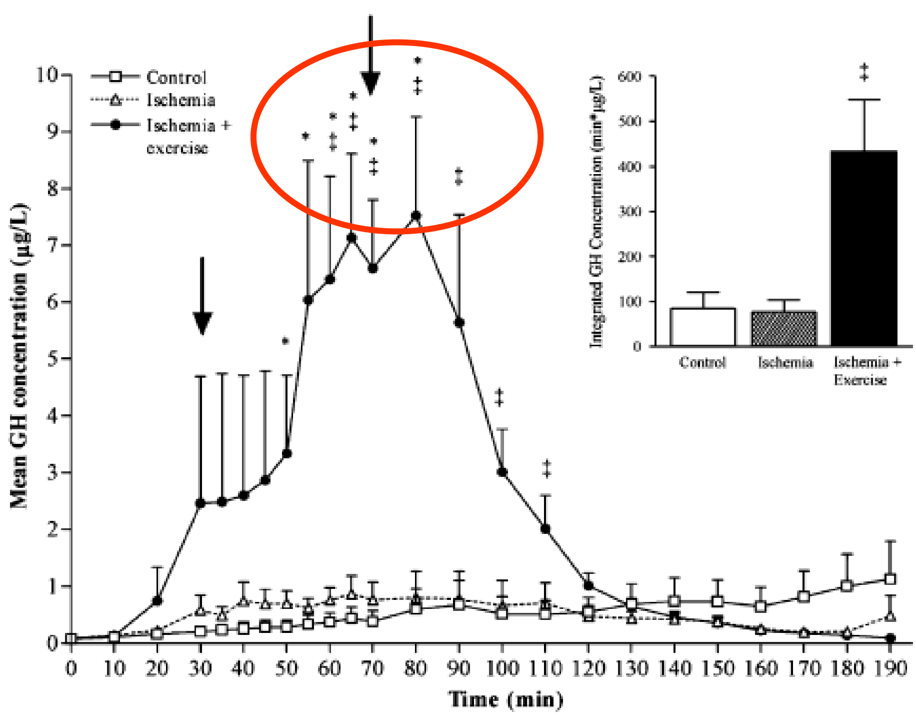
[1]Department of Aging and Geriatric Research, Institute on Aging, University of Florida, Gainesville, FL; and [2]Department of Biomedical Sciences, Institute for Neuromusculoskeletal Research, Ohio University, Athens, OH

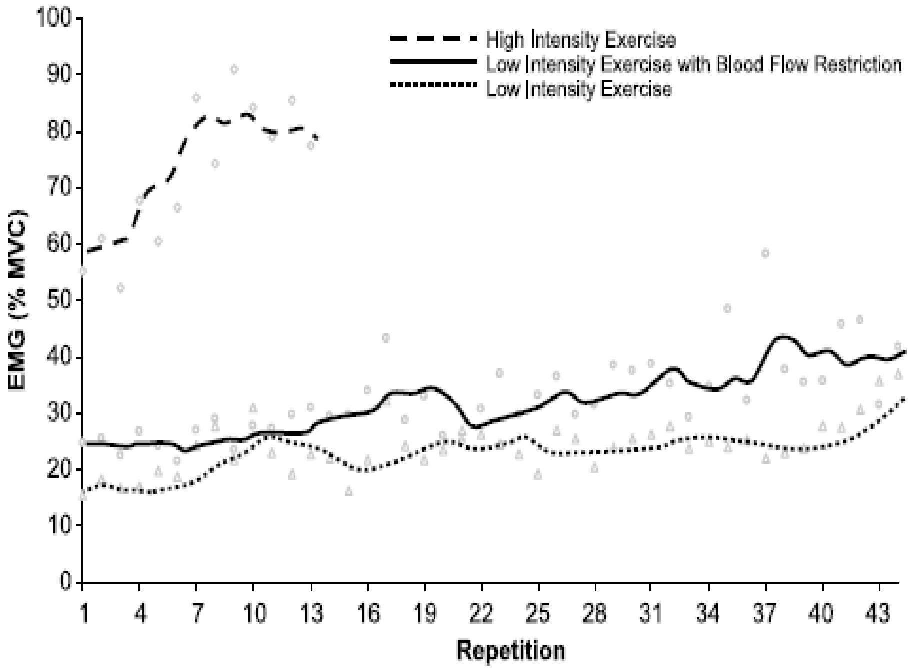
Exerc. Sport Sci. Rev., Vol. 37, No. 2, pp. 78–85, 2009.

EXERCÍCIO COM OCLUSÃO DE FLUXO E SAÚDE DO MÚSCULO ESQUELÉTICO

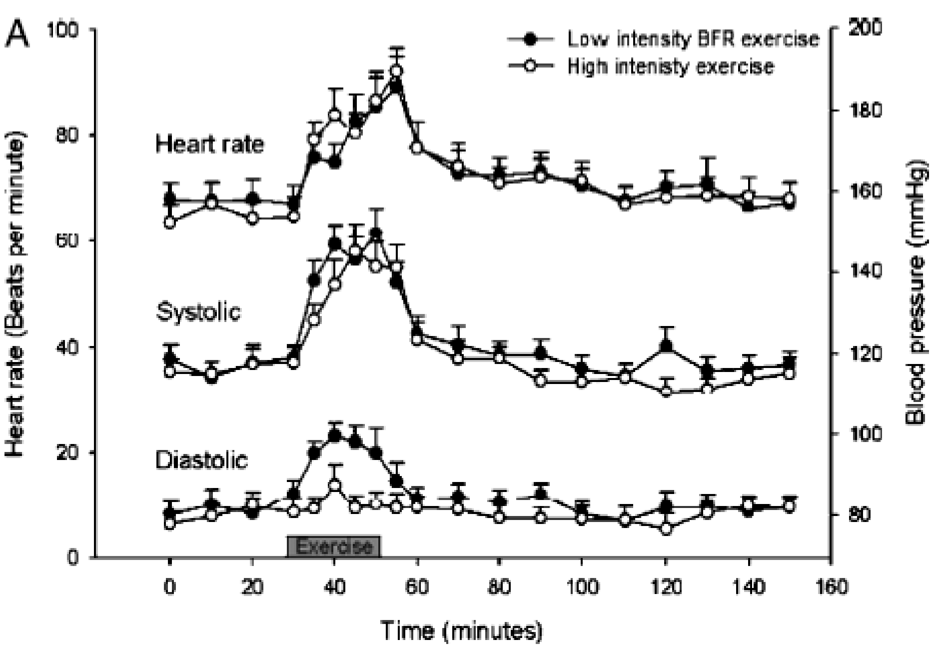



Low Intensity with BFR
High Intensity
Low Intensity
Percent Increase After Training
Área de secção transversal
Força muscular

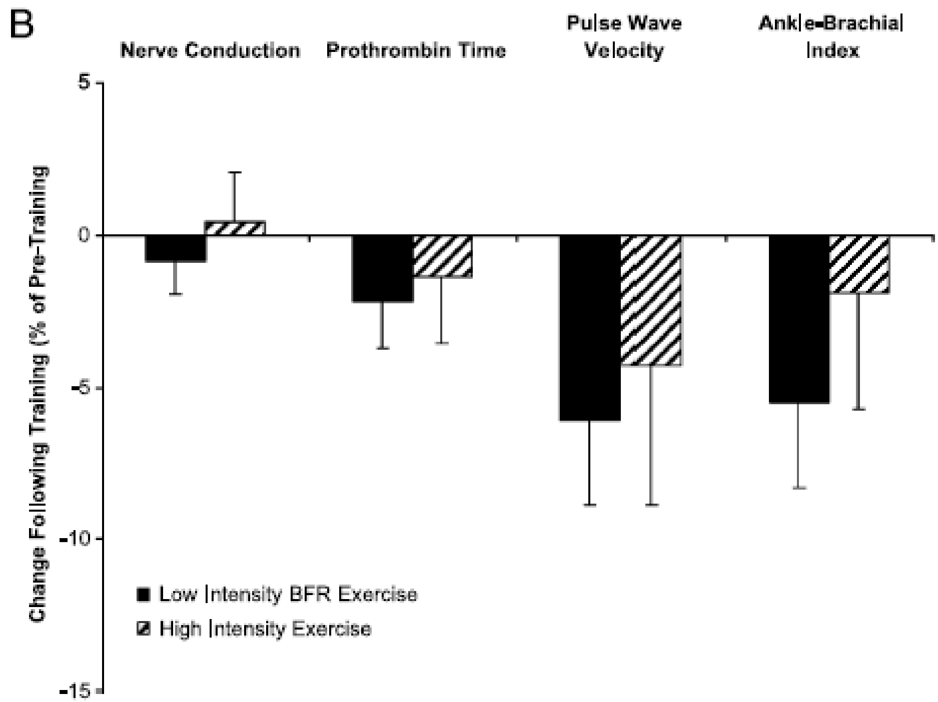

Control
Ischemia
Ischemia + exercise
Mean GH concentration (µg/L)
Time (min)
Integrated GH Concentration (min*µg/L)
Control
Ischemia
Ischemia + Exercise



High Intensity Exercise
Low Intensity Exercise with Blood Flow Restriction
Low Intensity Exercise
EMG (% MVC)
Repetition



A
Low intensity BFR exercise
High intenisty exercise
Heart rate
Systolic
Diastolic
Exercise
Heart rate (Beats per minute)
Blood pressure (mmHg)
Time (minutes)



Clin Physiol Funct Imaging (2013) doi: 10.1111/cpf.12117

Effect of very low-intensity resistance training with slow movement on muscle size and strength in healthy older adults

Yuya Watanabe[1], Haruhiko Madarame[1], Riki Ogasawara[2], Koichi Nakazato[3] and Naokata Ishii[1]

[1]Department of Life Sciences, Graduate School of Arts and Sciences, The University of Tokyo, Tokyo, [2]Department of Human and Engineered Environmental Studies, Graduate School of Frontier Sciences, The University of Tokyo, Chiba, and [3]Graduate School of Health and Sport Science, Nippon Sport Science University, Tokyo, Japan

Efeitos do treinamento de força de intensidade muito baixa com o movimento lento sobre o tamanho muscular e força em idosos saudáveis

Table 1 Physical characteristics of the participants.

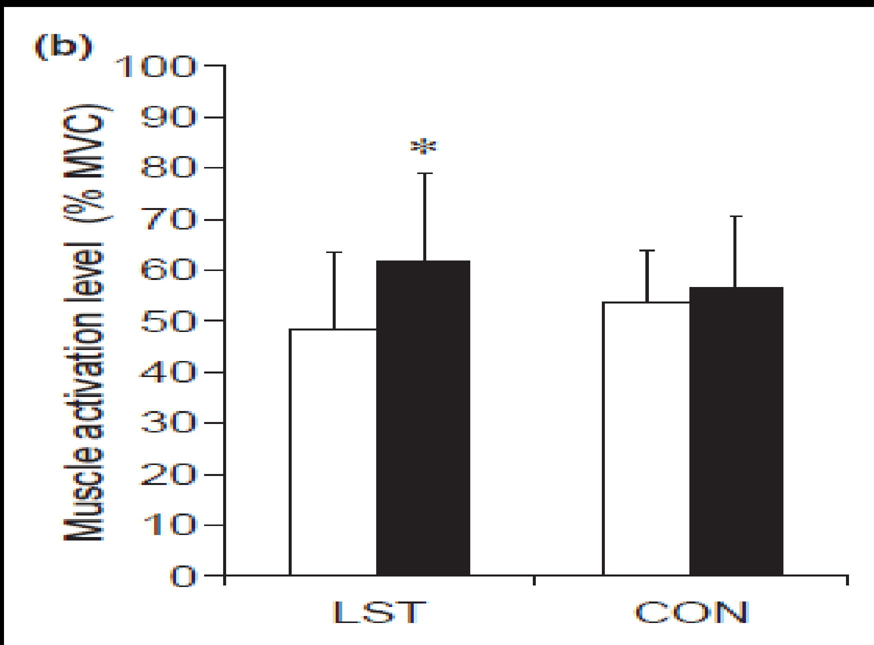
	LST (n = 9:7 men and 2 women)	CON (n = 9:7 men and 2 women)
Age (years)	69·0 ± 4·7	69·9 ± 5·1
Height (cm)	158·4 ± 10·2	159·8 ± 10·9
Body mass (kg)	60·8 ± 13·2	58·3 ± 13

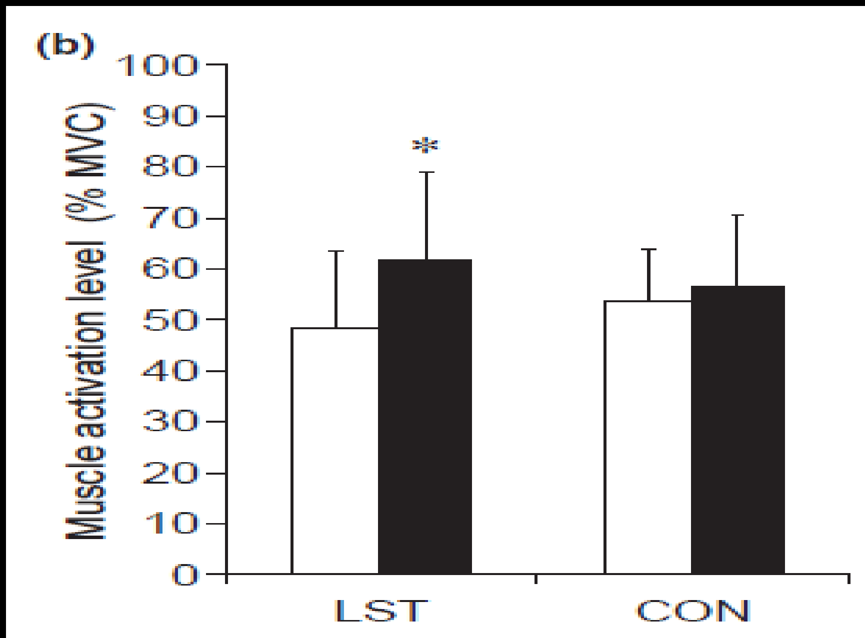
LST, low-intensity (30% 1RM) resistance training with slow movement and tonic force generation; CON, low-intensity (30% 1RM) resistance training with normal speed.

3 x 8 repetições a 30% de 1RM ajustado a cada 4 semanas – 2 x semana durante 12 semanas

Lento 3 s conc. e 3 s exc. + 1 s isom.

Convencional 1 s cada





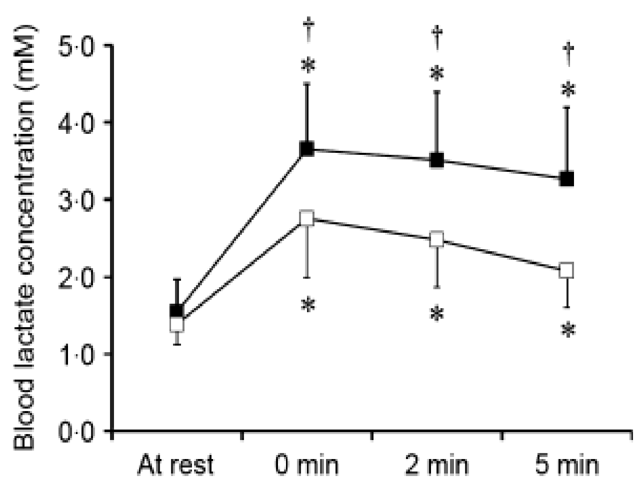


Figure 2 Blood lactate concentrations measured at rest, immediately after exercise (0 min), and 2 and 5 min after exercise. □, CON; ■, LST. *, $P<0\cdot05$, versus at rest; †, $P<0\cdot05$, LST versus CON.

Table 2 Systolic blood pressure measured at rest and during exercise.

LST ($n = 9$) At rest	During exercise	CON ($n = 9$) At rest	During exercise
131·1 ± 13·5	171·9 ± 31·8*	128·4 ± 12·0	165·0 ± 17·1*

Blood pressures are expressed in millimetres of mercury. LST, low-intensity (30% 1RM) resistance training with slow movement and tonic force generation; CON, low-intensity (30% 1RM) resistance training with normal speed.
*P<0·05 versus at rest.

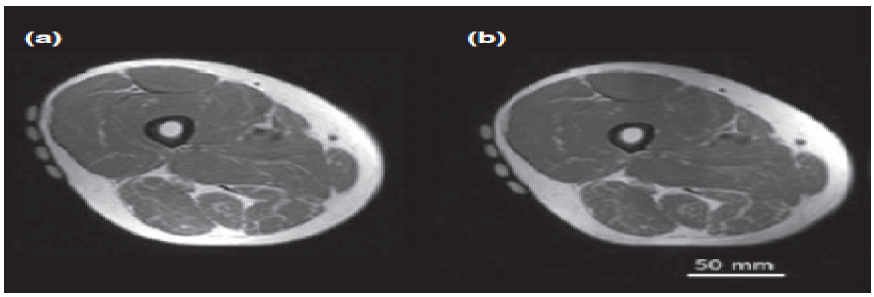


Figure 3 Typical magnetic resonance images showing transverse sections of the thigh taken before (a) and after (b) LST intervention for 12 weeks.

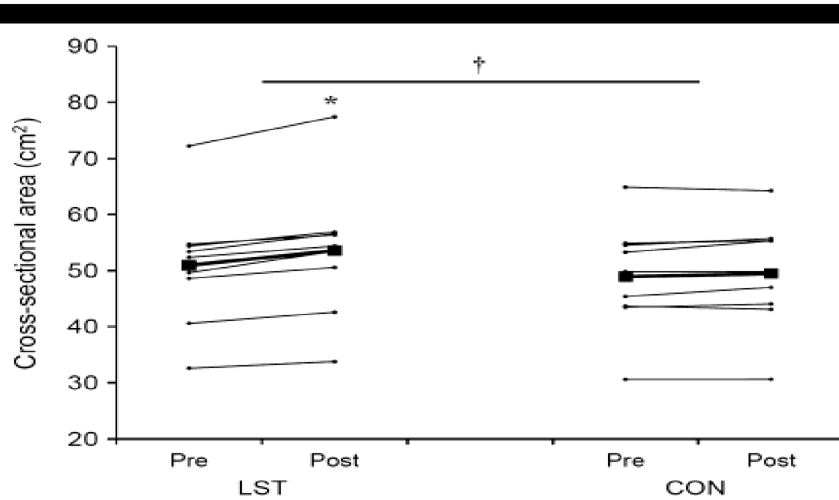


Figure 4 Cross-sectional area (CSA) of the quadriceps muscle measured before and after LST and CON interventions for 12 weeks. Each participant's value was presented by thin line, while mean value was presented by bold line. LST, low-intensity (30% 1RM) resistance training with slow movement and tonic force generation; CON, low-intensity (30% 1RM) resistance training with normal speed.*, P<0·05, versus preintervention. †, P<0·05, LST versus CON.

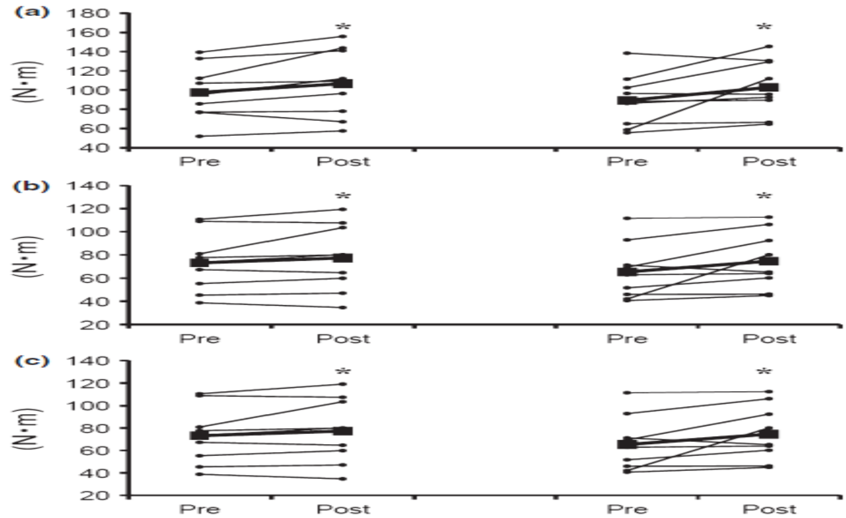


Figure 6 (a): Isometric strength measured before and after the intervention. (b): Isokinetic strength at 90° s^{-1} measured before and after the intervention. (c): Isokinetic strength at 180° s^{-1} measured before and after the intervention. Each participant's value was presented by thin line, while mean value was presented by bold line. LST, low-intensity (30% 1RM) resistance training with slow movement and tonic force generation; CON, low-intensity (30% 1RM) resistance training with normal speed. *, P<0·05 versuspreintervention.

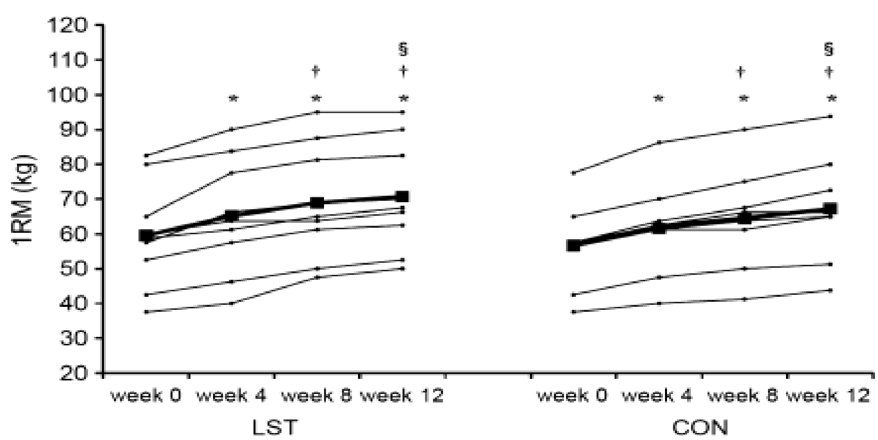


Figure 5 One repetition maximum at 0, 4, 8 and 12 weeks of the intervention. Each participant's value was presented by thin line, while mean value was presented by bold line. LST, low-intensity (30% 1RM) resistance training with slow movement and tonic force generation; CON, low-intensity (30% 1RM) resistance training with normal speed. *, P<0·05 versus week 0; †, P<0·05 versus week 4; §, P<0·05 versus week 8.

J Physiol 590.2 (2012) pp 351–362 351

Muscle time under tension during resistance exercise stimulates differential muscle protein sub-fractional synthetic responses in men

Nicholas A. Burd[1], Richard J. Andrews[1], Daniel W.D. West[1], Jonathan P. Little[1], Andrew J.R. Cochran[1], Amy J. Hector[1], Joshua G.A. Cashaback[2], Martin J. Gibala[1], James R. Potvin[2], Steven K. Baker[3] and Stuart M. Phillips[1]

[1]*Exercise Metabolism Research Group,* [2]*Occupational Biomechanics Laboratory, Department of Kinesiology, and* [3]*Michael G. DeGroote School of Medicine, Department of Neurology, McMaster University, Hamilton, Ontario, Canada*

O tempo de tensão durante o treinamento de força estimula a síntese proteica de diferentes sub-frações em homens

8 sujeitos jovens treinados em força

Cadeira extensora unilateral

3 x até a falha com 30% de 1RM

Lento 6 s conc. e 6 s exc.

Convencional 1 s cada

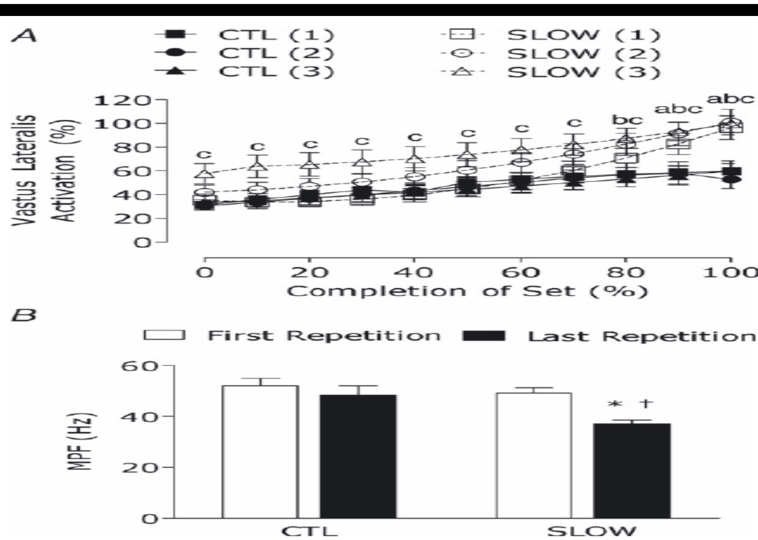


Figure 2. Percentage increase in vastus lateralis activation during the concentric phase of resistance exercise (*A*) and the change in mean power frequency (MPF) during the isometric phase of resistance exercise from the first repetition to the last repetition (*B*)

Numbers in parentheses following SLOW indicate set number. Lower case letter indicates significantly different from CTL for sets 1–3: a, SLOW(1); b, SLOW(2); c, SLOW(3); $P < 0.05$. *Significantly different from 0% set completion, $P < 0.05$. †Significantly different from CTL at that time point, $P < 0.05$.

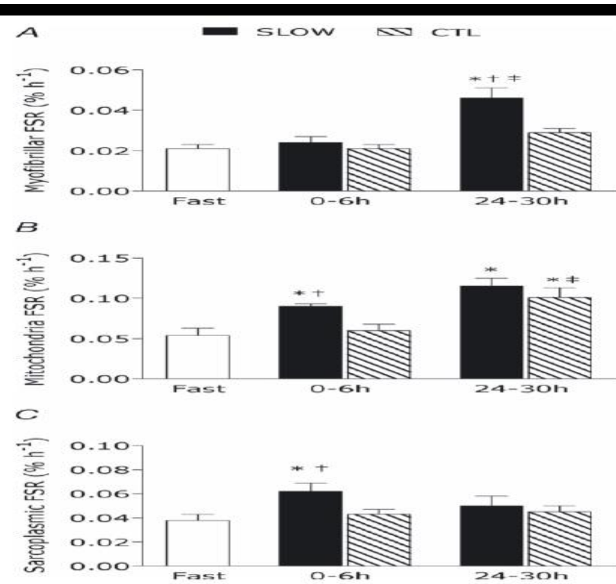


Figure 3. Myofibrillar (*A*), mitochondrial (*B*), and sarcoplasmic (*C*) protein fractional synthetic rates (FSR) during protocols

Note different scales on *y*-axes between graphs. Rates are from rested fasted and after resistance exercise with slow (SLOW) or external work match control (CTL) muscle time under tension. Values are means ± S.E.M. *Significantly different from fasting, $P < 0.05$. †Significantly different from CTL at that same time point, $P < 0.05$. ‡Significantly different from the 0–6 h response in the same condition, $P < 0.05$.

The Effects of Combining Elastic and Free Weight Resistance on Strength and Power in Athletes

Corey E. Anderson, Gary A. Sforzo, and John A. Sigg
Exercise and Sport Sciences, Ithaca College, Ithaca, New York

VOLUME 22 | NUMBER 2 | MARCH 2008 |

EFEITOS DO TREINAMENTO COMBINADO COM PESOS E ELÁSTICOS SOBRE A FORÇA E A POTÊNCIA EM ATLETAS

Figure 2. The back squat rack set up with elastic resistance in place. Carabineers are used to attach the elastic band to d-rings fixed to the rack at the bottom and the bar at the top.

Figure 1. The bench press set up with elastic resistance in place. Carabineers are used to attach the elastic band to d-rings fixed to the rack at the bottom and the bar at the top.

Sujeitos treinados em força

Resistência elástica utilizada no supino e no agachamento (20% da carga reduzido)

Foram realizados exercícios básicos do corpo todo
3 x semana
3-6 x 2-10 reps ondulatório a 72-98% de 1RM
7 semanas

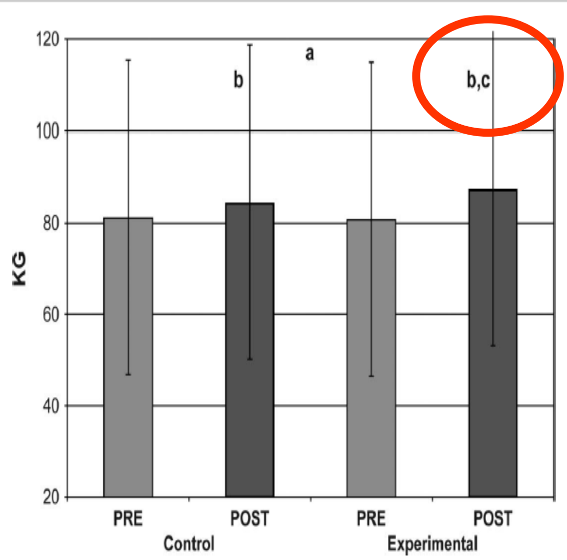


Figure 3. Bench press 1 repetition maximum before and after training. Mean ± *SD* for each group with significant differences ($P < 0.05$) denoted by (a) interaction, (b) time within group, and (c) between groups post training.

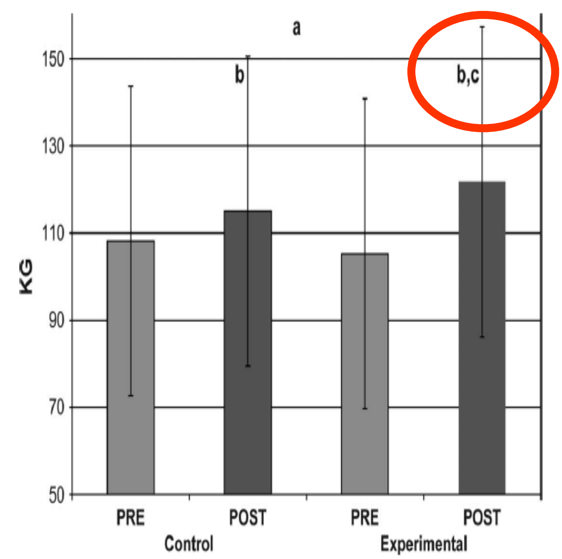


Figure 4. Back squat 1 repetition maximum before and after training. Mean ± *SD* for each group with significant differences ($P < 0.05$) denoted by (a) interaction, (b) time within group, and (c) between groups post training.

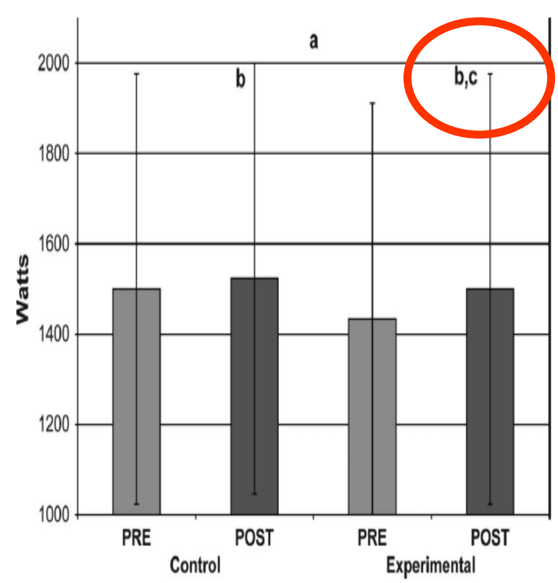


Figure 5. Average power before and after training. Mean ± *SD* for each group with significant differences ($P < 0.05$) denoted by (a) interaction, (b) time within group, and (c) between groups post training.

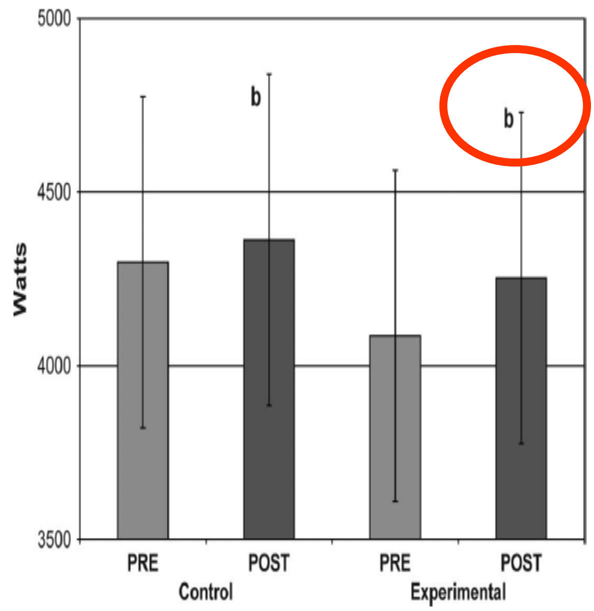


Figure 6. Peak power before and after training. Mean ± *SD* for each group with significant differences ($P < 0.05$) denoted (b) time within group.

INFLUENCE OF VARIABLE RESISTANCE LOADING ON SUBSEQUENT FREE WEIGHT MAXIMAL BACK SQUAT PERFORMANCE

MINAS A. MINA,[1] ANTHONY J. BLAZEVICH,[2] GIANNIS GIAKAS,[3] AND ANTHONY D. KAY[4]

[1]School of Sport, Exercise and Human Performance, University of Derby, Buxton, United Kingdom; [2]Centre for Exercise and Sports Science Research, School of Exercise and Health Sciences, Edith Cowan University, Joondalup, Western Australia; [3]Department of Physical Education and Sport Science, University of Thessaly, Greece; and [4]Sport, Exercise and Life Sciences, The University of Northampton, Northampton, United Kingdom

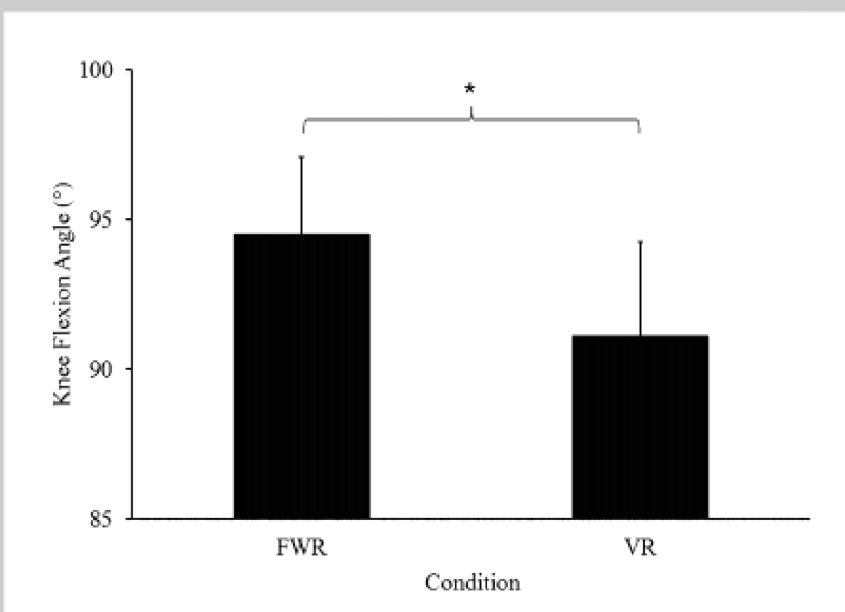
J Strength Cond Res 28(10): 2988–2995, 2014

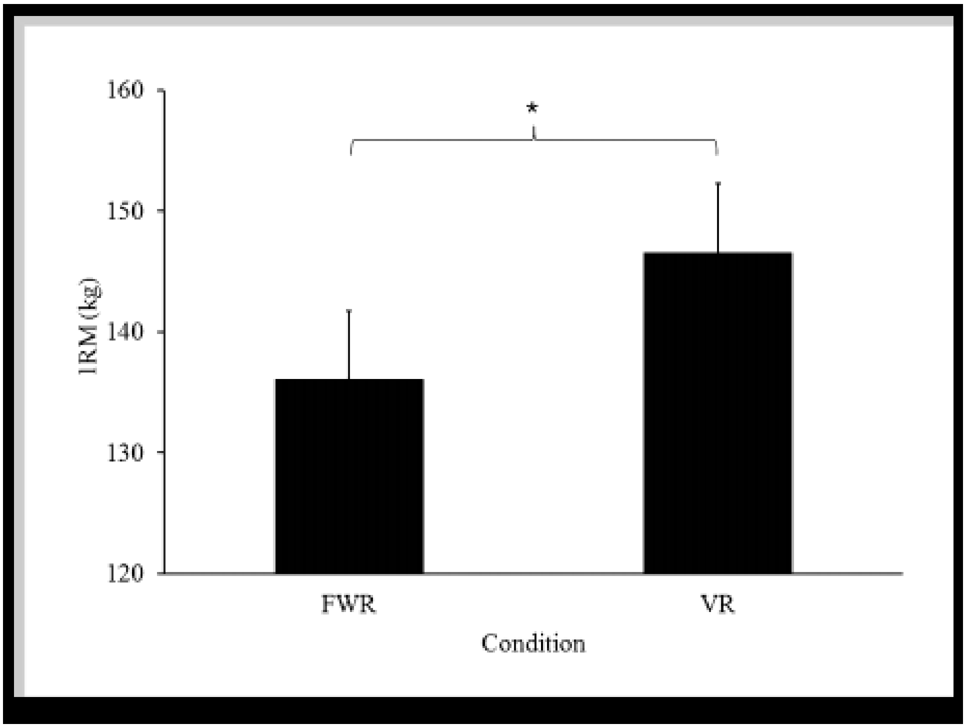
Influência da resistência variável sobre a performance de força máxima no agachamento livre

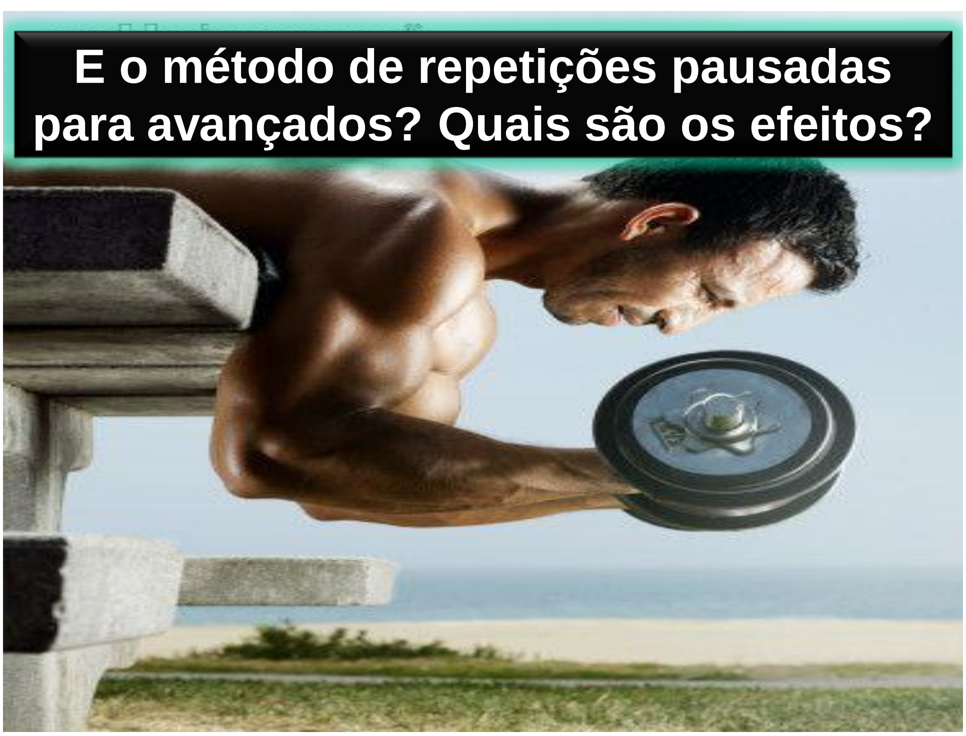
Aquecimento com 3 reps a 85% de 1RM com e sem elástico (35% da carga)

5 min de descanso sentado e 1RM

Sujeitos agachavam a mais de 3 anos




160
150
140
130
120
1RM (kg)
*
FWR
VR
Condition


E o método de repetições pausadas para avançados? Quais são os efeitos?

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Journal of Science and Medicine in Sport 15 (2012) 153–158

Journal of Science and Medicine in Sport

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www.elsevier.com/locate/jsams

Original research

Acute neuromuscular and fatigue responses to the rest-pause method

Paul W.M. Marshall[a,*], Daniel A. Robbins[b], Anthony W. Wrightson[a], Jason C. Siegler[a]

Resposta neuromuscular aguda e de fadiga ao método de repetições pausadas

14 indivíduos jovens treinados em força - ~5 anos

Sessões agudas:

A) 20 reps - 5 x 4 reps a 80% de 1RM c/ 3 min intervalo

B) 20 reps – 5 x 4 reps a 80% de 1RM c/ 20 s intervalo

Método repetição pausada reps até falha c/ 20 s intervalo

Table 1
Maximal isometric force output (N) and squat rate of force development (RFD) ($N\,s^{-1}$) measured before (PRE), immediately post (IP), and 5-min post (5P) each exercise protocol ($n = 14$). Data are mean ± SE.

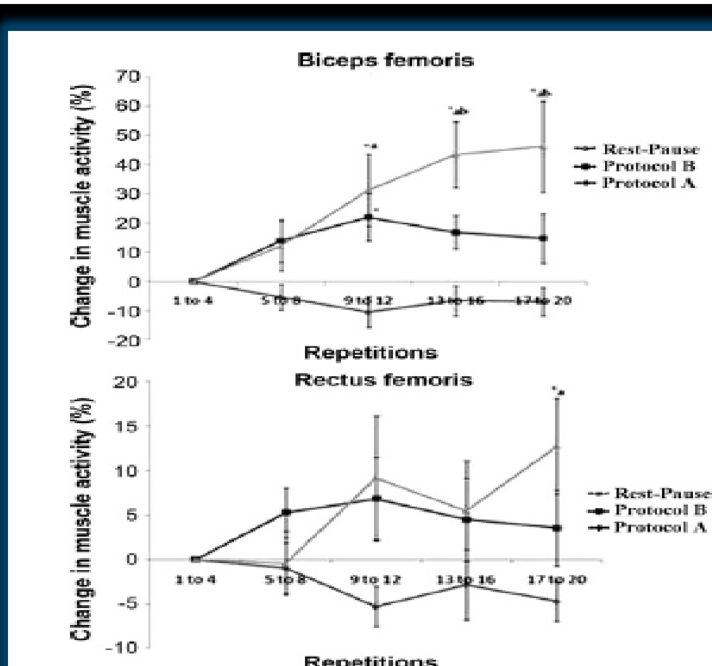
	Protocol A	Protocol B	Rest-pause method
Maximal isometric force output (N)			
PRE	1203.5 ± 99.8	1144.6 ± 84.6	1198 ± 75.2
IP	1105.6 ± 94.6*	1054.4 ± 89.9*	1095.3 ± 64.4*
5P	1219.9 ± 89.3	1146.6 ± 99.4	1169.1 ± 81.6
Maximal squat RFD ($N\,s^{-1}$)			
PRE	4204.3 ± 584.6	4517 ± 723.9	4562 ± 571.5
IP	4057.2 ± 504.4*	3668.2 ± 537.9*	4038.2 ± 676.3*
5P	4667.6 ± 583.8	4260.3 ± 793.9	4494.9 ± 723.5

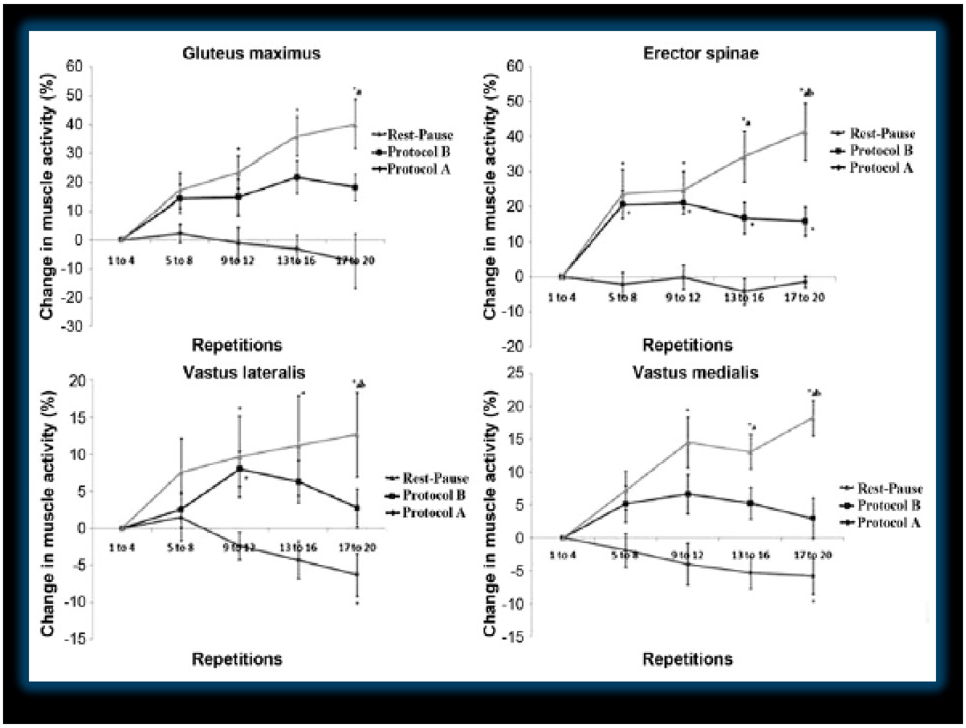
* $p < 0.05$ as compared to PRE.

O método de repetições pausadas EMG

Não foi mais fadigante versus sem falha

Pode ser eficiente para indivíduos treinados



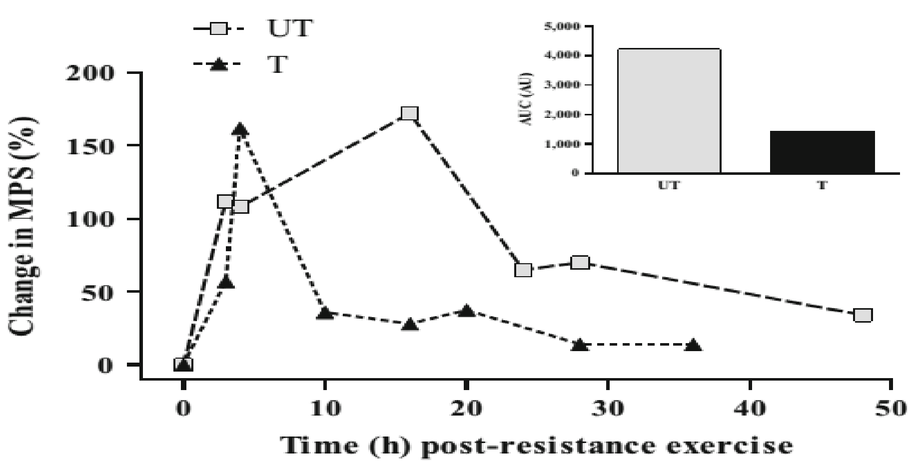


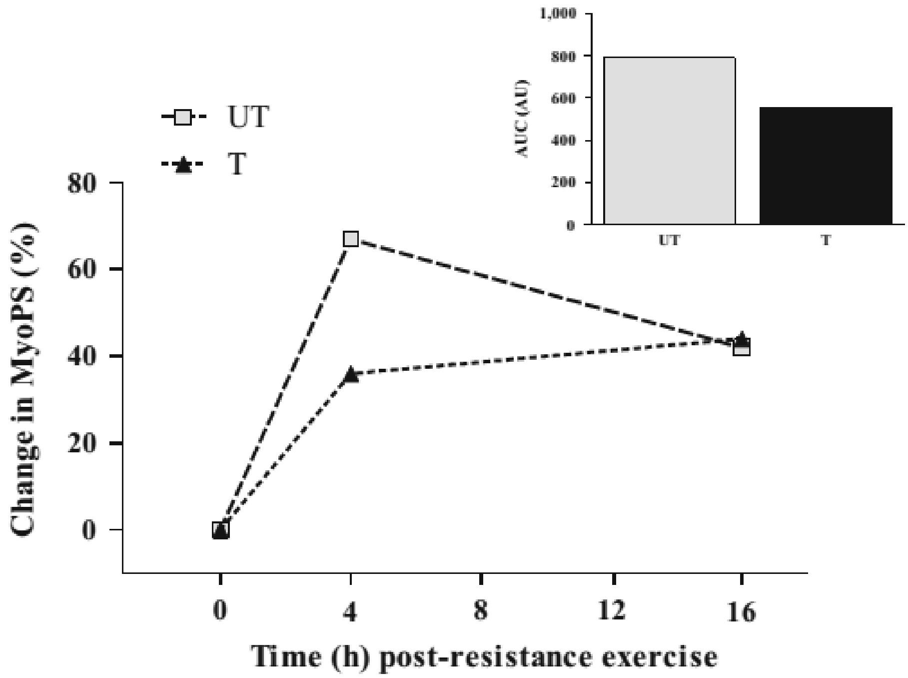
Sports Med
DOI 10.1007/s40279-015-0320-0
Published online: 06 March 2015

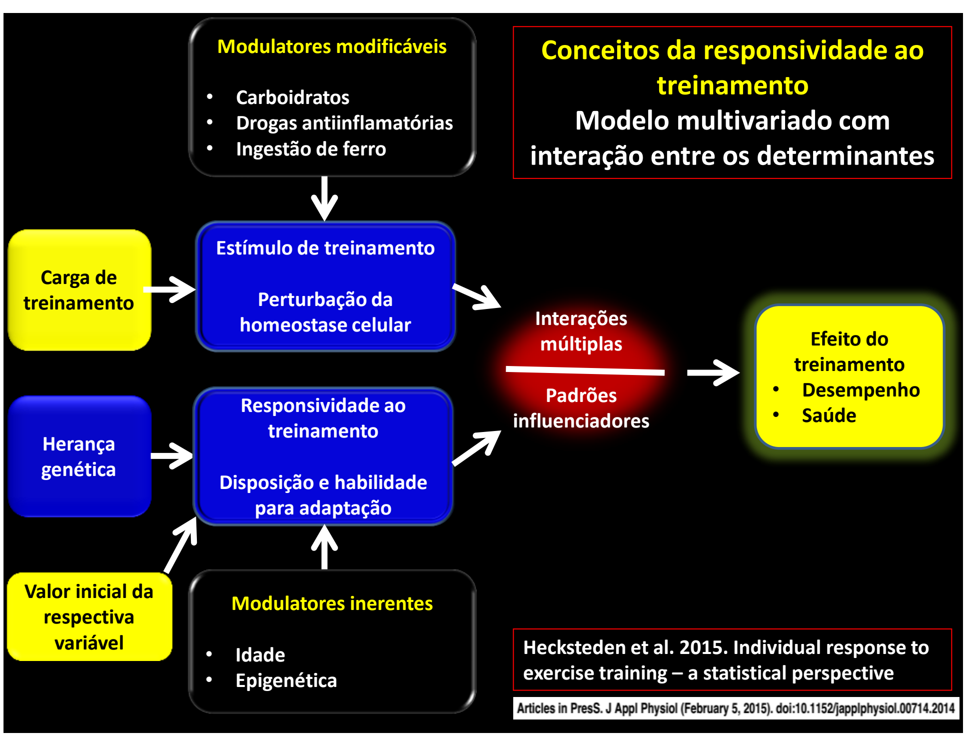
REVIEW ARTICLE

A Review of Resistance Training-Induced Changes in Skeletal Muscle Protein Synthesis and Their Contribution to Hypertrophy

Felipe Damas · Stuart Phillips · Felipe Cassaro Vechin · Carlos Ugrinowitsch




UT
T
Change in MyoPS (%)
80
60
40
20
0
0
4
8
12
16
Time (h) post-resistance exercise
AUC (AU)
1,000
800
600
400
200
0
UT
T


Modulatores modificáveis
• Carboidratos
• Drogas antiinflamatórias
• Ingestão de ferro
Conceitos da responsividade ao treinamento
Modelo multivariado com interação entre os determinantes
Carga de treinamento
Estímulo de treinamento
Perturbação da homeostase celular
Interações múltiplas
Padrões influenciadores
Efeito do treinamento
• Desempenho
• Saúde
Herança genética
Responsividade ao treinamento
Disposição e habilidade para adaptação
Valor inicial da respectiva variável
Modulatores inerentes
• Idade
• Epigenética
Hecksteden et al. 2015. Individual response to exercise training – a statistical perspective
Articles in PresS. J Appl Physiol (February 5, 2015). doi:10.1152/japplphysiol.00714.2014

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JAMDA

journal homepage: www.jamda.com

Original Study

There Are No Nonresponders to Resistance-Type Exercise Training in Older Men and Women

Tyler A. Churchward-Venne PhD[a,b], Michael Tieland PhD[b,c], Lex B. Verdijk PhD[a,b], Marika Leenders MSc[a,b], Marlou L. Dirks MSc[a], Lisette C.P.G.M. de Groot PhD[b,c], Luc J.C. van Loon PhD[a,b,*]

JAMDA xxx (2015) 1–12

Não há não-responsivos no treinamento de força em homens e mulheres idosas

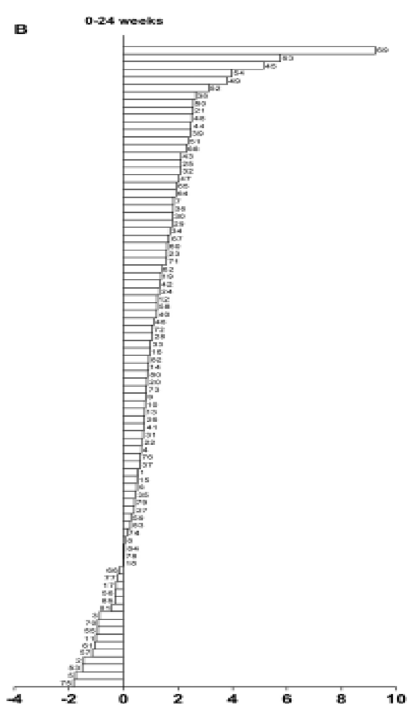
Table 1
Participants' Characteristics

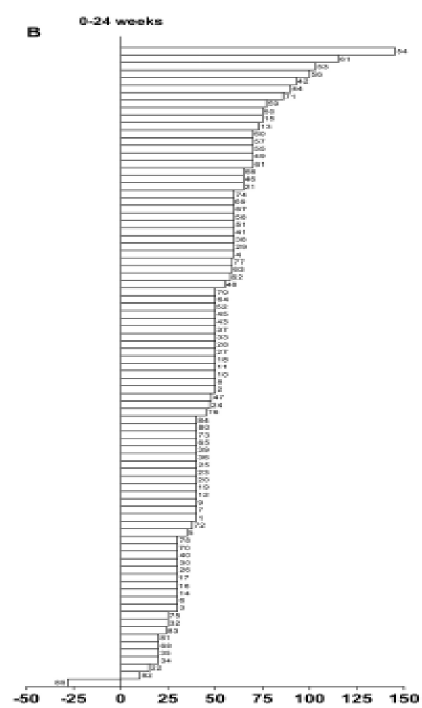
Group	Age, y	Height, m	Body Weight, kg	Body Mass Index
12-wk analysis				
All (n = 110)	72.6 ± 0.6	1.70 ± 0.01	78.1 ± 1.1	27.1 ± 0.4
Men (n = 66)	72.6 ± 0.9	1.74 ± 0.01	82.9 ± 1.4	27.2 ± 0.4
Women (n = 44)	72.6 ± 0.9	1.62 ± 0.01	71.0 ± 1.8	26.9 ± 0.7
24-wk analysis				
All (n = 85)	72.8 ± 0.8	1.69 ± 0.01	77.7 ± 1.5	27.2 ± 0.4
Men (n = 41)	73.0 ± 1.2	1.76 ± 0.01	84.8 ± 1.7	27.4 ± 0.5
Women (n = 44)	72.6 ± 0.9	1.62 ± 0.01	71.0 ± 1.8	26.9 ± 0.7

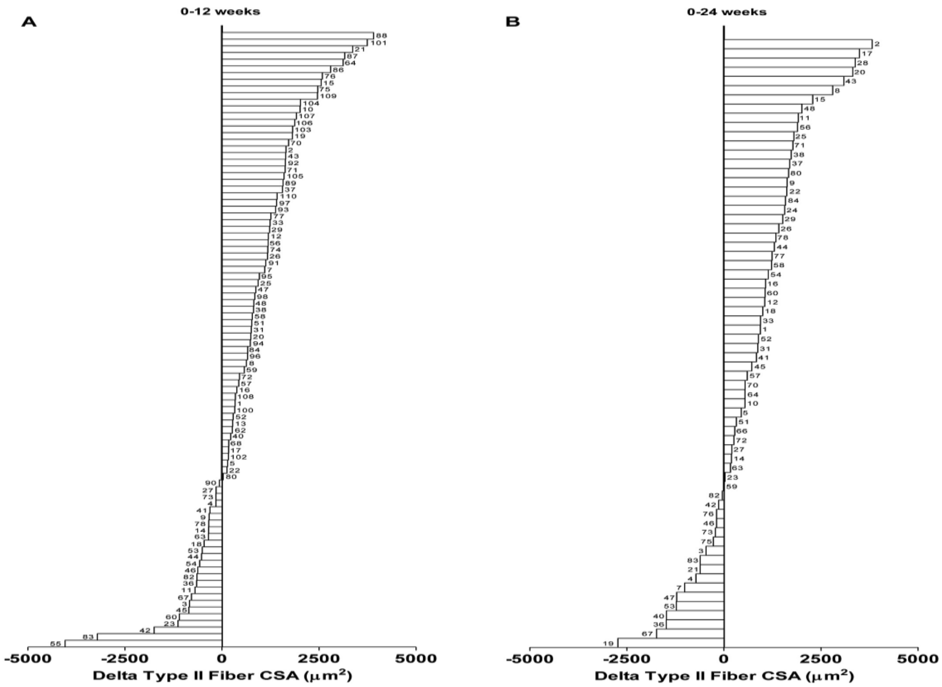
Data represent means ± SEM.

TREINAMENTO

- 2-3 vezes por semana de 12-24 semanas
- 4 séries no leg press 45^0 e extensora
- 4 semanas: 60-75% - 10-15 para 8-10 repetições e depois da semana 5: 8 repetições a 75-80% de 1RM – sempre reajustado.
- 1 min entre as séries e 3 min entre os exercícios







ig. 3. Histograms of the absolute changes in type II muscle fiber cross-sectional area (μm^2) for each individual after 12 (A) and 24 (B) weeks of resistance-type exercise training in lderly men and women. Numbers next to the bars represent the individual participants and match with the same participant number presented in Figures 1–6.

Journal of Strength and Conditioning Research, 2004, 18(4), 730–737

Muscular Adaptations to Combinations of High- and Low-Intensity Resistance Exercises

Kazushige Goto,[1] Masanari Nagasawa,[2] Osamu Yanagisawa,[3] Tomohiro Kizuka,[1] Naokata Ishii,[4] and Kaoru Takamatsu[1]

[1]Institute of Health and Sport Sciences, University of Tsukuba, Tsukuba, Ibaraki, Japan; [2]Shimizu Corporation, Minato, Tokyo, Japan; [3]Japan Institute of Sports Sciences, Kita, Tokyo, Japan; [4]Department of Life Sciences, Graduate School of Arts and Sciences, University of Tokyo, Komaba, Tokyo, Japan.

TABLE 1. Workout style in each group.*

Phase	Hypertrophy phase (0–6 wk)	Strength phase (7–10 wk)
Regimen	Hypertrophy type (HC/HS groups)	Combi type (HC group) Strength type (HS group)
Exercise	Leg press/leg extension	Leg press/leg extension
Frequency	2 d/wk	2 d/wk

* HC = hypertrophy/combi; HS = hypertrophy/strength.

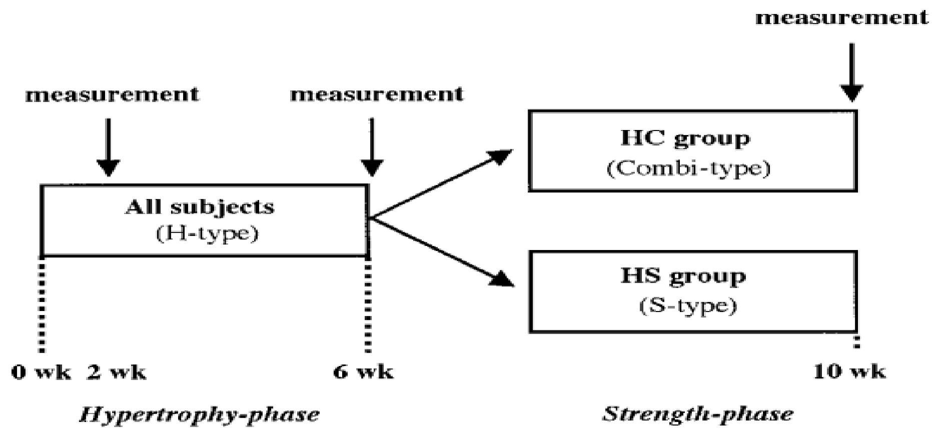
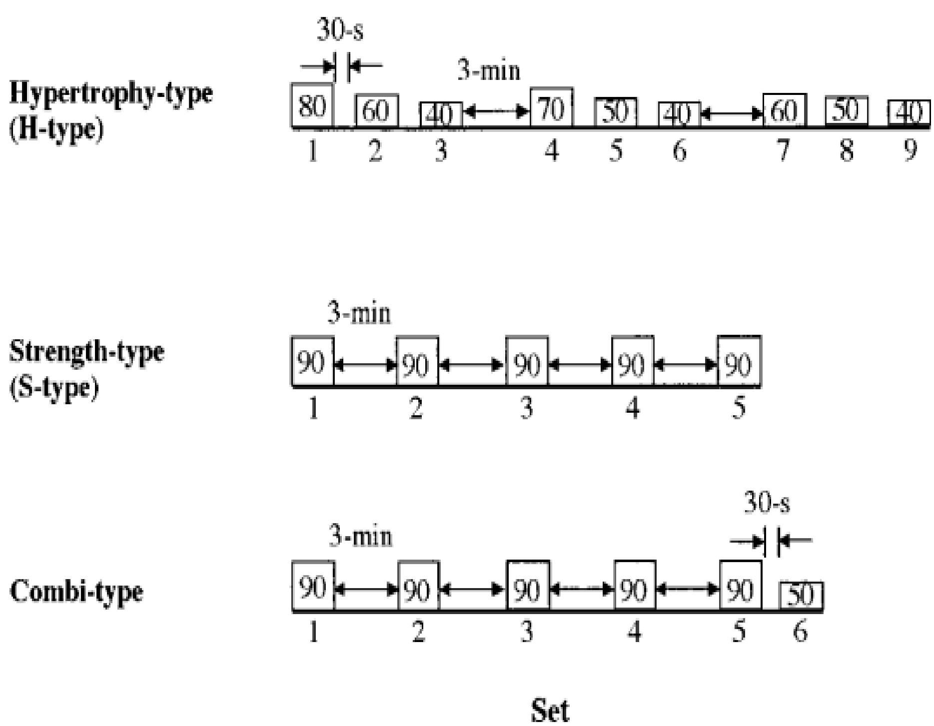


FIGURE 1. Experimental design showing periodization of resistance training and timing of measurements.



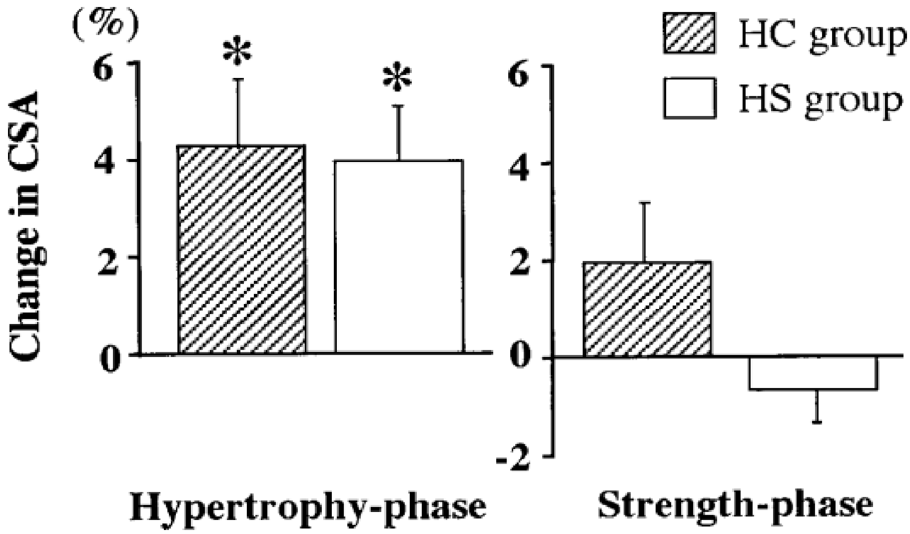


FIGURE 4. Percentage changes in muscle cross-sectional area (CSA) of the thigh after hypertrophy (0–6 weeks) and strength phases (7–10 weeks). Values are mean ± *SEM*. * = significant change from pretraining value ($p < 0.05$).

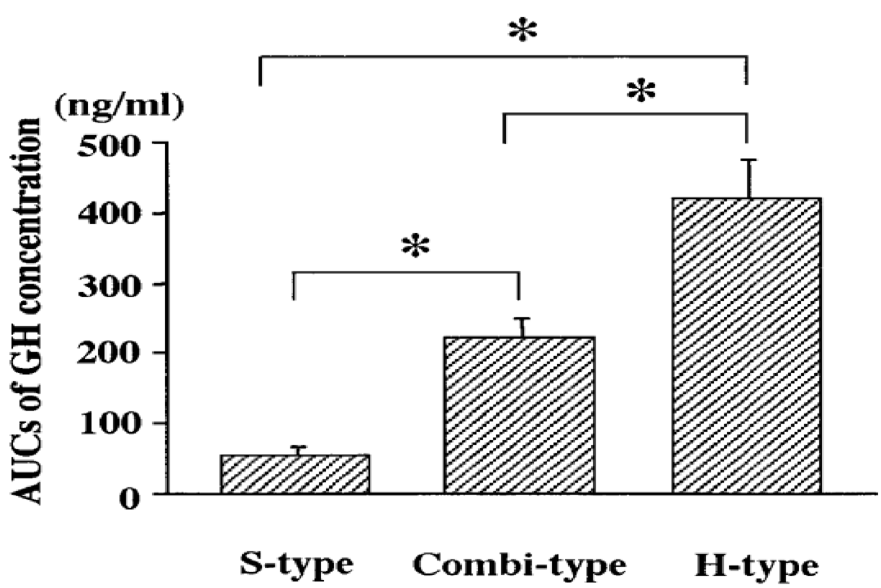


FIGURE 3. Area under the curves (AUCs) in the time course of growth hormone (GH) concentration after 3 types of training regimen. Values are mean ± *SEM*. * = significant difference between regimens ($p < 0.05$).

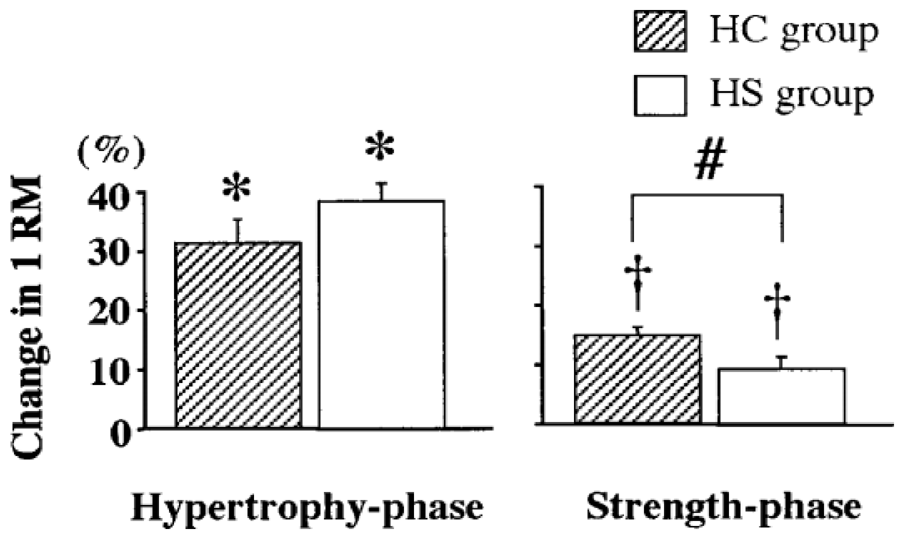


Figure 6. Percentage changes in one repetition maximum (1RM) of leg press after hypertrophy (0–6 weeks) and strength phases (7–10 weeks). Symbols denote significant differences ($p < 0.05$) from pretraining (*) and midtraining (†), and between groups (#). Values are mean ± *SEM*.

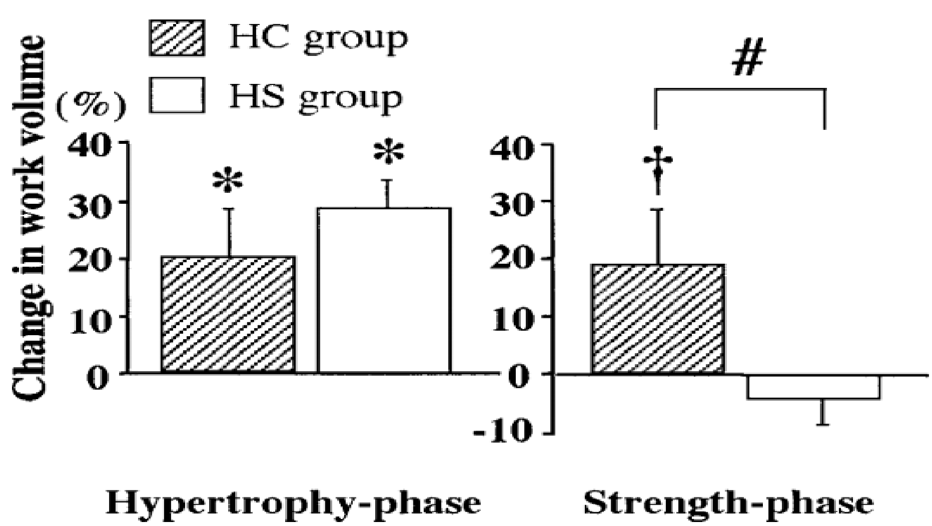


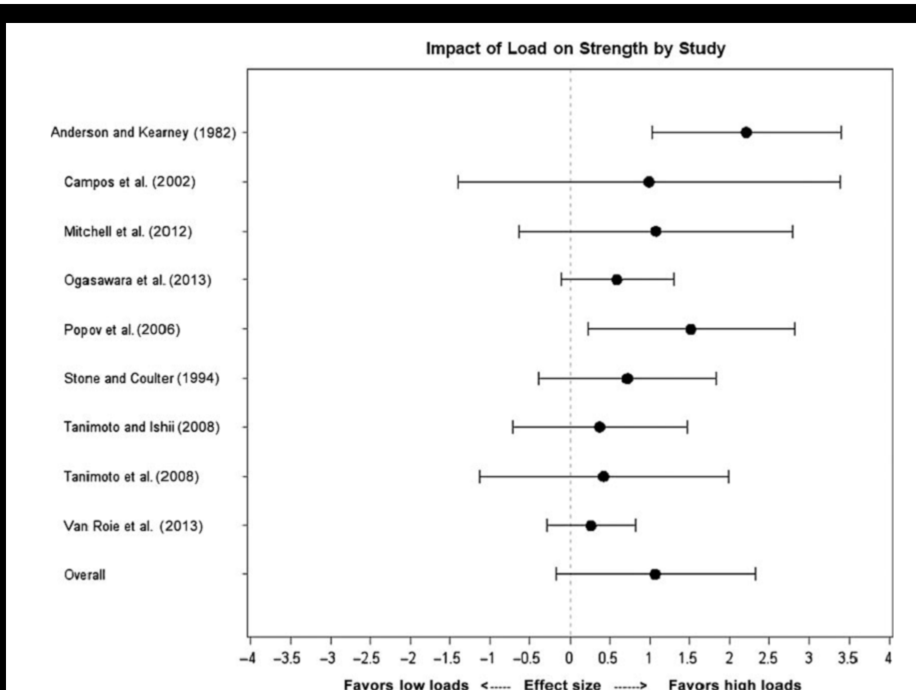
Figure 9. Percentage changes in work volume in knee extension exercise with the load corresponding to 30% of maximal isometric strength after hypertrophy (0–6 weeks) and strength phases (7–10 weeks). Symbols denote significant differences ($p < 0.05$) from pretraining (*) and midtraining (†), and between groups (#). Values are mean ± *SEM*.

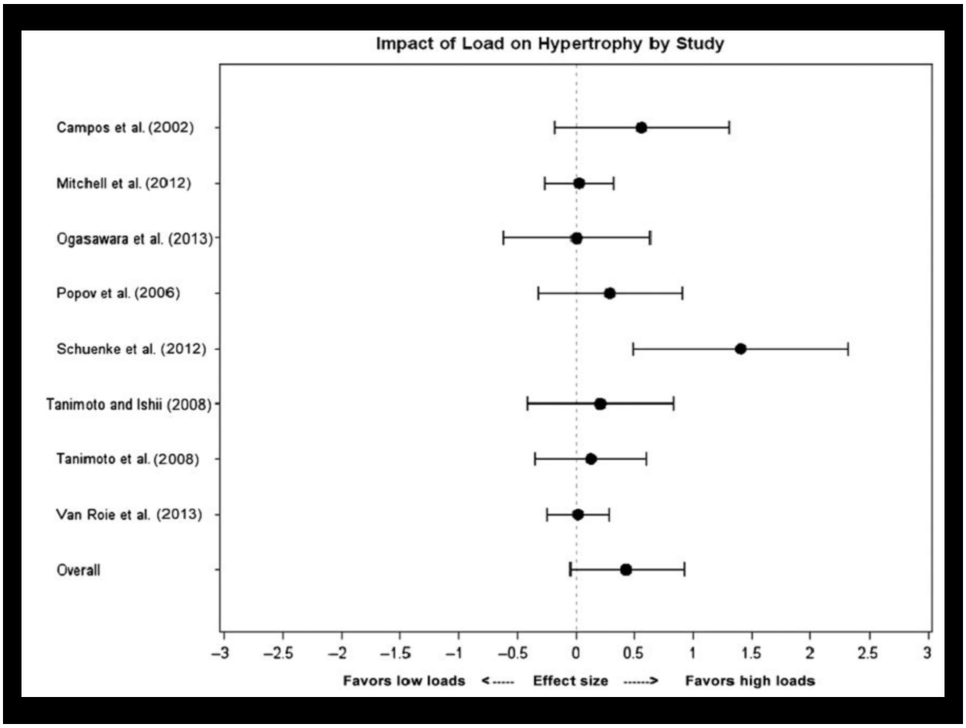
European Journal of Sport Science
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tejs20

Muscular adaptations in low- versus high-load resistance training: A meta-analysis

Brad J. Schoenfeld[a], Jacob M. Wilson[b], Ryan P. Lowery[b] & James W. Krieger[c]
[a] Department of Health Sciences, CUNY Lehman College, Bronx, NY, USA
[b] Department of Health Sciences and Human Performance, University of Tampa, Tampa, FL, USA
[c] Weightology LLC, Redmond, WA, USA
Published online: 20 Dec 2014.

European Journal of Sport Science, 2014
http://dx.doi.org/10.1080/17461391.2014.989922

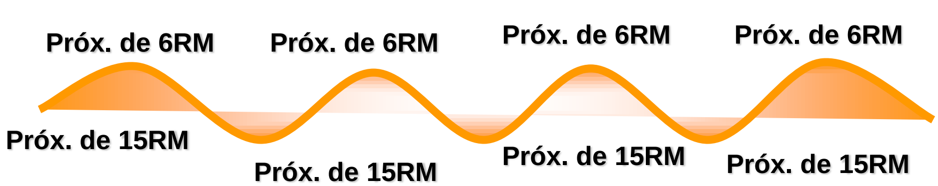




Ondulatório (avançado)

Exercício	Séries	Repetições	Peso
Peck deck	8	15, 6, 15, 6, 15, 6, 15, 6	Próximo às RMs

Intervalos entre as séries: 2 minutos.



SÉRIE FRACIONADA SEM FALHA CONCÊNTRICA?

RESTRIÇÃO ALIMENTAR NO FISICULTURISMO

RECUPERAÇÃO HORMONAL

PERIODIZAÇÃO

Eur J Appl Physiol
DOI 10.1007/s00421-015-3216-7

CrossMark

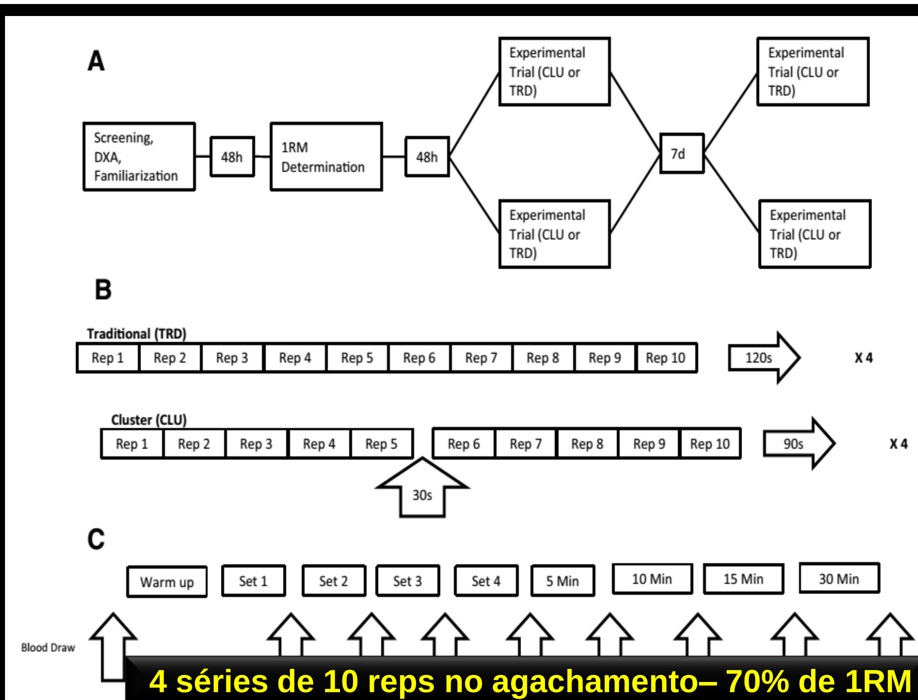
ORIGINAL ARTICLE

Acute response to cluster sets in trained and untrained men

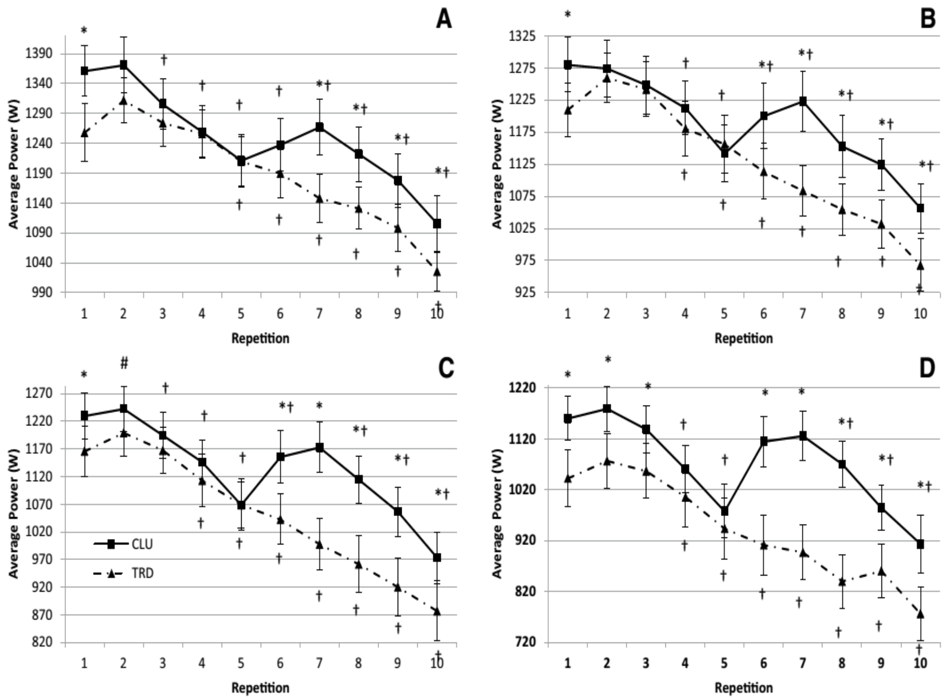
Jonathan M. Oliver[1] · Andreas Kreutzer[1] · Shane Jenke[1] · Melody D. Phillips[1] · Joel B. Mitchell[1] · Margaret T. Jones[2]

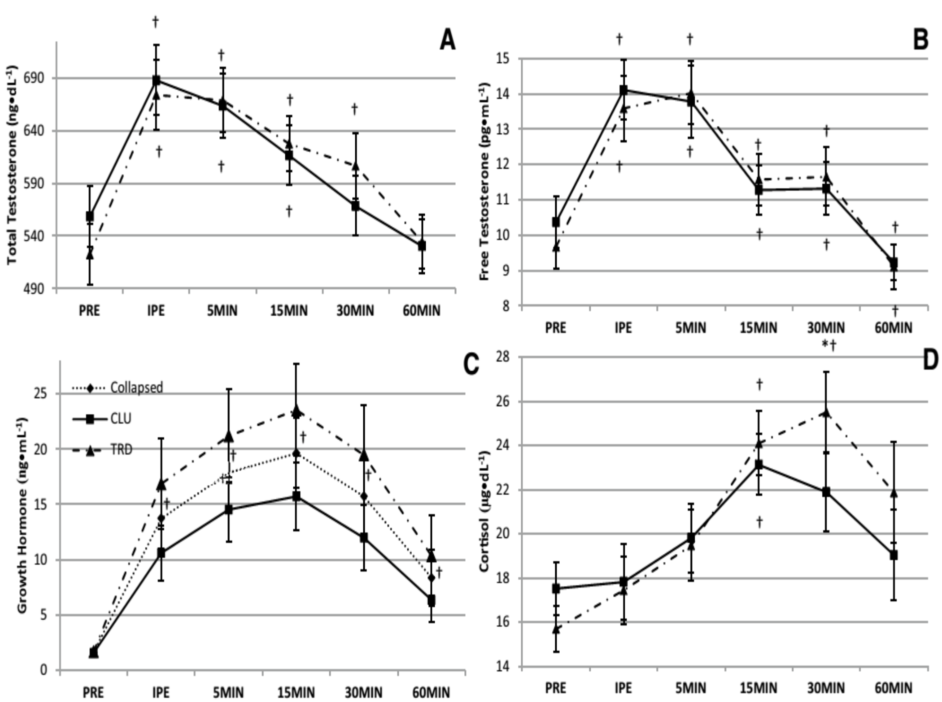
TREINO COM SÉRIE FRACIONADO SEM FALHA CONCÊNTRICA? QUAIS SÃO OS EFEITOS?

	Untrained ($n = 11$)	Resistance trained ($n = 12$)	Cohen's d
Age (years)	25 ± 1	25 ± 1	0.0
Height (cm)	179.9 ± 2.0	179.1 ± 2.2	0.1
Body mass (kg)	83.3 ± 3.5	84.6 ± 2.1	0.1
Body fat (%)	27.6 ± 2.2	15.8 ± 1.3*	0.6
Lean mass (kg)	56.6 ± 1.6	67.7 ± 1.6*	2.0
Bone mineral content (kg)	3.1 ± 0.4	3.6 ± 0.3*	0.4
1RM back squat (kg)	86.8 ± 5.1	146.9 ± 4.9*	3.5
1RM back squat:body mass	1.07 ± 0.08	1.75 ± 0.07*	3.0

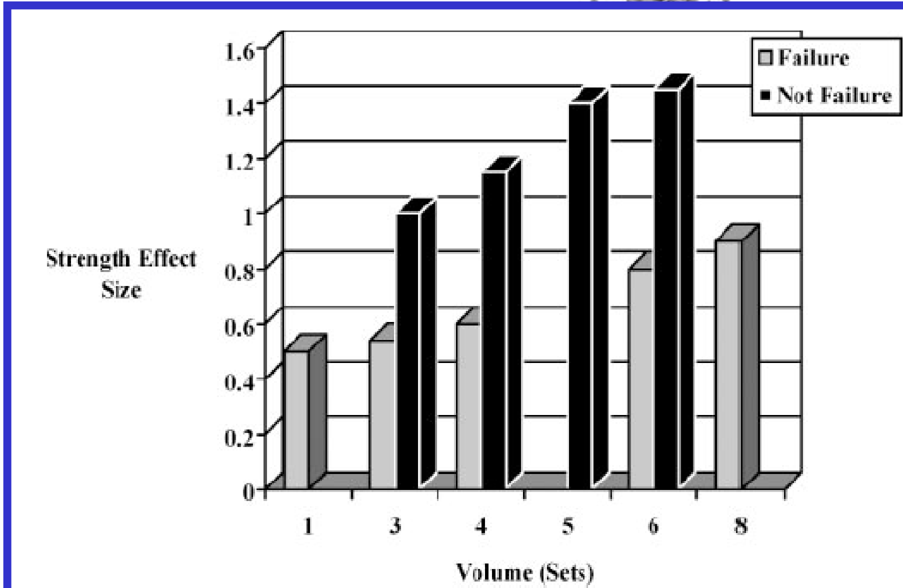


4 séries de 10 reps no agachamento– 70% de 1RM


A
B
C
D
Average Power (W)
Repetition
CLU
TRD


A
B
C
D
Total Testosterone (ng•dL⁻¹)
Free Testosterone (pg•mL⁻¹)
Growth Hormone (ng•mL⁻¹)
Cortisol (µg•dL⁻¹)
Collapsed
CLU
TRD
PRE
IPE
5MIN
15MIN
30MIN
60MIN

TREINAMENTO ATÉ A FADIGA



Differential effects of strength training leading to failure versus not to failure on hormonal responses, strength, and muscle power gains

Mikel Izquierdo,[1] Javier Ibañez,[1] Juan José González-Badillo,[2] Keijo Häkkinen,[3] Nicholas A. Ratamess,[4] William J. Kraemer,[5] Duncan N. French,[6] Jesus Eslava,[1] Aritz Altadill,[1] Xabier Asiain,[1] and Esteban M. Gorostiaga[1]

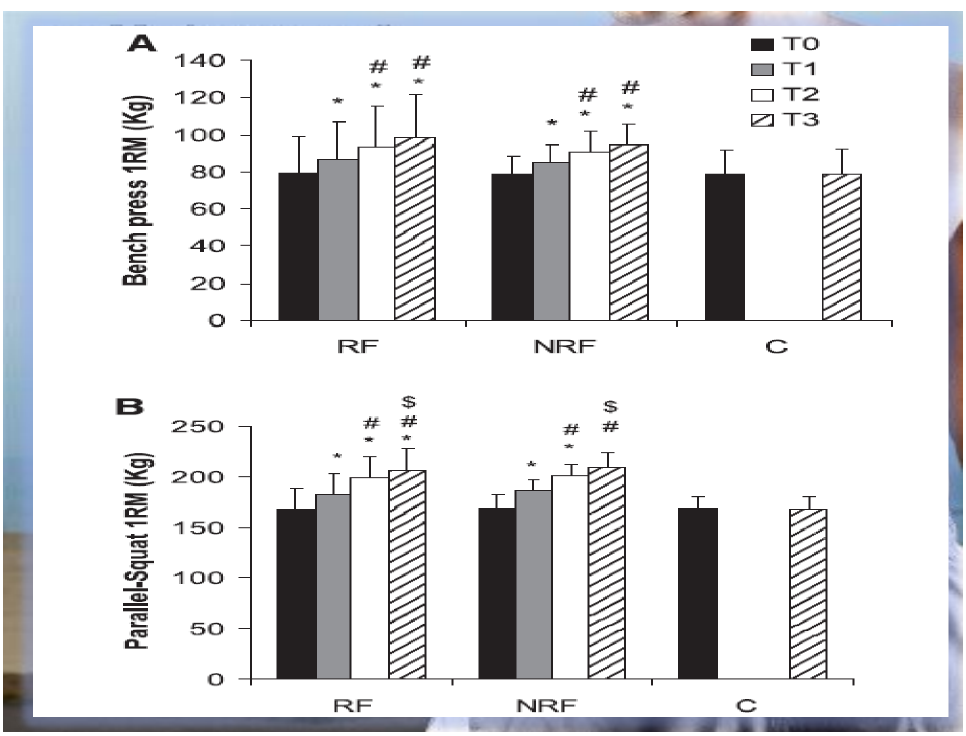
[1]Studies, Research and Sport Medicine Center, Government of Navarra and [2]Olympic Center of Sport Studies, Spanish Olympic Committee, Madrid, Spain; [3]Department of Biology of Physical Activity, University of Jyväskylä, Jyväskylä, Finland, [4]Department of Health and Exercise Science, The College of New Jersey, Ewing, New Jersey; [5]Department of Kinesiology, Human Performance Laboratory, University of Connecticut, Storrs, Connecticut; and [6]Institute of Sport, Northumbria University, Newcastle, United Kingdom

J Appl Physiol 100: 1647–1656, 2006.

DIFERENTES EFEITOS DO TF ATÉ A FALHA VERSUS SEM FALHA SOBRE AS RESPOSTAS HORMONAIS, FORÇA E POTÊNCIA

TREINAMENTO

- 2 vezes por semana de 16 semanas
- Grupo falha: 3 x 10RM no supino e 80% de 10RM no agachamento, depois 6RM, nas últimas semanas os dois grupos - 2-4 reps 85-90% de 1RM.
- Grupo sem falha: 6 séries de 5 repetições com carga similar e 6 séries de 3 repetições
- 2 min entre as séries e os exercícios



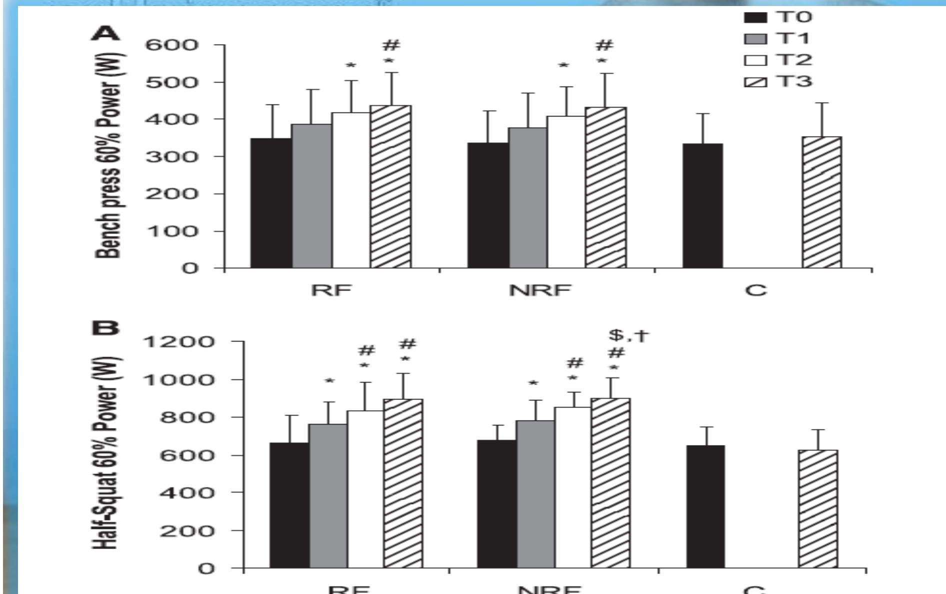
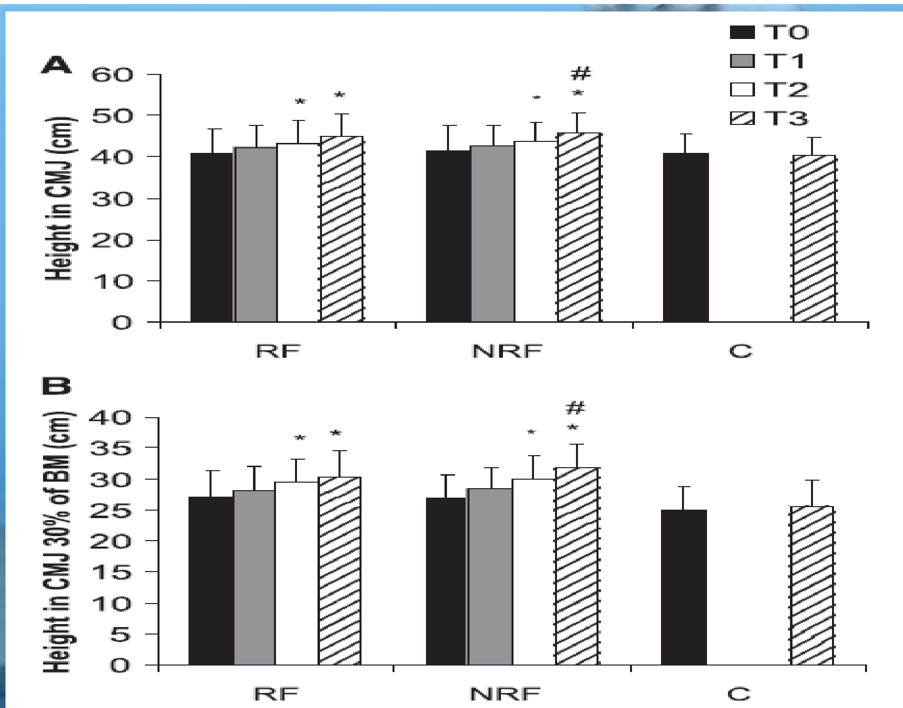
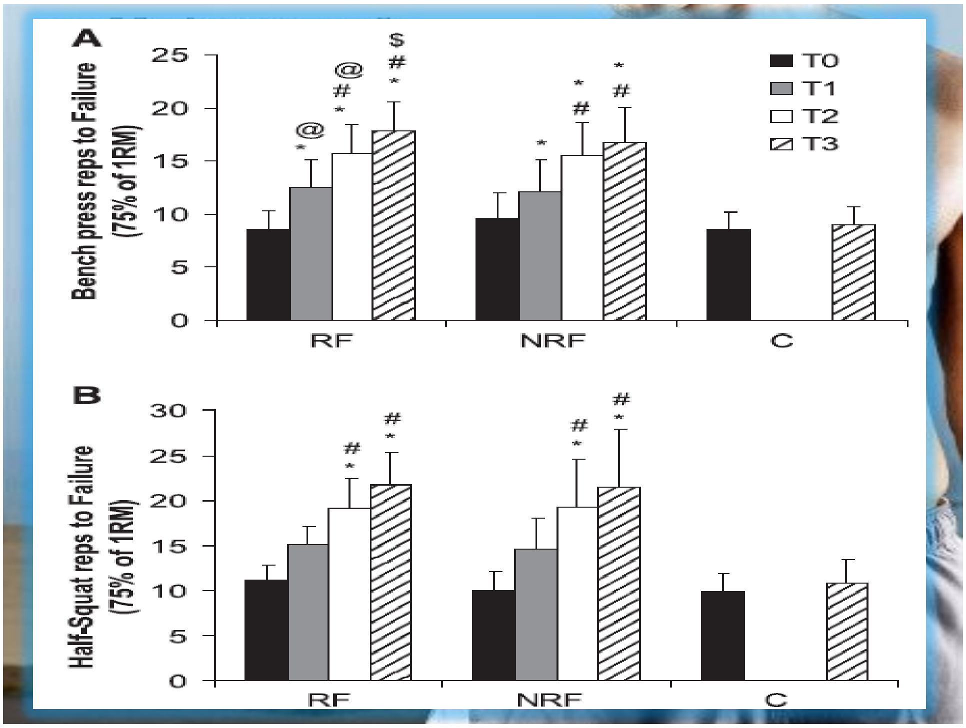
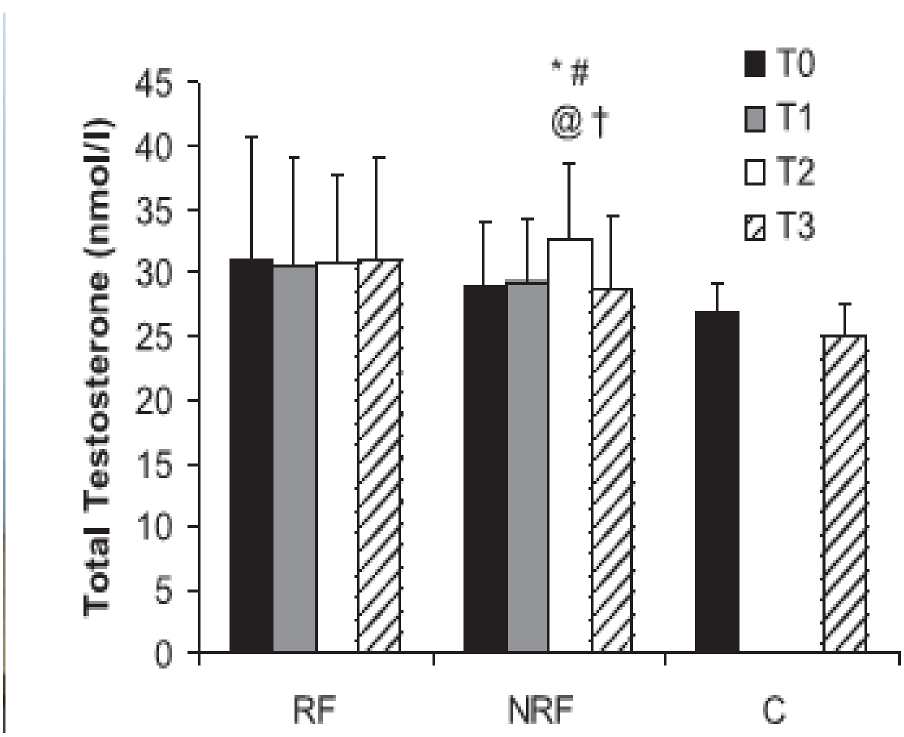
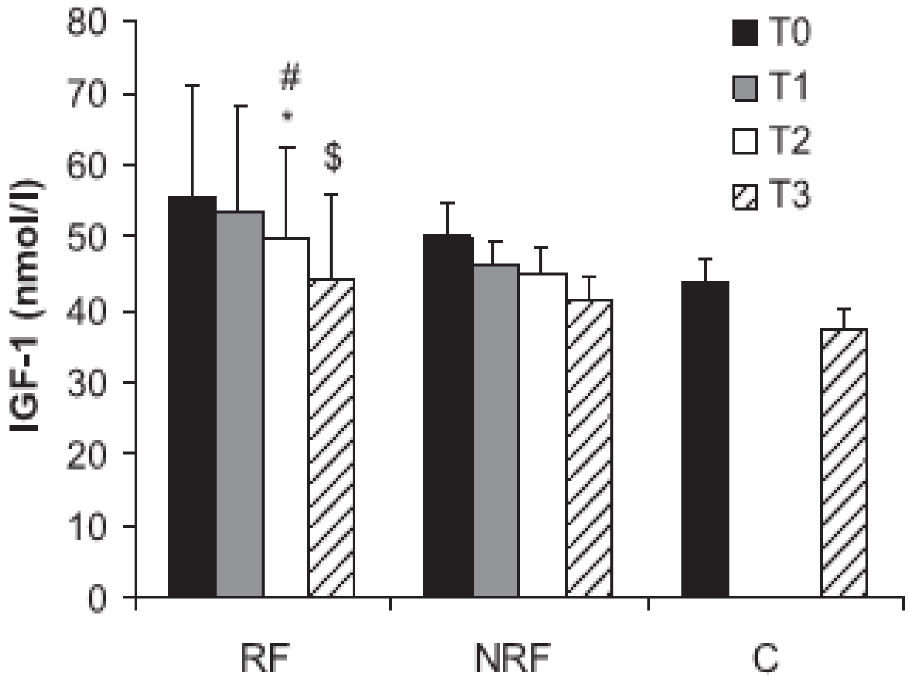


Fig. 2. Bench press (*A*) and parallel squat (*B*) muscle power output during the experimental period. *$P < 0.05$ from the corresponding time point T0. #$P < 0.05$ from the corresponding time point T1. \$$P < 0.05$ from the corresponding time point T2. †$P < 0.05$ from relative change at point time T1 between the groups. Data are means and SD.




A
Bench press reps to Failure (75% of 1RM)
25
20
15
10
5
0
RF
NRF
C
T0
T1
T2
T3
B
Half-Squat reps to Failure (75% of 1RM)
30
25
20
15
10
5
0
RF
NRF
C


Total Testosterone (nmol/l)
45
40
35
30
25
20
15
10
5
0
RF
NRF
C
T0
T1
T2
T3



Eur J Appl Physiol (2013) 113:2133–2142
DOI 10.1007/s00421-013-2642-7

ORIGINAL ARTICLE

Effect of range of motion in heavy load squatting on muscle and tendon adaptations

K. Bloomquist · H. Langberg · S. Karlsen ·
S. Madsgaard · M. Boesen · T. Raastad

EFEITO DA AMPLITUDE DE MOVIMENTO NO AGACHAMENTO PESADO SOBRE AS ADAPTAÇÕES MUSCULARES E TENDÍNEAS

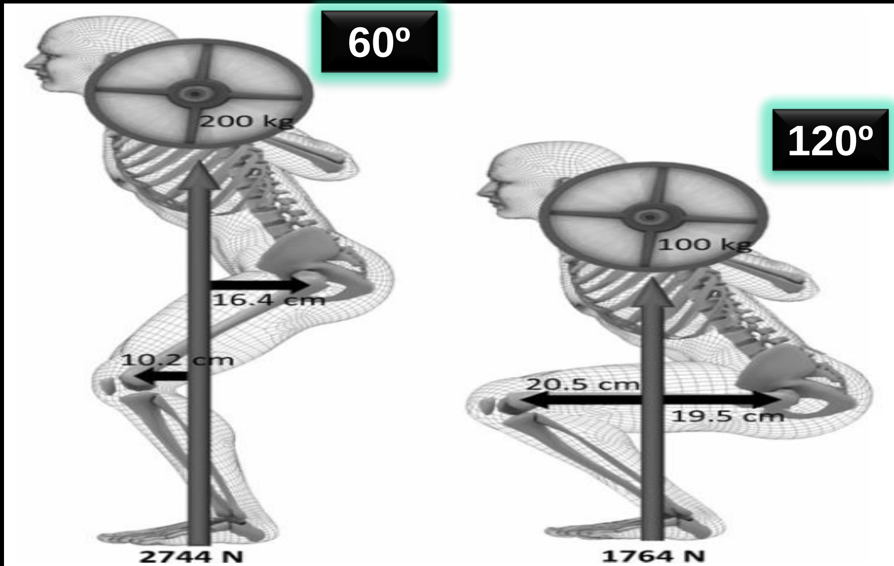


Fig. 1 Illustration of the deepest position in the SS (*left*) and DS exercise (*right*). The external moment arms indicated are estimated from an average subject with regard to lifting technique and height (180 cm). The ground reaction forces represent a body mass of 80 kg and an external load of 200 kg in the SS, and 100 kg in the DS

Table 1 Pretest characteristics of subjects in the SS group and in the DS group (mean ± SD)

	Shallow squat group ($n = 9$)	Deep squat group ($n = 8$)
Age (years)	23 ± 3	25 ± 6
Weight (kg)	80 ± 15	79 ± 6
Height (cm)	178 ± 6	181 ± 5
Peak torque (Nm) (isometric at 105°)	241 ± 66	242 ± 29
Jump height (cm) (squat jump)	33.9 ± 3.6	32.8 ± 3.3
Muscle CSA (cm^2) (front thigh)	95.6 ± 14.1	95.2 ± 7.3
Tendon CSA (mm^2) (middle part)	162 ± 9	166 ± 12

Table 2 Periodization and progression of strength training

Week	Monday	Wednesday	Friday
1	Familiarization	Familiarization	Familiarization
2	Pretesting	Pretesting	Pretesting
3	3 × 10 RM	3 × 8 (submax)[a]	4 × 5 RM
4	3 × 10 RM	3 × 10 (submax)	4 × 5 RM
5	3 × 10 RM	3 × 8 (submax)	4 × 5 RM
6	3 × 10 RM	3 × 10 (submax)	4 × 5 RM
7	3 × 10 RM	3 × 8 (submax)	4 × 5 RM
8	3 × 10 RM	3 × 10 (submax)	4 × 5 RM
9	3 × 6 RM	3 × 8 (submax)	5 × 3 RM
10	3 × 6 RM	3 × 10 (submax)	5 × 3 RM
11	3 × 6 RM	3 × 8 (submax)	5 × 3 RM
12	3 × 6 RM	3 × 10 (submax)	5 × 3 RM
13	3 × 6 RM	3 × 8 (submax)	5 × 3 RM
14	3 × 6 RM	3 × 10 (submax)	5 × 3 RM
15	Posttesting	Posttesting	Posttesting

[a] Eight reps with a 12–13 RM load

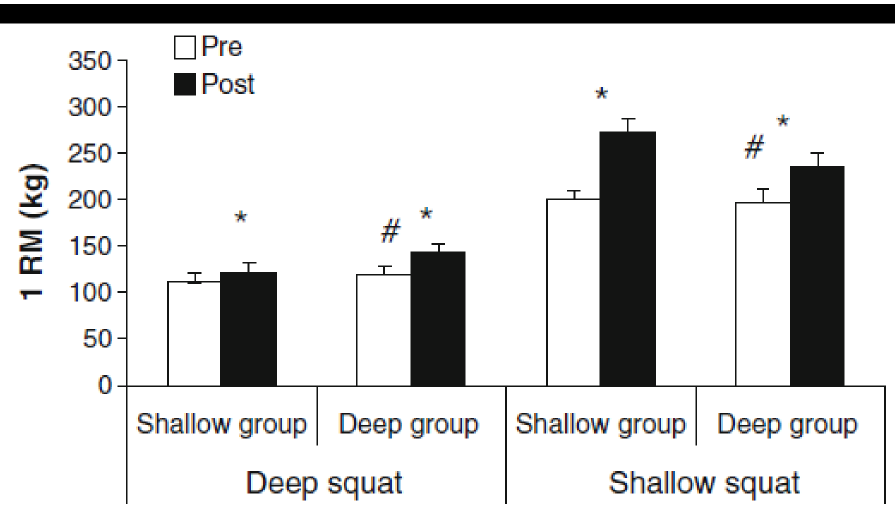


Fig. 2 One repetition maximum (1 RM) in the DS and SS exercise measured pre and post intervention. *Asterisk* significant change from pretest, *hash* significant difference between groups from pre to posttest

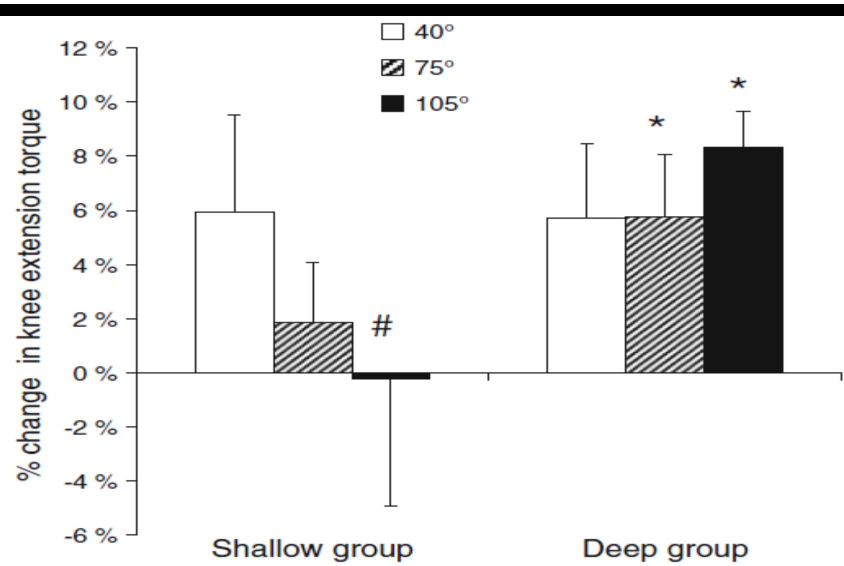


Fig. 3 Change in isometric knee-extension peak torque measured at knee angles of 40°, 75° and 105° (0° is full extension). *Asterisk* significant change from pretest, *hash* significant difference between groups from pre to posttest

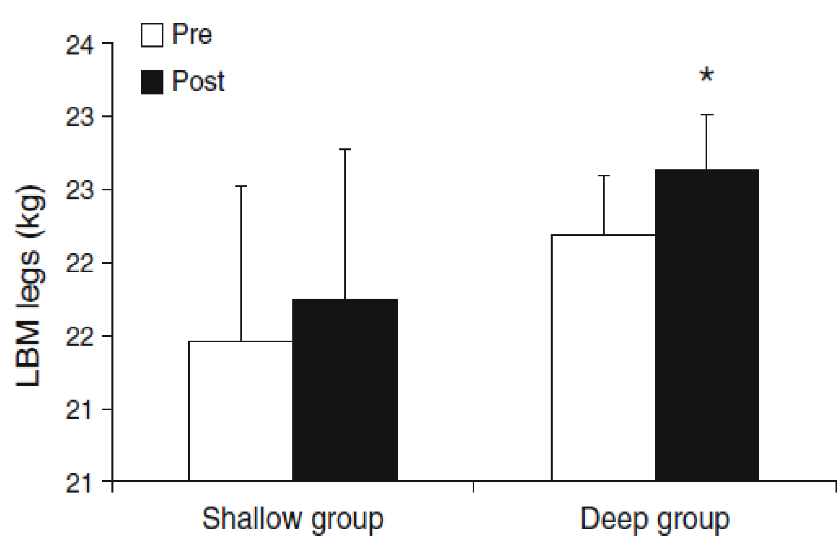


Fig. 5 Leg lean body mass (LBM) pre and post intervention. *Asterisk* significant change from pretest

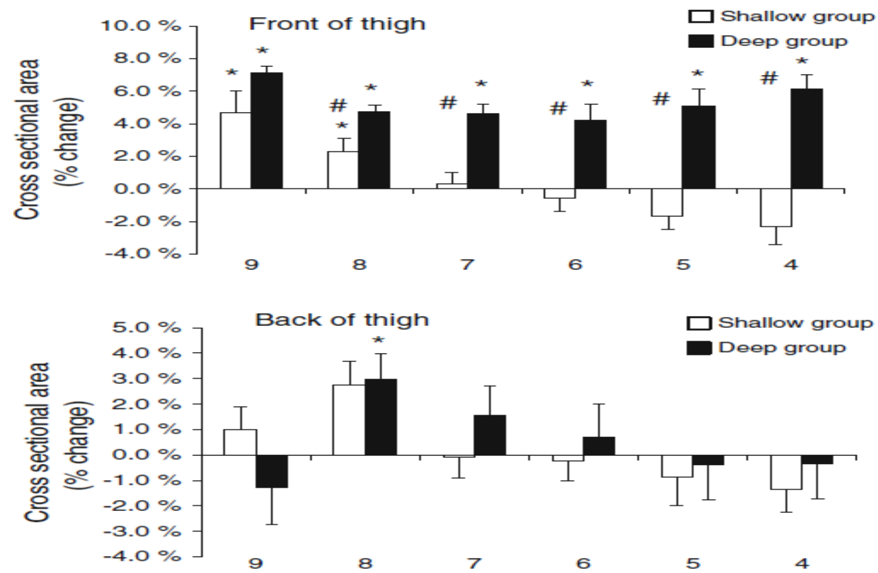


Fig. 4 Change in front thigh muscle CSA (*upper panel*) and back thigh (*lower panel*). *Asterisk* significant change from pretest (Section 9 was the most proximal), *hash* significant difference between groups from pre to posttest

Table 3 Muscle architecture before and after training in the SS and DS group

	Shallow squat group		Deep squat group	
	Pre	Post	Pre	Post
Muscle thickness (cm)	2.47 ± 0.37	2.54 ± 0.33	2.51 ± 0.26	2.60 ± 0.32
Fasicle angle (°)	18.5 ± 3.0	22.6 ± 3.7*	18.6 ± 2.8	21.7 ± 2.0*

Pre and post values given as mean ± SD

* $P < 0.05$

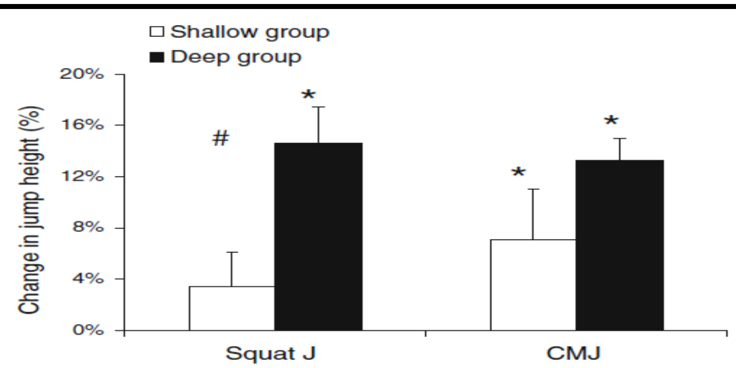


Fig. 6 Change in jump height in SJ and CMJ. *Asterisk* significant change from pretest, *hash* significant difference between groups from pre to posttest

Eur J Appl Physiol (2013) 113:2691–2703
DOI 10.1007/s00421-013-2700-1

ORIGINAL ARTICLE

Inhomogeneous architectural changes of the quadriceps femoris induced by resistance training

Ryoichi Ema · Taku Wakahara · Naokazu Miyamoto ·
Hiroaki Kanehisa · Yasuo Kawakami

Mudanças não homogêneas na arquitetura do quadríceps induzidas pela treinamento de força

11 Jovens fisicamente ativos

10 controles

TREINAMENTO DE 3 MESES:

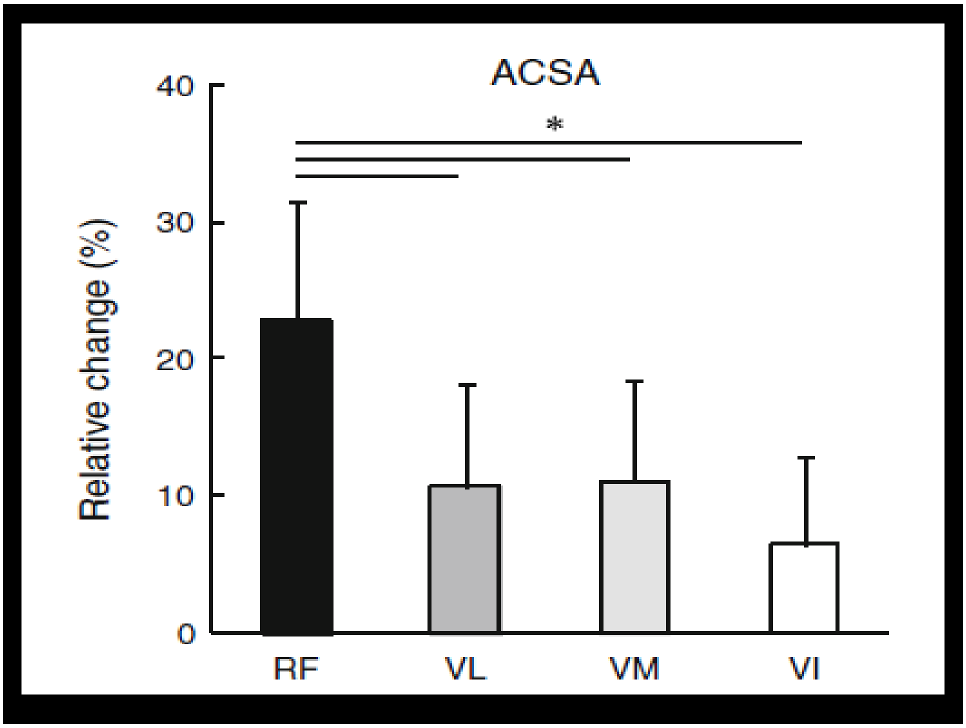
Extensão dos joelhos (2 s conc. e 2 s na exc.)

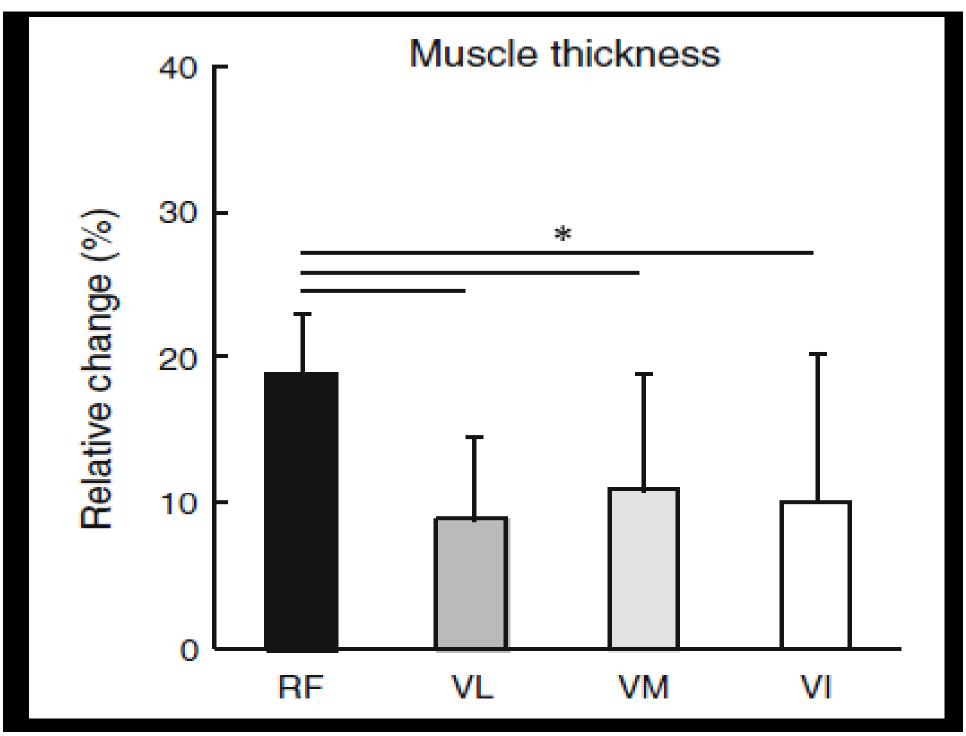
3 x semana

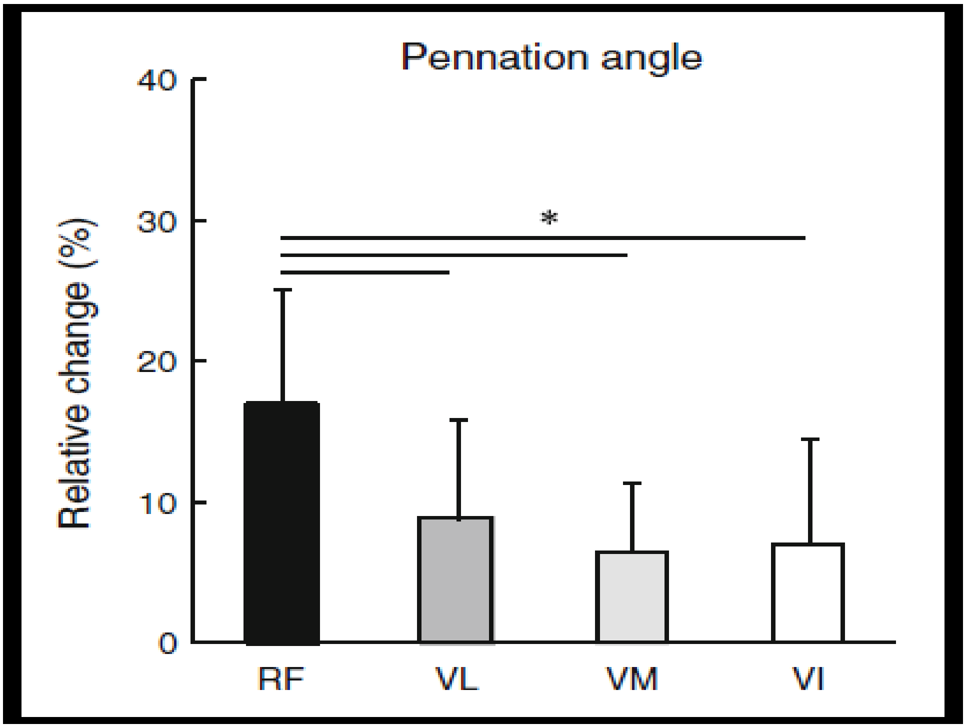
5 x 8 reps a 80% de 1RM

1,5 min intervalo entre as séries

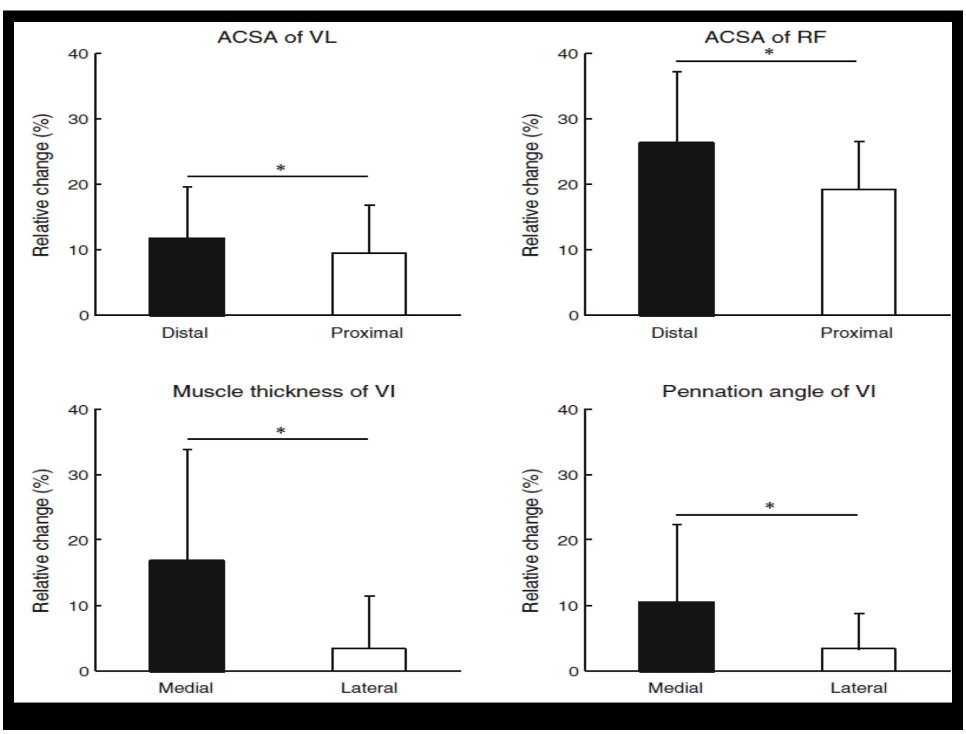
1RM ajustada a cada 2 semanas


ACSA
Relative change (%)
0
10
20
30
40
*
RF
VL
VM
VI


Muscle thickness
Relative change (%)
0
10
20
30
40
*
RF
VL
VM
VI



Pennation angle
Relative change (%)
40
30
20
10
0
*
RF
VL
VM
VI



ACSA of VL
Relative change (%)
Distal
Proximal
ACSA of RF
Muscle thickness of VI
Medial
Lateral
Pennation angle of VI

Eur J Appl Physiol (2012) 112:1569–1576
DOI 10.1007/s00421-011-2121-y

ORIGINAL ARTICLE

Association between regional differences in muscle activation in one session of resistance exercise and in muscle hypertrophy after resistance training

Taku Wakahara · Naokazu Miyamoto · Norihide Sugisaki · Koichiro Murata · Hiroaki Kanehisa · Yasuo Kawakami · Tetsuo Fukunaga · Toshimasa Yanai

Associação entre diferenças na ativação muscular regional em uma sessão de TF e a hipertrofia após o treinamento

12 Jovens fisicamente ativos

TREINAMENTO DE 3 MESES:

Extensão dos cotovelos com halteres

3 x semana

5 x 8 reps a 80% de 1RM

1,5 min intervalo entre as séries

1RM ajustada a cada 2 semanas

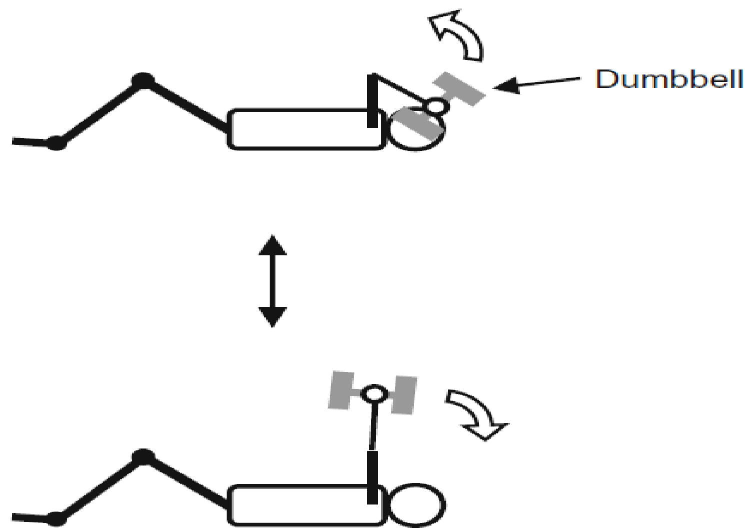
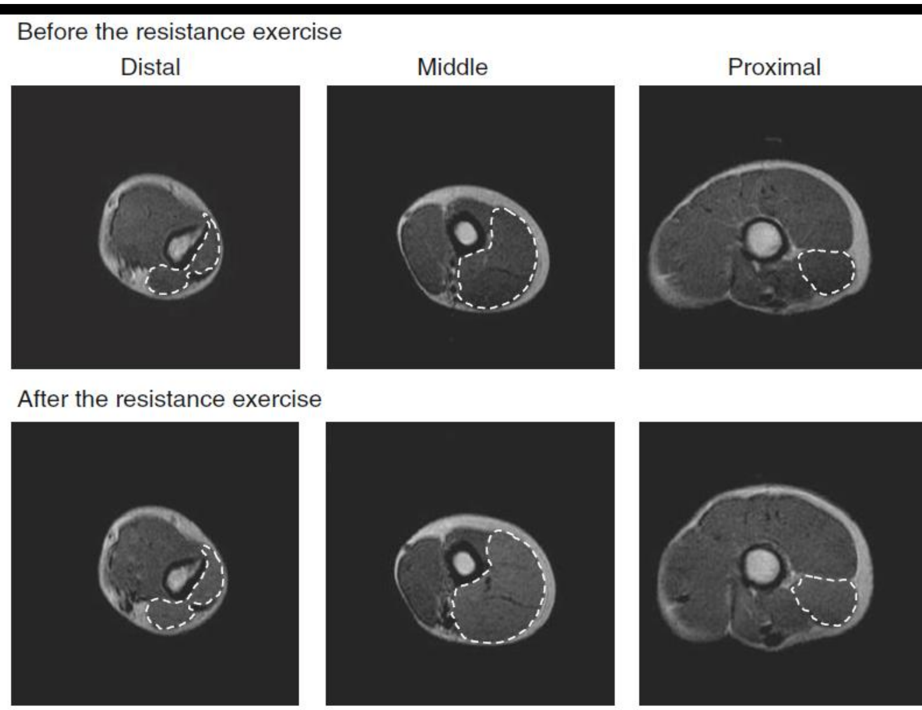
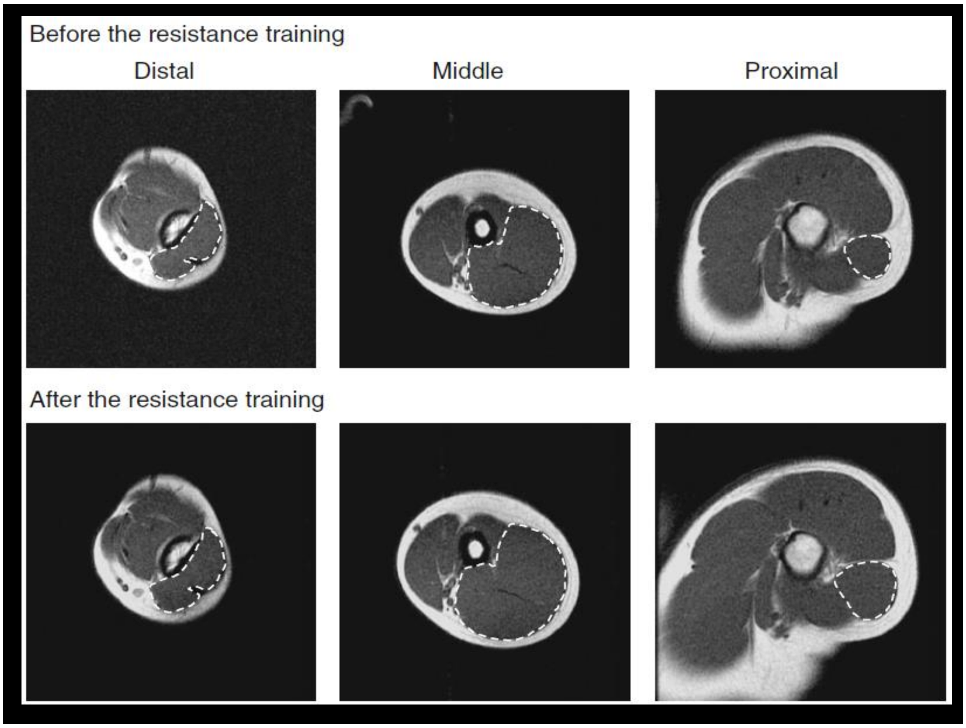


Fig. 1 Schematic illustrations of the "lying triceps extension" exercise. The subjects concentrically extend, and then eccentrically flexed the elbow with a dumbbell in the hand





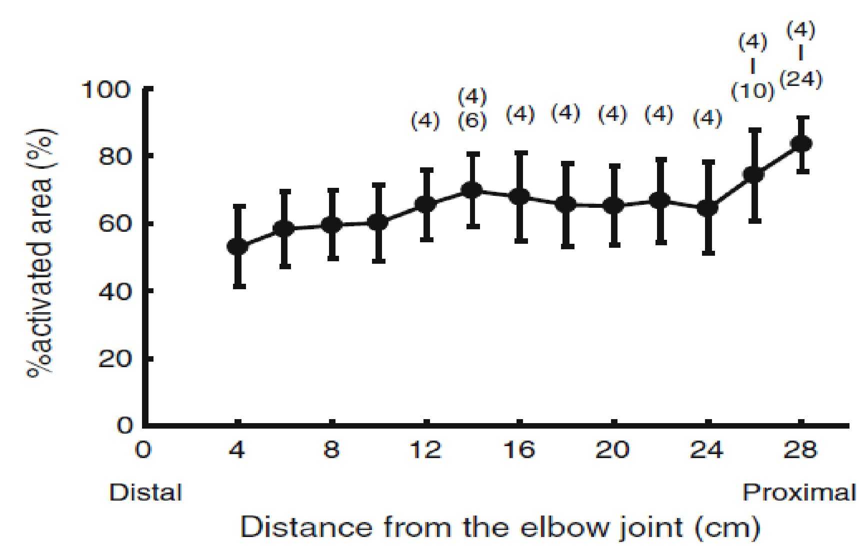


Fig. 4 The %activated area of the triceps brachii muscle along its length induced by one session of the resistance exercise. The *number* in *parentheses* indicates the position (distance from the elbow joint), where a significant difference was found

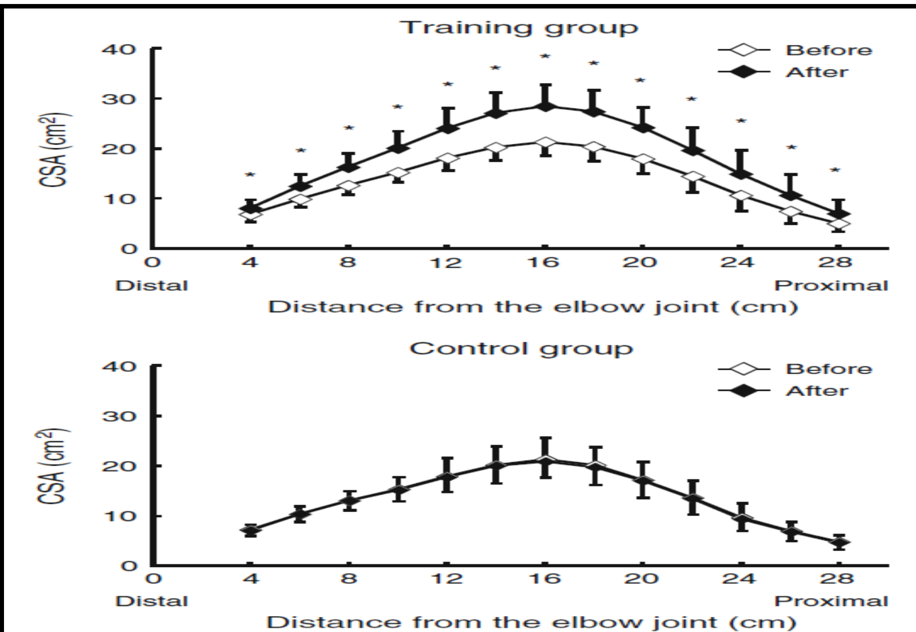


Fig. 6 Distribution of the CSA (cross-sectional area) of the triceps brachii muscle in the training (*upper panel*) and control (*lower panel*) groups. *Asterisk* denotes a significant difference between before and after the training

Nonuniform Muscle Hypertrophy: Its Relation to Muscle Activation in Training Session

TAKU WAKAHARA[1,2], ATSUKI FUKUTANI[3,4,5], YASUO KAWAKAMI[1], and TOSHIMASA YANAI[1]

[1]Faculty of Sport Sciences, Waseda University, Tokorozawa, Saitama, JAPAN; [2]Faculty of Health and Sports Science, Doshisha University, Kyotanabe, Kyoto, JAPAN; [3]Graduate School of Sport Sciences, Waseda University, Saitama, JAPAN; [4]Faculty of Sport and Health Science, Ritsumeikan University, Shiga, JAPAN; and [5]Japan Society for the Promotion of Science, Tokyo, JAPAN

Med. Sci. Sports Exerc., Vol. 45, No. 11, pp. 2158–2165, 2013.

Hipertrofia muscular não uniforme: Relação com a ativação muscular na sessão de treino

12 Jovens fisicamente ativos

TREINAMENTO DE 3 MESES:

Extensão dos cotovelos com halteres

3 x semana

5 x 8 reps a 80% de 1RM

1,5 min intervalo entre as séries

1RM ajustada a cada 2 semanas

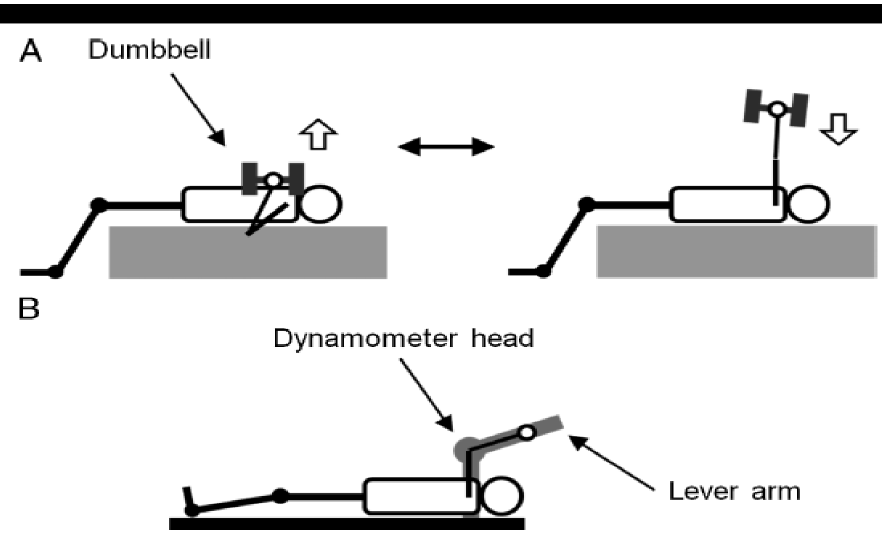
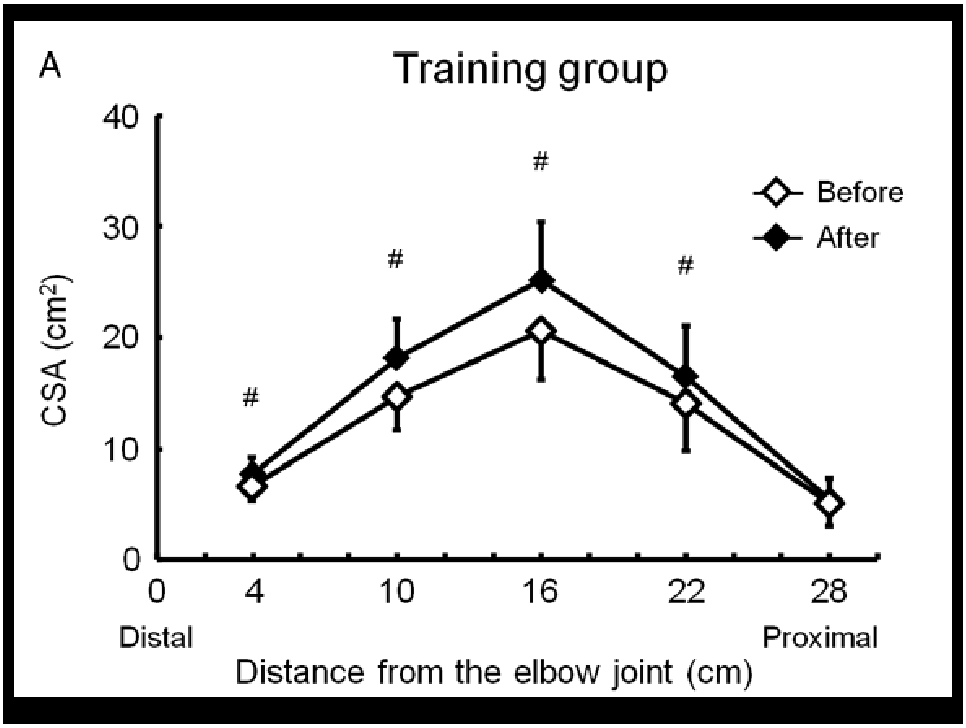
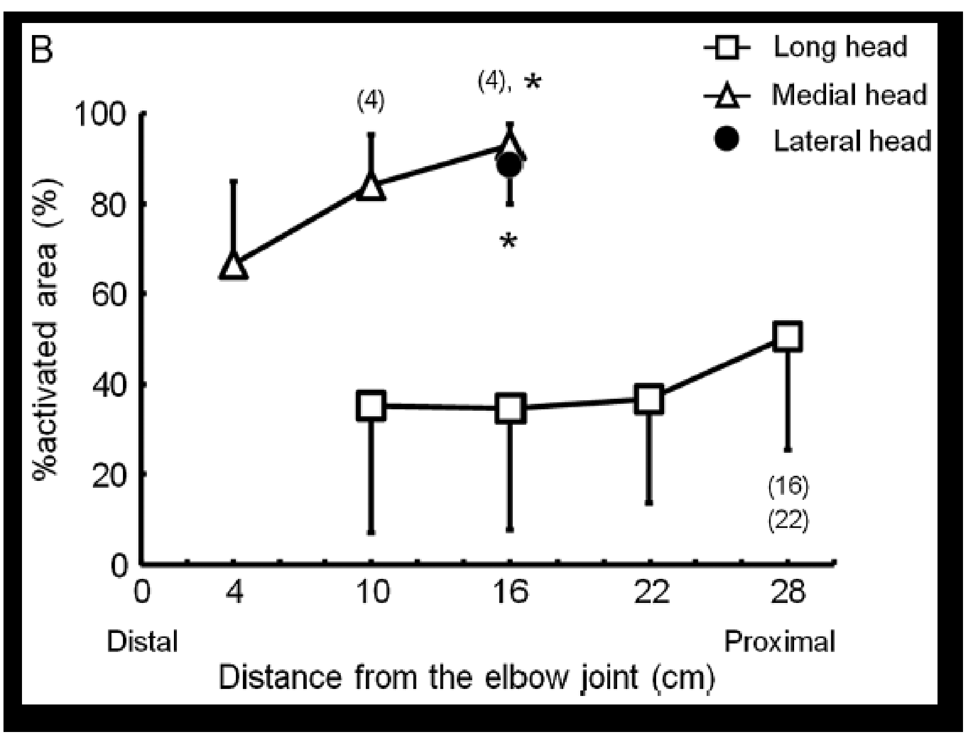
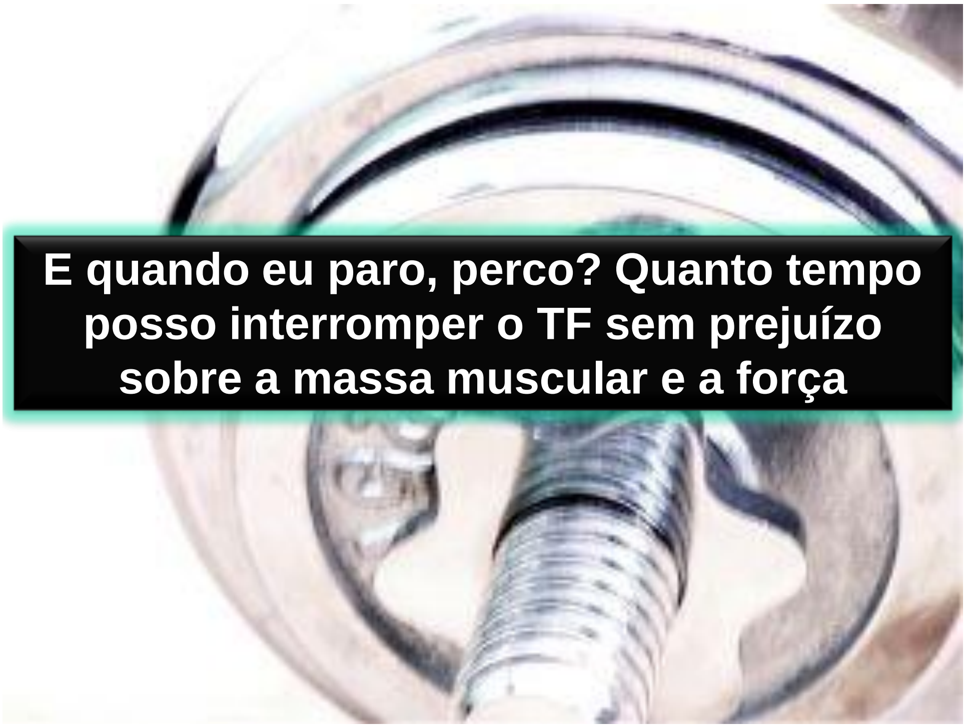


FIGURE 1—A, Schematic illustrations of the resistance exercise used in the present study. The exercise was similar to a "dumbbell press" exercise. The subjects lifted a dumbbell vertically (from the left to the right illustration), and then lowered it (from the right to the left illustration). B, A schematic illustration of strength testing.


A
Training group
CSA (cm^2)
40
30
20
10
0
#
#
#
#
Before
After
0
4
10
16
22
28
Distal
Proximal
Distance from the elbow joint (cm)


B
Long head
Medial head
Lateral head
%activated area (%)
100
80
60
40
20
0
(4)
(4), *
*
(16)
(22)
0
4
10
16
22
28
Distal
Proximal
Distance from the elbow joint (cm)


E quando eu paro, perco? Quanto tempo posso interromper o TF sem prejuízo sobre a massa muscular e a força


Eur J Appl Physiol
DOI 10.1007/s00421-012-2511-9
ORIGINAL ARTICLE
Comparison of muscle hypertrophy following 6-month of continuous and periodic strength training
Riki Ogasawara · Tomohiro Yasuda · Naokata Ishii · Takashi Abe
Eur J Appl Physiol. 2013 Apr;113(4):975-85.
Comparação da hipertrofia muscular após 6 meses de TF contínuo versus periódico

14 HOMENS JOVENS DESTREINADOS

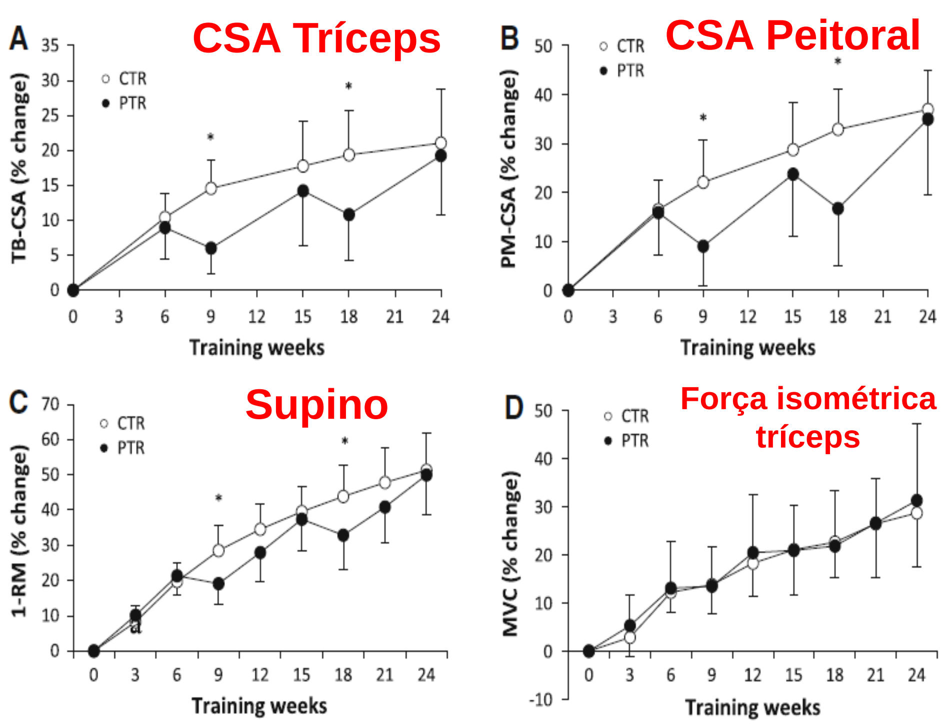
TREINAMENTO DE FORÇA

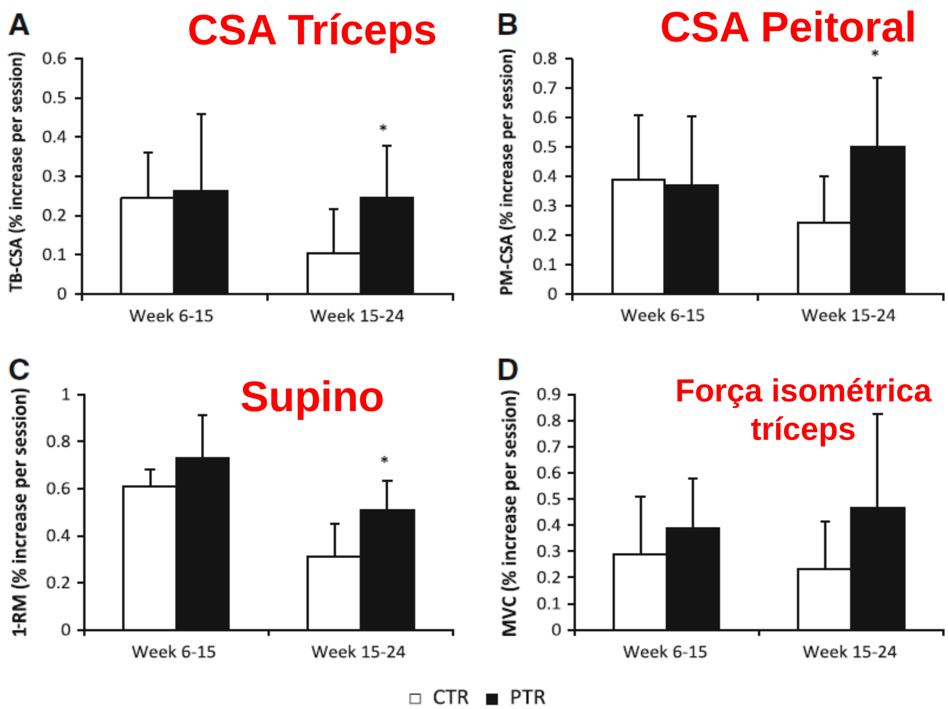
3 x semana supino

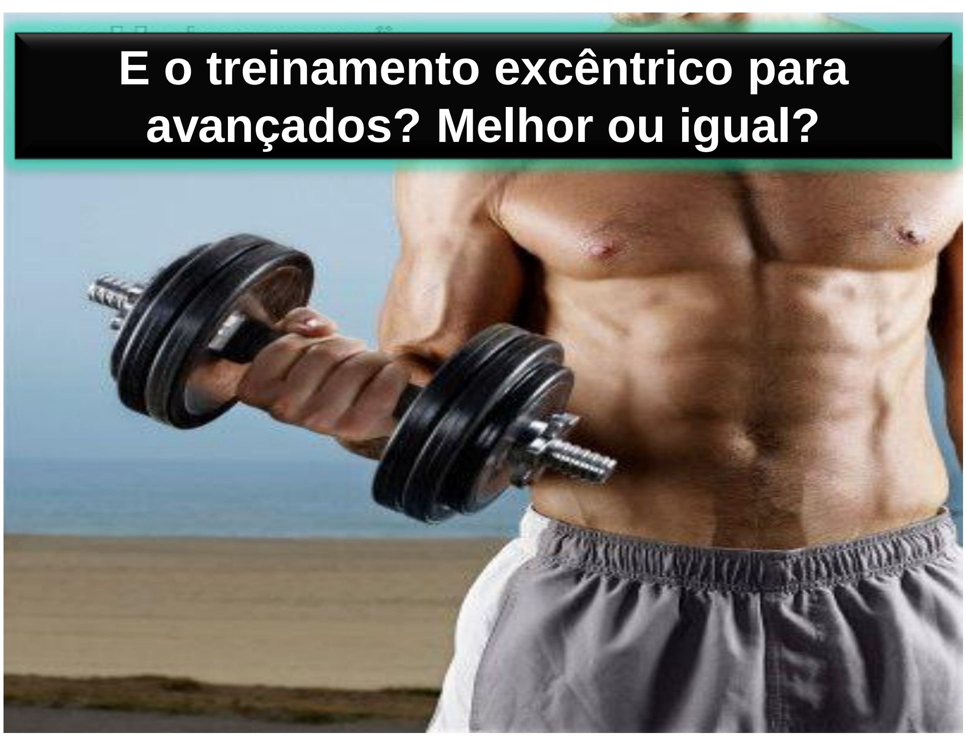
3 x 10 reps a 75% de 1RM (reaferida a cada 3 semanas) c/ 2-3 minutos de intervalo

Contínuo: 24 semanas

Periódico: 6 semanas treino + dois ciclos de 3 semanas de destreino / 6 retreino




A
CSA Tríceps
TB-CSA (% increase per session)
0.6
0.5
0.4
0.3
0.2
0.1
0
*
Week 6-15
Week 15-24
B
CSA Peitoral
PM-CSA (% increase per session)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
*
Week 6-15
Week 15-24
C
Supino
1-RM (% increase per session)
1
0.8
0.6
0.4
0.2
0
*
Week 6-15
Week 15-24
D
Força isométrica tríceps
MVC (% increase per session)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Week 6-15
Week 15-24
CTR
PTR


E o treinamento excêntrico para avançados? Melhor ou igual?

Muscular Performance after Concentric and Eccentric Exercise in Trained Men

HARALD VIKNE[1,2], PER E. REFSNES[3], MERETE EKMARK[2], JON INGULF MEDBØ[4], VIDAR GUNDERSEN[5], and KRISTIAN GUNDERSEN[2]

[1]*Norwegian School of Sport Sciences, Oslo, NORWAY;* [2]*Department of Molecular Biosciences, University of Oslo, NORWAY;* [3]*Norwegian Olympic Sports Centre, Oslo, NORWAY;* [4]*National Institute of Occupational Health, Oslo, NORWAY; and* [5]*Department of Anatomy and the CMBN, University of Oslo, NORWAY*

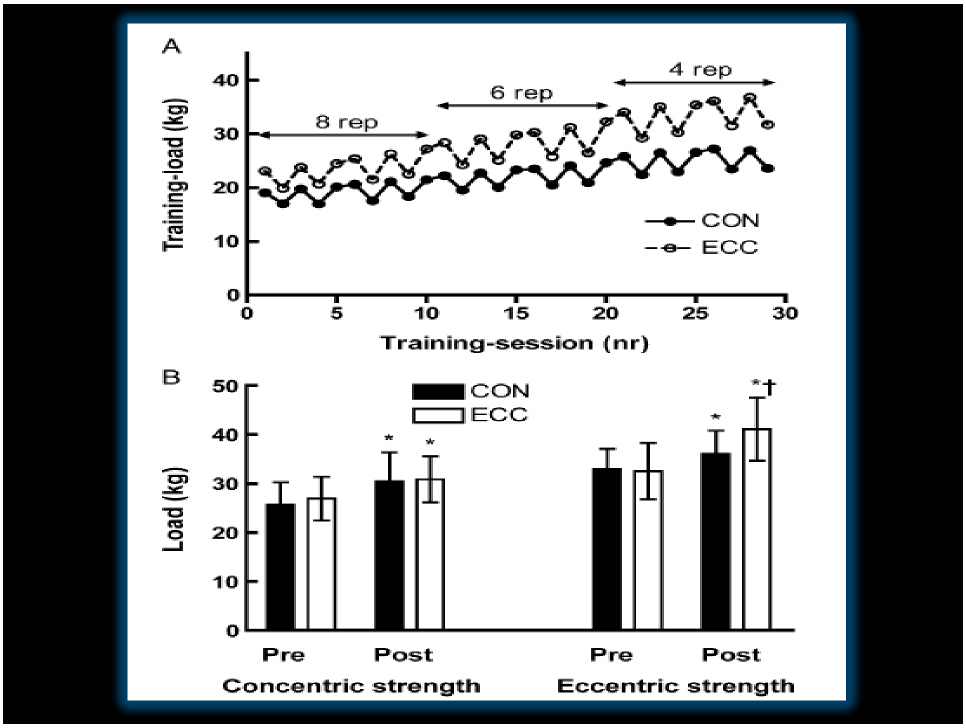
Med. Sci. Sports Exerc., Vol. 38, No. 10, pp. 1770–1781, 2006.

Desempenho muscular após treinamento concêntrico e excêntrico em homens treinados

TABLE 2. The training program for the concentric exercise and eccentric exercise groups.

	Training Session Each Week			
Week	**1**	**2**	**3**	**Reps per week**
1	3 × 8RM	3 × 8 medium	3 × 8RM	72
2	3 × 8 medium	4 × 8RM		56
3	4 × 8RM	3 × 8 medium	4 × 8RM	88
4	3 × 8 medium	4 × 8RM		56
5	4 × 6RM	3 × 6 medium	4 × 6RM	66
6	3 × 6 medium	4 × 6RM		42
7	4 × 6RM	4 × 6 medium	4 × 6RM	72
8	4 × 6 medium	4 × 6RM		48
9	5 × 4RM	4 × 4 medium	5 × 4RM	56
10	4 × 4 medium	5 × 4RM		36
11	5 × 4RM	4 × 4 medium	5 × 4RM	56
12	4 × 4 medium	5 × 4RM		36

The training within each session is given as the number of sets times the number of repetitions in each set. The designated intensity of each training session is termed RM (maximum load) or medium (10–15% lower than maximum).


A
Training-load (kg)
8 rep
6 rep
4 rep
CON
ECC
Training-session (nr)
B
Load (kg)
CON
ECC
Pre
Post
Pre
Post
Concentric strength
Eccentric strength

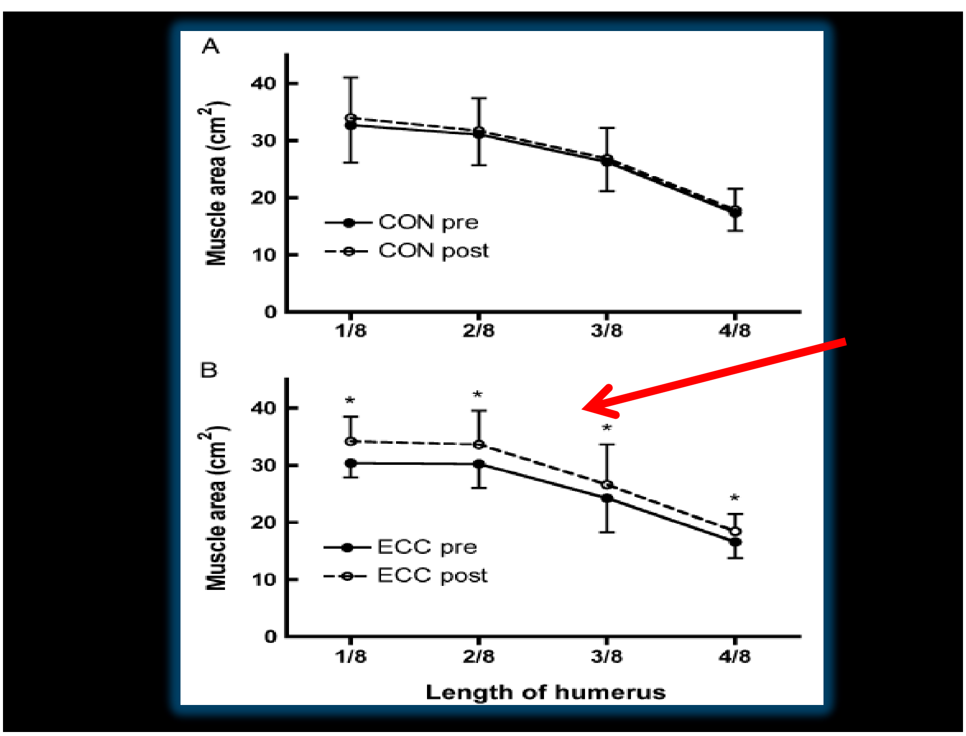

A
Muscle area (cm^2)
CON pre
CON post
B
Muscle area (cm^2)
ECC pre
ECC post
Length of humerus

TABLE 4. Single-fiber cross-sectional area, weighted mean cross-sectional area, and relative cross-sectional fiber area in CON and ECC before and after the training period.

	CON ($N = 7$)			ECC ($N = 6$)		
	Pre	Post	Δ (%)	Pre	Post	Δ (%)
Fiber area (μm²)						
Type I	5942 ± 1628	5821 ± 1304	−2 ± 9	5320 ± 1227	6635 ± 1361*	25 ± 11†
Type IIA	9615 ± 3004‡	10,087 ± 3059‡	5 ± 15	9459 ± 1387‡	13,213 ± 1899‡*	40 ± 18†
Weighted mean	8408 ± 2670	8715 ± 2654	4 ± 15	7394 ± 1223	10,453 ± 1910*	41 ± 20†
IIA/I-area	1.6 ± 0.2	1.7 ± 0.3	7 ± 15	1.8 ± 0.3	2 ± 0.3*	12 ± 7
Relative fiber area/%						
Type I	24.7 ± 8.3	24.1 ± 10.7	−0.6 ± 13.2	36.1 ± 5.5†	27 ± 5.1*	−9.1 ± 8.4
Type II	75.3 ± 8.3	75.9 ± 10.7	0.6 ± 13.2	63.9 ± 5.5†	73 ± 5.1*	9.1 ± 8.4

Values are means ± SD. CON, concentric exercise group; ECC, eccentric exercise group.
* Significantly different from pre values ($P < 0.05$); † significantly different from CON ($P < 0.01$); ‡ significantly larger than type I fibers ($P < 0.001$).

Maior hipertrofia e ganho de força excêntrica

Ganho similar de força concêntrica e velocidade angular

BOA ESTRATÉGIA PARA INDIVÍDUOS TREINADOS

ACTA PHYSIOLOGICA
Acta Physiol 2014, 210, 642–654

Architectural, functional and molecular responses to concentric and eccentric loading in human skeletal muscle

M. V. Franchi,[1,2] P. J. Atherton,[1] N. D. Reeves,[2] M. Flück,[3] J. Williams,[1] W. K. Mitchell,[1] A. Selby,[1] R. M. Beltran Valls[1] and M. V. Narici[1]
1 School of Graduate Entry Medicine and Health, MRC-ARUK Centre of Excellence for Musculoskeletal Ageing Research, University of Nottingham, Derby, UK
2 School of Healthcare Science, Institute for Biomedical Research into Human Movement and Health, Manchester Metropolitan University, Manchester, UK
3 Department of Orthopaedics, University of Zurich, Balgrist University Hospital, Zurich, Switzerland

Respostas estruturais, funcionais e moleculares ao TF concêntrico e excêntrico no músculo humano

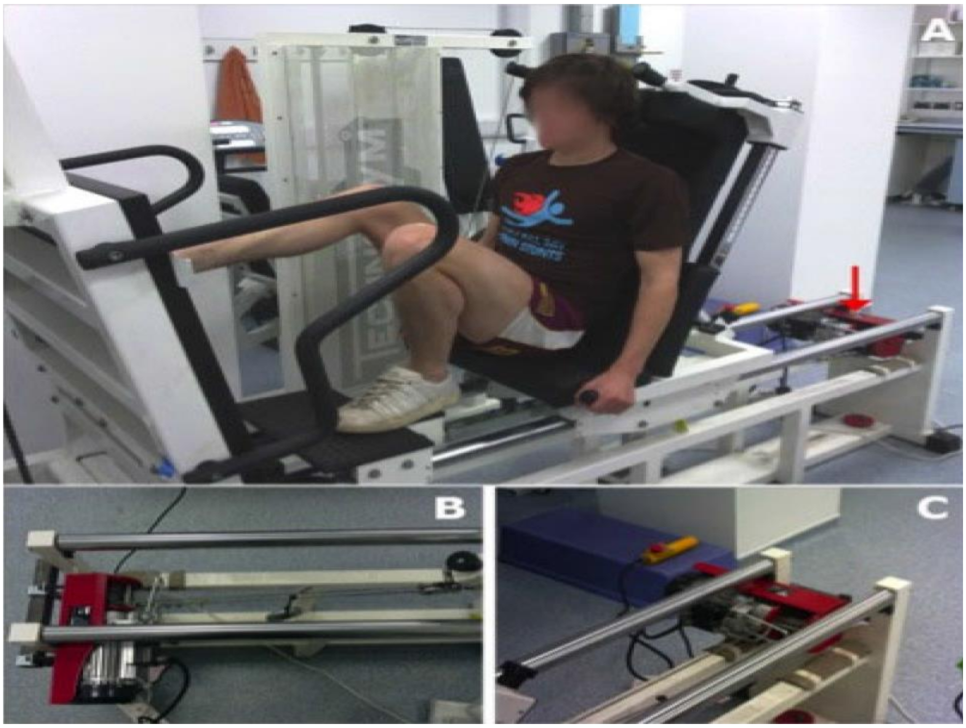
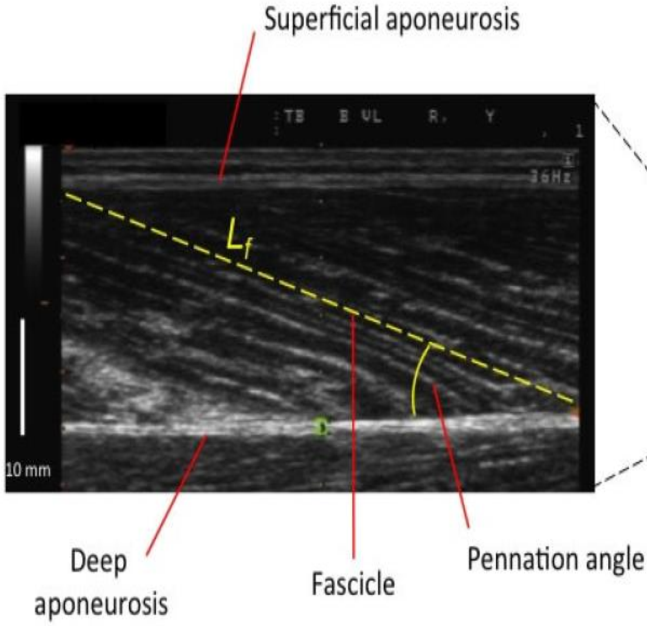


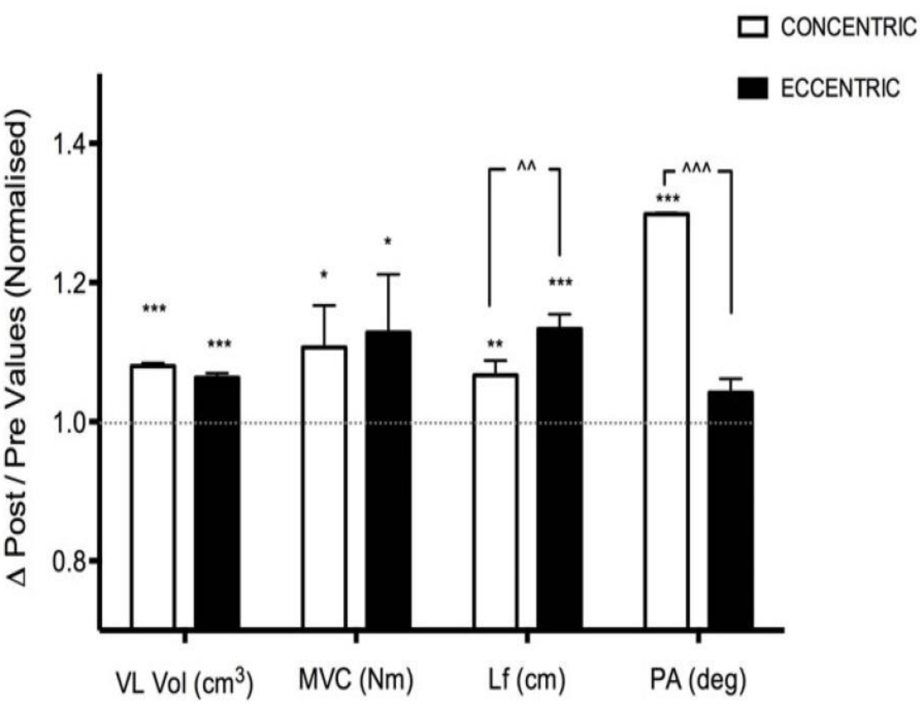
Table 1. Maximum lifting or lowering ability changes for the CON Group (CON) and the ECC one (ECC). EMG values were recorded only at baseline during 1RM leg-press for concentric and eccentric phases. Load ratio is also showed and calculated as the ratio of pre and post ECC/CON training loads.

CON 1RM (Kg)			**ECC 1RM (Kg)**			**Load ratio**	
Pre	**Post**	**Δ%**	**Pre**	**Post**	**Δ%**	**Pre**	**Post**
192 ± 16	262 ± 30	36*	233 ± 13	337 ± 9	44*	1.21	1.29
EMG (mV)			**EMG (mV)**				
0.33± 0.1			0.31± 0.1				

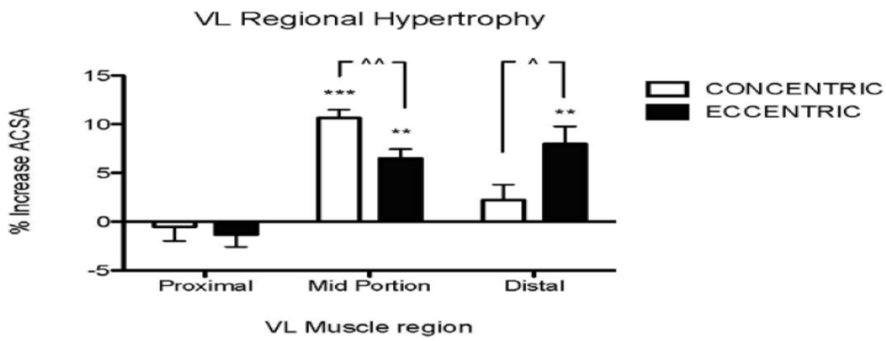
(Pre = baseline, Post = Post-training) values are means ± SEM (** P<0.05, pre-to-post difference*).

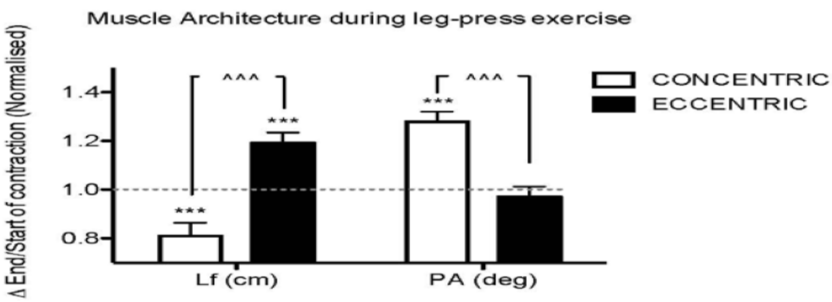


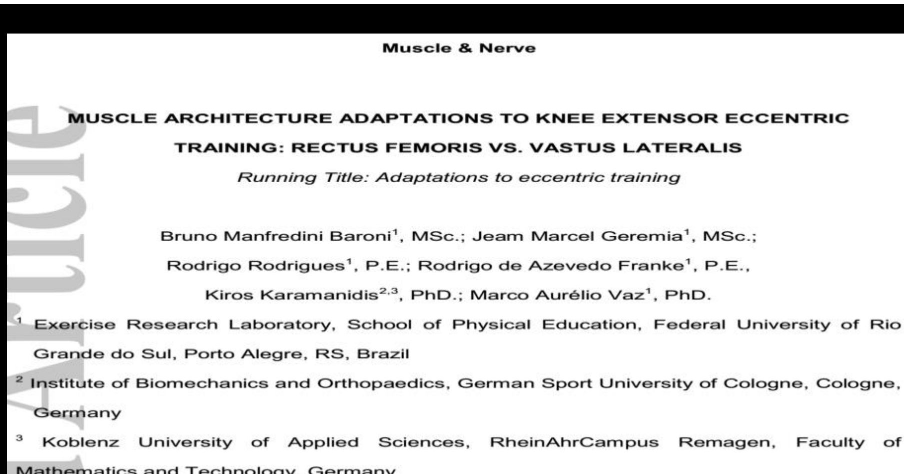
Superficial aponeurosis
L_f
10 mm
Deep aponeurosis
Fascicle
Pennation angle



CONCENTRIC
ECCENTRIC
Δ Post / Pre Values (Normalised)
1.4
1.2
1.0
0.8
***
*
**
^^
^^^
VL Vol (cm³)
MVC (Nm)
Lf (cm)
PA (deg)







Muscle & Nerve

MUSCLE ARCHITECTURE ADAPTATIONS TO KNEE EXTENSOR ECCENTRIC TRAINING: RECTUS FEMORIS VS. VASTUS LATERALIS

Running Title: Adaptations to eccentric training

Bruno Manfredini Baroni[1], MSc.; Jeam Marcel Geremia[1], MSc.;
Rodrigo Rodrigues[1], P.E.; Rodrigo de Azevedo Franke[1], P.E.,
Kiros Karamanidis[2,3], PhD.; Marco Aurélio Vaz[1], PhD.

[1] Exercise Research Laboratory, School of Physical Education, Federal University of Rio Grande do Sul, Porto Alegre, RS, Brazil

[2] Institute of Biomechanics and Orthopaedics, German Sport University of Cologne, Cologne, Germany

[3] Koblenz University of Applied Sciences, RheinAhrCampus Remagen, Faculty of Mathematics and Technology, Germany

Adaptações na arquitetura muscular ao treinamento excêntrico dos extensores dos joelhos: reto femoral versus vasto lateral

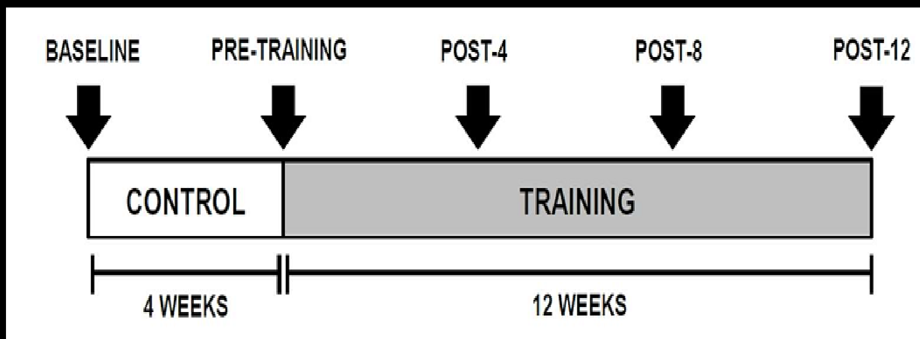


Table 1. Eccentric training program.

Mesocycle	Week	Frequency	Sets	Repetitions	Volume
1	1	1	3	10	30
	2	2	3	10	30
	3	2	3	10	30
	4	2	3	10	30
2	5	1	4	10	40
	6	2	4	10	40
	7	2	4	10	40
	8	2	4	10	40
3	9	1	5	10	50
	10	2	5	10	50
	11	2	5	10	50
	12	2	5	10	50

1 minuto entre as séries no dinamômetro isocinético 60º/s por 1 s

Table 2. Muscle thickness (MT), pennation angle (PA) and fascicle length (FL) from rectus femoris (RF) and vastus lateralis (VL) at the different evaluation times of the study.

		Baseline	Pre-training	Post-4	Post-8	Post-12
RF	MT (cm)	2.01±0.34	2.01±0.35	2.15±0.35 *	2.20±2.20 *	2.19±0.33 *
	PA (°)	8.48±1.85	8.70±1.87	8.55±1.43	8.42±1.48	8.67±1.35
	FL (cm)	13.49±2.48	13.63±2.29	14.31±1.97 *	15.32±1.86 *#	15.61±1.51 *#
VL	MT (cm)	2.61±0.24	2.59±0.23	2.72±0.23 *	2.75±0.25 *	2.77±0.29 *
	PA (°)	17.18±2.54	17.28±2.50	17.79±2.50	17.02±2.78	17.15±2.58
	FL (cm)	8.10±1.11	8.22±1.32	8.54±1.21 *	9.51±1.50 *#	9.67±1.75 *#

** different from baseline and pre-training (P<0.05); # different from post-4 (P<0.05).*

Comparison of Concentric and Eccentric Bench Press Repetitions to Failure

Stephen B. Kelly,[1] Lee E. Brown,[2] Steven P. Hooker,[3] Pamela D. Swan,[3] Matthew P. Buman,[3] Brent A. Alvar,[4] and Laurie E. Black[5]

[1]Department of Kinesiology, Vanguard University, Costa Mesa, California; [2]Center for Sport Performance, California State University, Fullerton, California; [3]School of Nutrition and Health Promotion, Arizona State University, Phoenix, Arizona; [4]Rocky Mountain University of Health Professions, Provo, Utah; and [5]College of Allied Health, California Baptist University, Riverside, California

J Strength Cond Res 29(4): 1027–1032, 2015

Comparação das repetições realizadas até falha no supino concêntrico e excêntrico

Figure 1. Bench press and crane setup.

TABLE 1. Concentric (CON) and eccentric (ECC) 1RM descriptives.*

	Mean (kg) ± *SD*	Skewness	*SE* of skewness	Kurtosis	*SE* of kurtosis
CON 1RM†	93.56 ± 26.56	1.27	0.427	1.324	0.833
ECC 1RM†	115.99 ± 31.08	0.874	0.427	0.141	0.833
lnCON 1RM‡	5.29 ± 0.26	0.715	0.427	0.01	0.833
lnECC 1RM‡	5.51 ± 0.26	0.367	0.427	−0.434	0.833

*1RM = 1 repetition maximum.
†Data before logarithmic transformation.
‡Data after logarithmic transformation (ln = natural log).

24%!!!! Maior

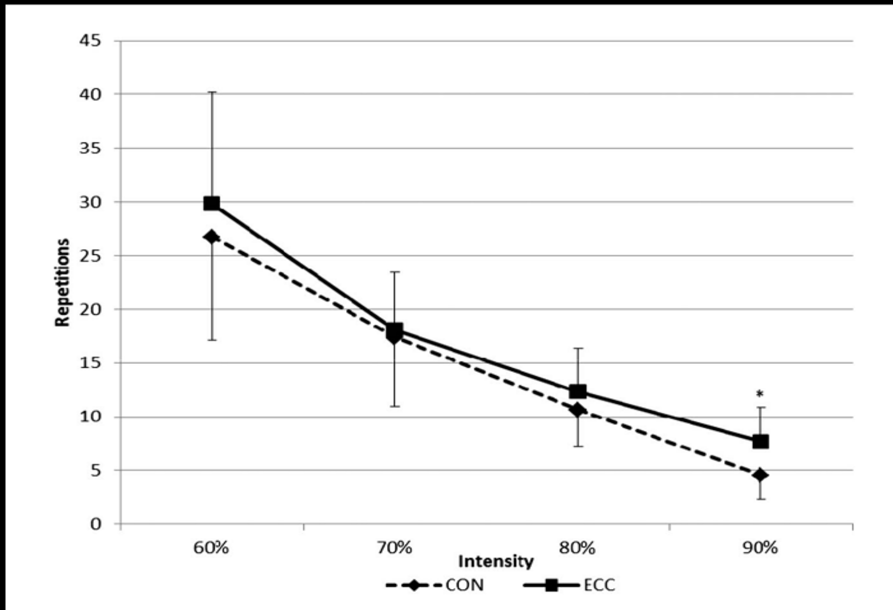


Figure 2. Comparison of repetitions to failure (mean ± *SD*) by percentage 1RM between concentric (CON) and eccentric (ECC). *Significantly greater than CON. 1RM = 1 repetition maximum.

TRAINING, PREVENTION, AND REHABILITATION

Current Sports Medicine Reports

Eccentric Training for the Treatment of Tendinopathies

Bryan Murtaugh, MD and Joseph M. Ihm, MD

Volume 12 • Number 3 • May/June 2013

Treinamento excêntrico para o tratamento de tendinopatias

International Journal of Sports Science 2014, 4(2): 47-49
DOI: 10.5923/j.sports.20140402.02

Acute Effects on Maximal Isometric Force with and without Knee Wrap During Squat Exercise

Willy Andrade Gomes, Érica Paes Serpa, Enrico Gori Soares, Josinaldo Jarbas da Silva, Daniel Corrêa, Fernando Henrique Domingues de Oliveira, Francisco de Abreu Neto, Gustavo Martins, Guanis de Barros Vilela Junior, Paulo Henrique Marchetti*

Department of Human Movement Sciences, Methodist University of Piracicaba, Piracicaba, São Paulo, Brazil

Efeitos agudos sobre a força máxima isométrica com e sem faixa de joelho durante o agachamento

10 indivíduos fisicamente ativos acostumados ao TF

3 ações isométricas máximas em 3 condições

Sem faixa de jeolho

Faixa mais leve

Faixa apertada

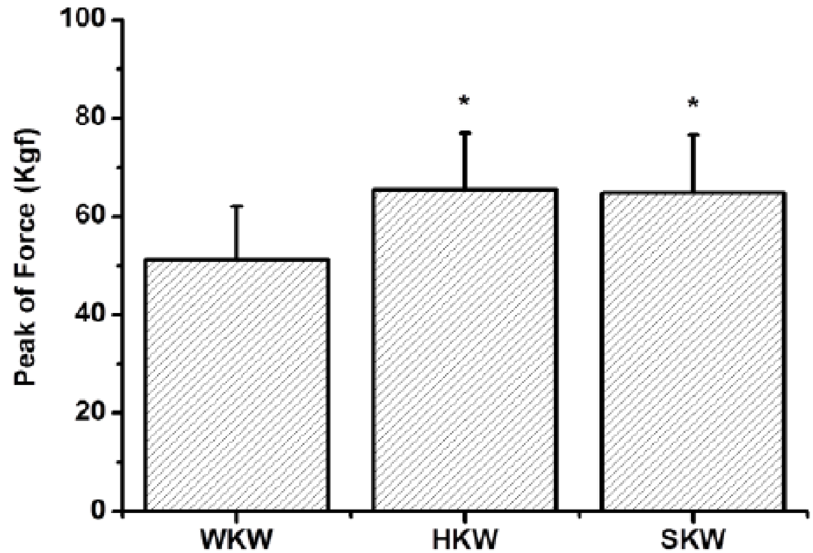


Figure 1. Mean ± standard deviation of the peak of force during isometric squat for different conditions (without knee wrap, high knee wrap and soft knee wrap, respectively). *$P<0.05$

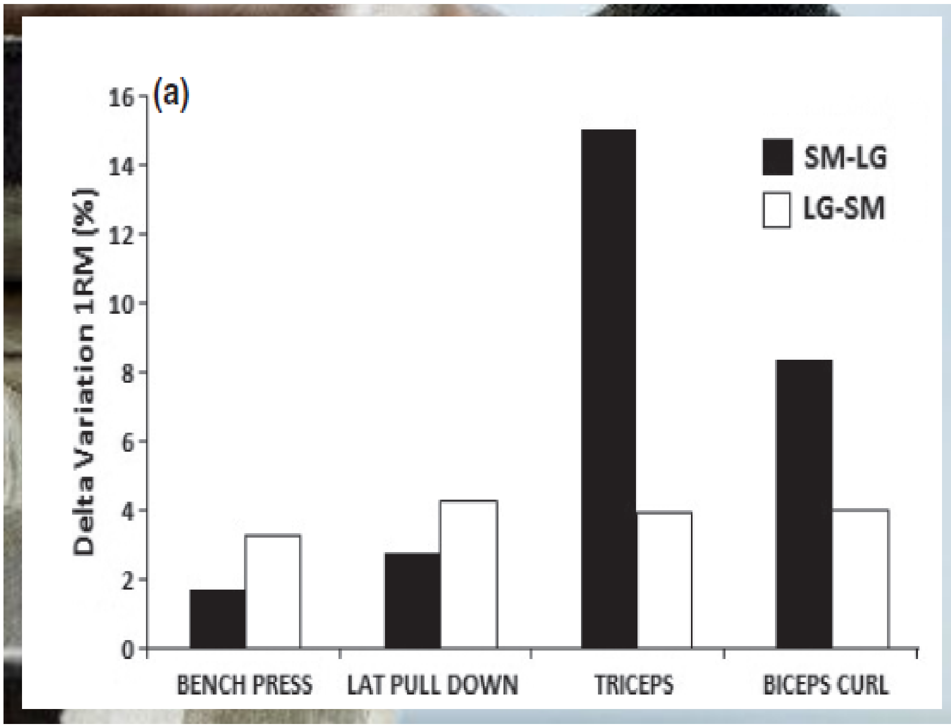
Clin Physiol Funct Imaging (2013) 33, pp359–363 doi: 10.1111/cpf.12036

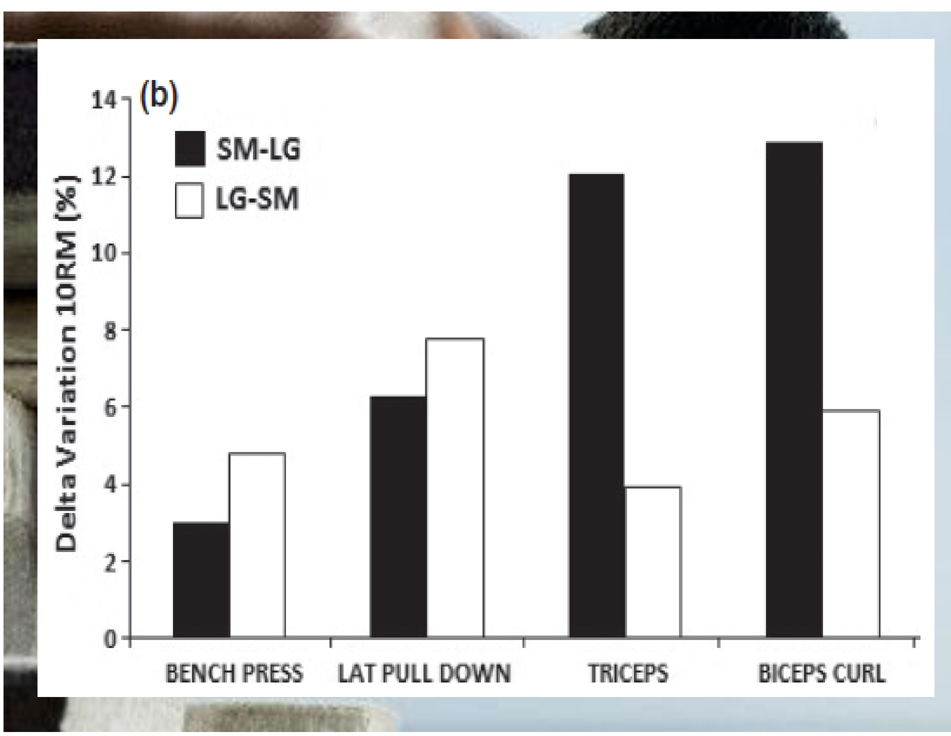
Influence of exercise order on upper body maximum and submaximal strength gains in trained men

Claudio O. Assumpção[1], Ramires A. Tibana[2], Luan C. Viana[2], Jeffrey M. Willardson[3] and Jonato Prestes[2]

[1]Graduation Program in Human Development and Technologies, Human Performance Laboratory São Paulo State University-UNESP, Rio Claro, SP, Brazil, [2]Graduation Program on Physical Education, Catholic University of Brasilia, Brasilia, Brazil and [3]Kinesiology and Sports Studies Department, Eastern Illinois University, Charleston, IL, USA

INFLUÊNCIA DA ORDEM DOS EXERCÍCIOS SOBRE A FORÇA MÁXIMA E SUBMÁXIMA DE MEMBROS SUPERIORES EM HOMENS TREINADOS


(a)
SM-LG
LG-SM
Delta Variation 1RM (%)
0
2
4
6
8
10
12
14
16
BENCH PRESS
LAT PULL DOWN
TRICEPS
BICEPS CURL


(b)
SM-LG
LG-SM
Delta Variation 10RM (%)
0
2
4
6
8
10
12
14
BENCH PRESS
LAT PULL DOWN
TRICEPS
BICEPS CURL

Journal of Sports Sciences, December 2009; 27(14): 1617–1625

Routledge
Taylor & Francis Group

Effects of agonist–antagonist complex resistance training on upper body strength and power development

DANIEL W. ROBBINS[1], WARREN B. YOUNG[1], DAVID G. BEHM[2], & WARREN R. PAYNE[1]

EFEITOS DO TF AGONISTA-ANTAGONISTA SOBRE A FORÇA E POTÊNCIA DE MEMBROS SUPERIORES

SEMANAS 1-4

	Week 1				Week 2			
Exercise	Sets	Reps	Load	Rest*	Sets	Reps	Load	Rest*
Bench pull	4	6	6-RM	4 min	5	5	5-RM	4 min
Bench press	3	6	6-RM	4 min	4	5	5-RM	4 min
Bench press throw	1	6	40% 1-RM	4 min	1	5	40% 1-RM	4 min

*Rest between like sets. RM = repetition maximum.

Week 3				Week 4			
Sets	Reps	Load	Rest*	Sets	Reps	Load	Rest*
6	4	4-RM	4 min	6	3	3-RM	4 min
4	4	4-RM	4 min	4	3	3-RM	4 min
2	4	40% 1-RM	4 min	2	3	40% 1-RM	4 min

SEMANAS 5-8

	Week 1				Week 2			
Exercise	Sets	Reps	Load	Rest*	Sets	Reps	Load	Rest*
Bench pull	4	6	6-RM	4 min	5	5	5-RM	4 min
Bench press	1	6	6-RM	4 min	1	5	5-RM	4 min
Bench press throw	3	6	40% 1-RM	4 min	4	5	40% 1-RM	4 min

*Rest between like sets. RM = repetition maximum.

Week 3				Week 4			
Sets	Reps	Load	Rest*	Sets	Reps	Load	Rest*
6	4	4-RM	4 min	6	3	3-RM	4 min
4	4	4-RM	4 min	4	3	3-RM	4 min
2	4	40% 1-RM	4 min	2	3	40% 1-RM	4 min

	Complex set				
Variable	Pre	Post	Gain	%Δ	Effect size
Bench pull 1-RM (kg)	92.1 ± 14.1	96.7 ± 15.9	4.5 ± 3.0*	2.2 ± 1.1	0.45 (small)
Bench press 1-RM (kg)	100.9 ± 27.8	106.0 ± 27.6	5.1 ± 3.4*	2.4 ± 1.8	0.26 (small)
BPT height (cm), 4 throws	97.1 ± 18.5	99.9 ± 10.3	2.7 ± 15.3	5.0 ± 16.5	0.21 (small)
BPT peak velocity ($m \cdot s^{-1}$), 4 throws	6.8 ± 0.5	7.1 ± 0.4	0.3 ± 0.4	4.2 ± 6.3	0.73 (medium)
BPT peak power (W), 4 throws	3002 ± 898	3232 ± 716	230 ± 227	9.7 ± 9.2	0.36 (small)

*Significant difference between pre and post values ($P < 0.01$).

Traditional set				
Pre	Post	Gain	%Δ	Effect size
95.9 ± 14.1	98.5 ± 15.9	2.6 ± 3.8	1.2 ± 1.7	0.26 (small)
94.6 ± 20.5	99.1 ± 20.4	4.5 ± 3.5	2.3 ± 1.9	0.31 (small)
86.8 ± 17.6	95.4 ± 17.5	8.6 ± 8.8	10.8 ± 10.7	0.70 (medium)
7.0 ± 0.5	7.2 ± 0.6	0.2 ± 0.3	3.0 ± 4.0	0.58 (medium)
3047 ± 552	3321 ± 528	274 ± 152*	9.4 ± 5.4	0.70 (medium)

Variable	Complex: Absolute training gains	Complex: Time (h)*	Complex: Efficiency	Traditional: Absolute training gains	Traditional: Time (h)*	Traditional: Efficiency	Effect size
Bench pull 1-RM (kg)	4.5 ± 2.97	4.53	1.00 ± 0.66 ($kg \cdot h^{-1}$)	2.6 ± 3.80	10.13	0.26 ± 0.38 ($kg \cdot h^{-1}$)	1.37 (large)
Bench press 1-RM (kg)	5.1 ± 3.37	4.53	1.13 ± 0.74 ($kg \cdot h^{-1}$)	4.5 ± 3.46	10.13	0.45 ± 0.34 ($kg \cdot h^{-1}$)	1.18 (large)
BPT height (cm)	2.7 ± 15.32	4.53	0.60 ± 0.38 ($cm \cdot h^{-1}$)	8.6 ± 8.78	10.13	0.85 ± 0.87 ($cm \cdot h^{-1}$)	0.37 (small)
BPT peak velocity ($m \cdot s^{-1}$)	0.3 ± 0.41	4.53	0.06 ± 0.09 ($m \cdot s^{-1} \cdot h^{-1}$)	0.2 ± 0.30	10.13	0.02 ± 0.03 ($m \cdot s^{-1} \cdot h^{-1}$)	0.60 (medium)
BPT peak power (W)	230 ± 227	4.53	50.7 ± 50.1 ($W \cdot h^{-1}$)	274 ± 152	10.13	27.1 ± 15.0 ($W \cdot h^{-1}$)	0.64 (medium)

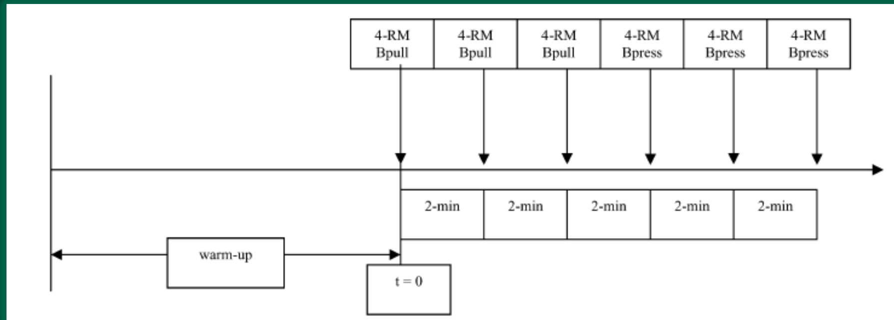
The Effect of an Upper-Body Agonist–Antagonist Resistance Training Protocol on Volume Load and Efficiency

Daniel W. Robbins,[1] Warren B. Young,[2] and David G. Behm[3]

[1]School of Physiotherapy, Faculty of Health Sciences, University of Sydney, Lidcombe, New South Wales, Australia; [2]School of Human Movement and Sport Sciences, University of Ballarat, Ballarat, Victoria, Australia; and [3]School of Human Kinetics and Recreation, Memorial University of Newfoundland, St. John's, Newfoundland, Canada

J Strength Cond Res 24(x): 000–000, 2010

EFEITOS DE UM PROTOCOLO AGONISTA-ANTAGONISTA DE MEMBROS SUPERIORES SOBRE O VOLUME TOTAL E EFICÊNCIA



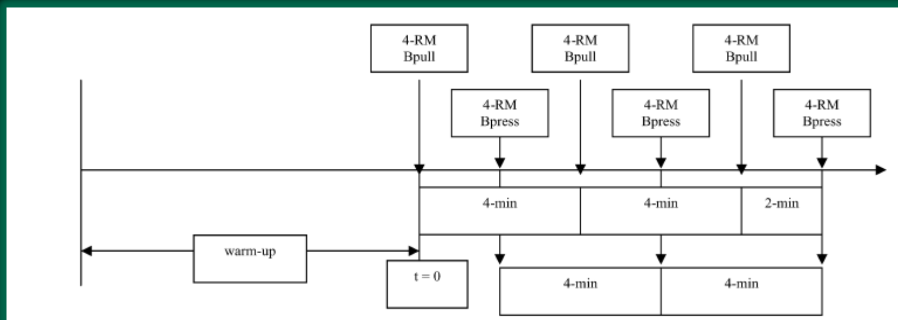


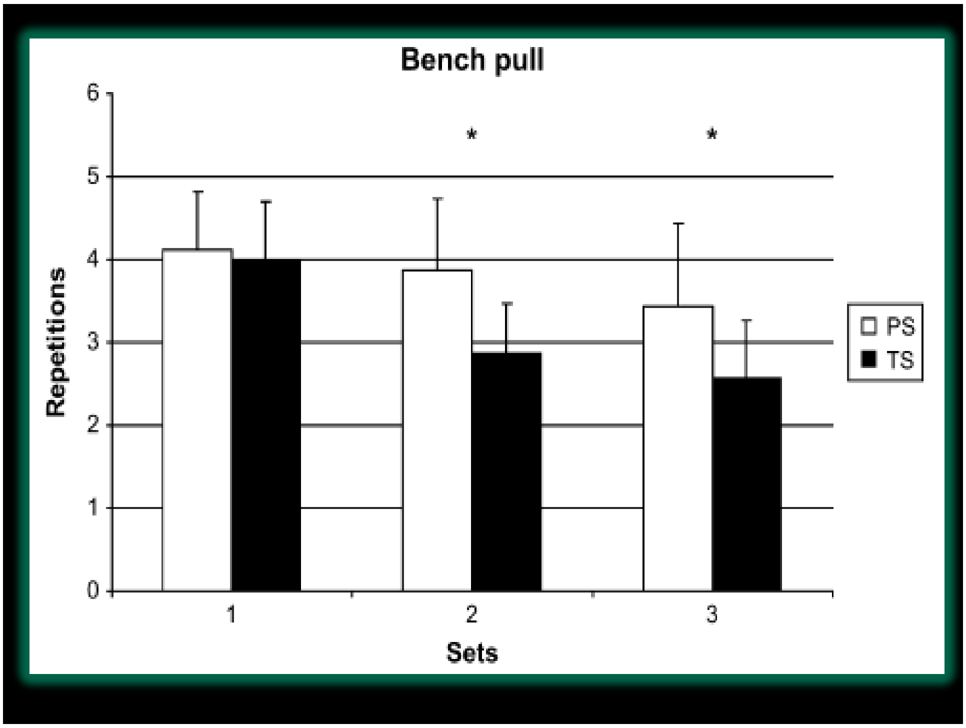
Table 2. Percent changes in VL from set 1 to set 2, set 2 to set 3, and set 1 to set 3 for Bpull and Bpress during PS and TS protocols. ($N = 16$).*†

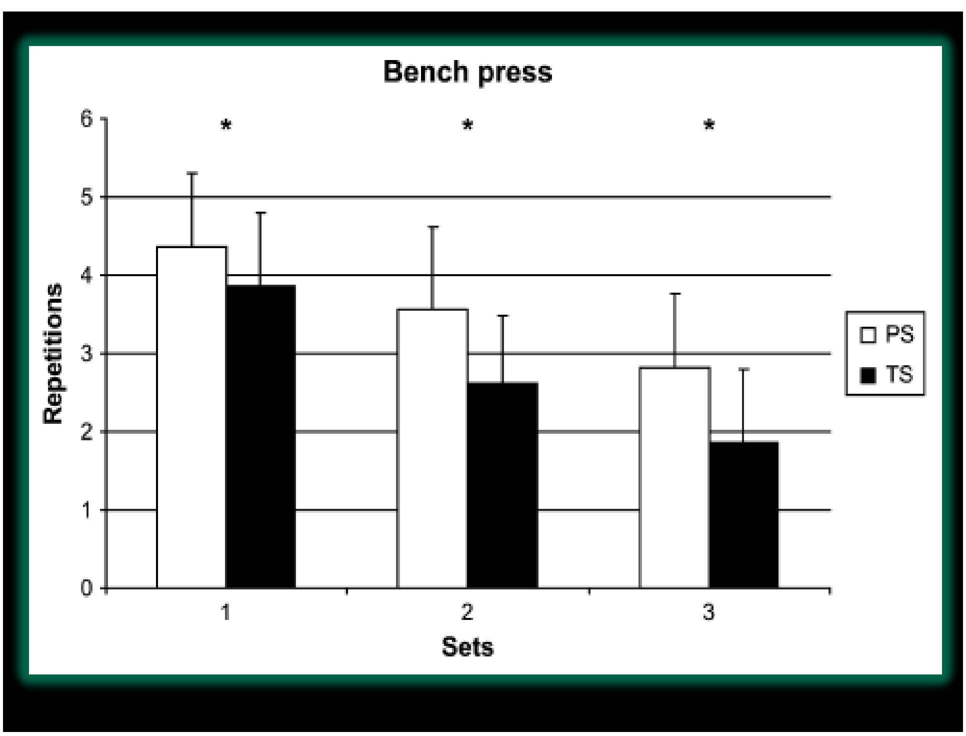
	Set 1–set 2		Set 2–set 3		Set 1–set 3	
Variable	PS	TS	PS	TS	PS	TS
Bpull VL	−6.5 (±11.8)	−27.5 (±13.4)	−11.3 (±13.9)	−10.9 (±17.4)	−17.3 (±15.9)	−34.7 (±18.5)
Bpress VL	−19.0 (±16.2)	−32.9 (±11.9)	−20.2 (±18.4)	−27.1 (±20.7)	−36.1 (±16.4)	−50.7 (±16.5)

*VL = volume load; Bpull = bench pull; Bpress = bench press; PS = paired set; TS = traditional set.
†Values are given as mean% (*SD*).

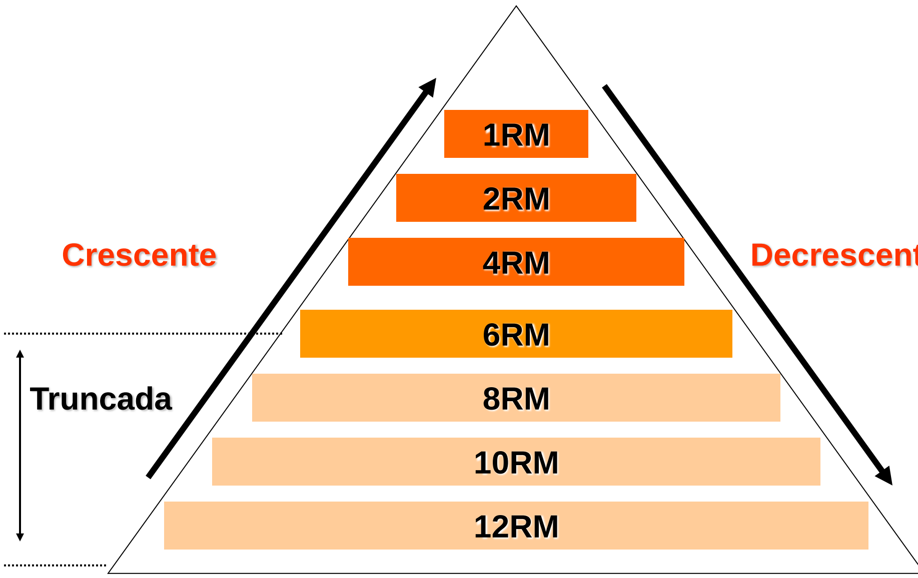
Table 4. Efficiency (volume load/time) calculations for session Bpull, VL, and session Bpress VL during PS and TS protocols. ($N = 16$).*

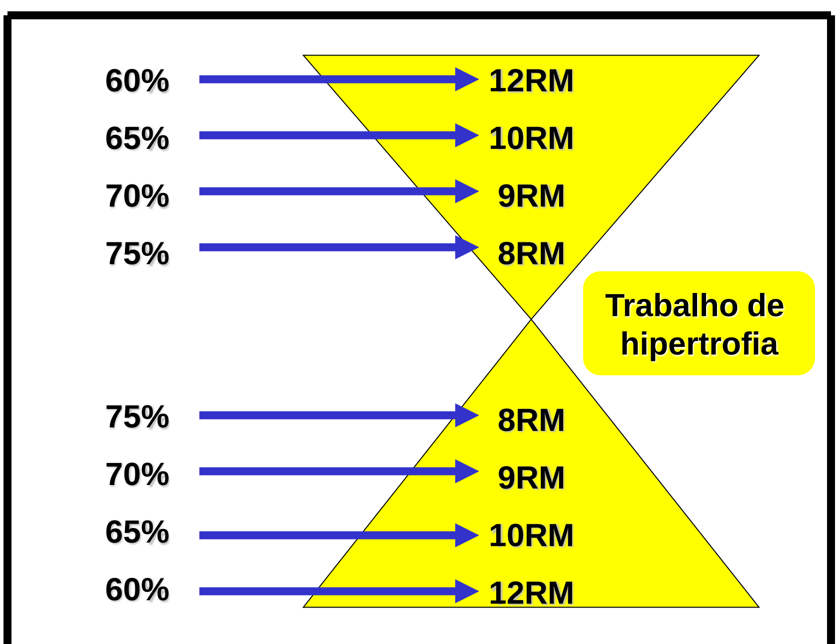
	PS			TS		
Variable	VL (kg)	Time (min)†	Efficiency ($kg \cdot min^{-1}$)	VL (kg)	Time (min)†	Efficiency ($kg \cdot min^{-1}$)
Bpull	895.4	10	89.5	738.1	10	73.8
Bpress	930.4	10	93.0	731.3	10	73.1


Bench pull
6
5
4
3
2
1
0
Repetitions
*
*
1
2
3
Sets
PS
TS

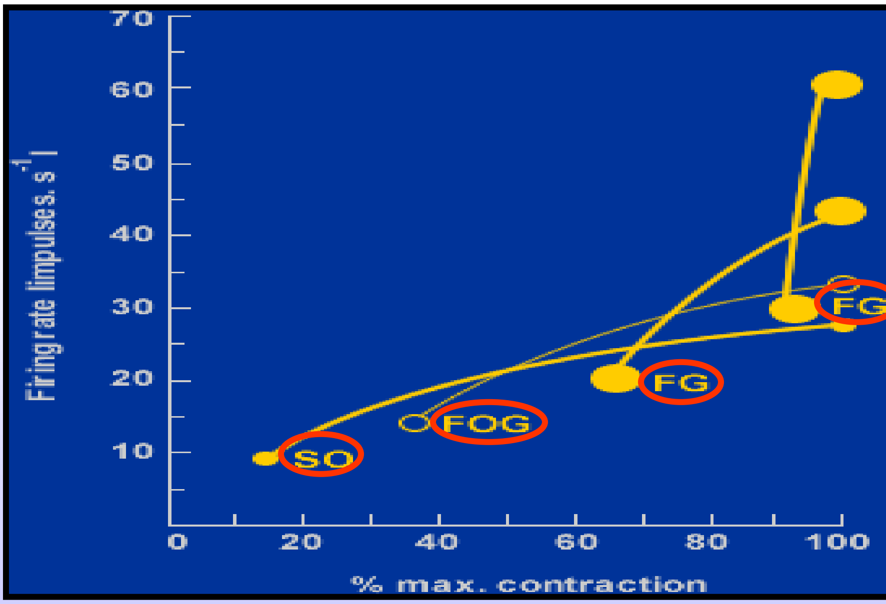

Bench press
6
5
4
3
2
1
0
Repetitions
*
*
*
1
2
3
Sets
PS
TS

Programa de treinamento Pirâmide Crescente e Decrescente e Truncada Crescente e Decrescente





Padrão de sobrecarga dupla. Reproduzido de Bompa, 2000.



Princípio de Henneman. Reproduzido de SALE (1992).

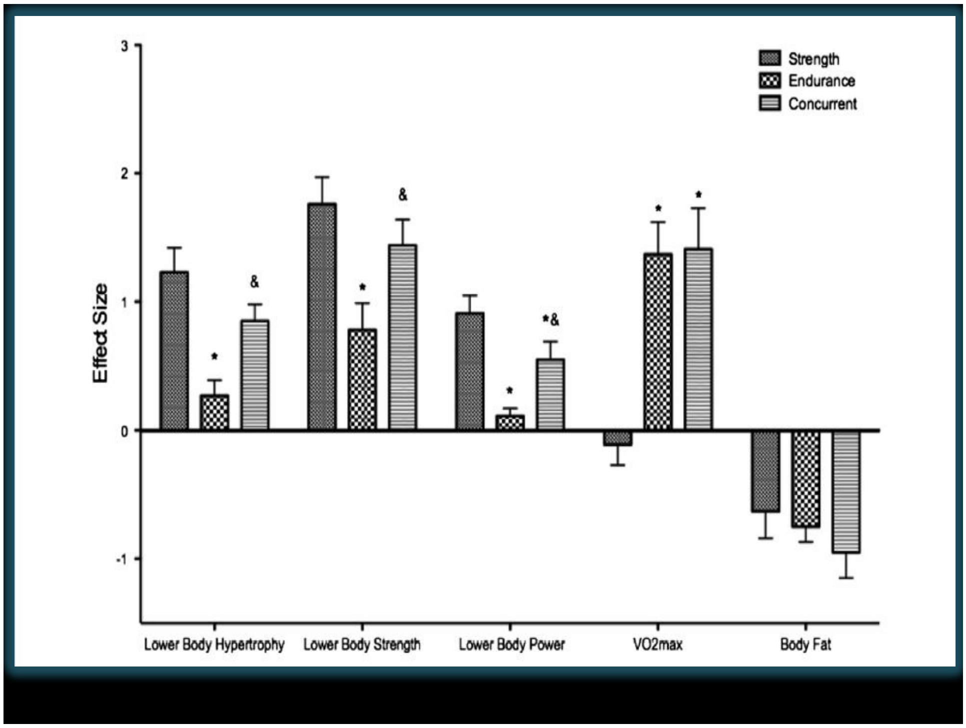
BRIEF REVIEW

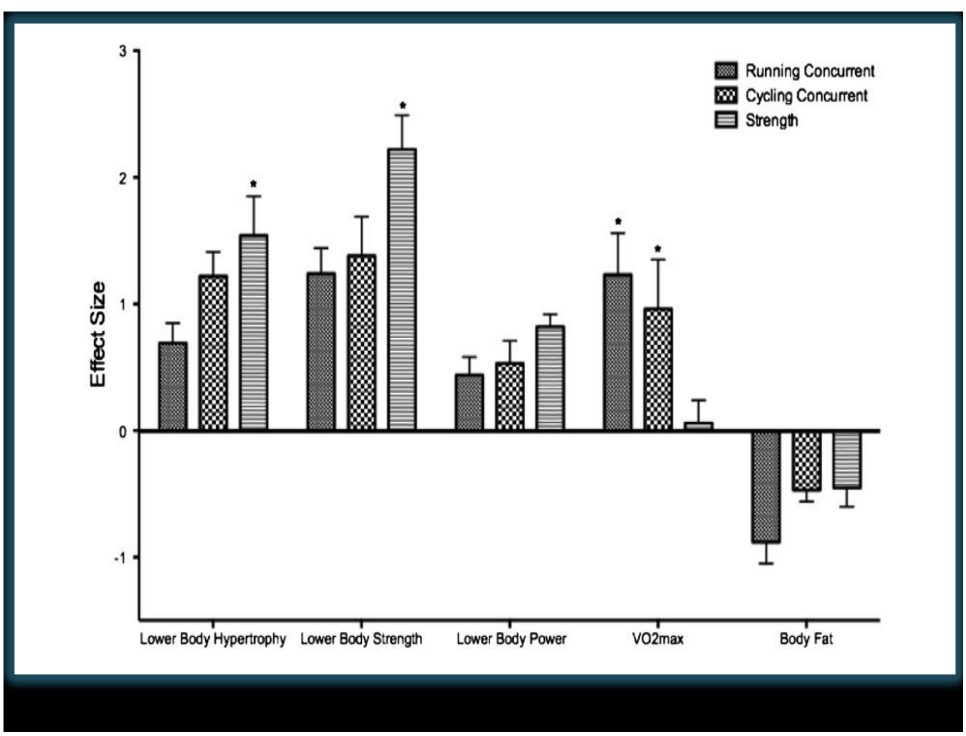
Concurrent Training: A Meta-Analysis Examining Interference of Aerobic and Resistance Exercises

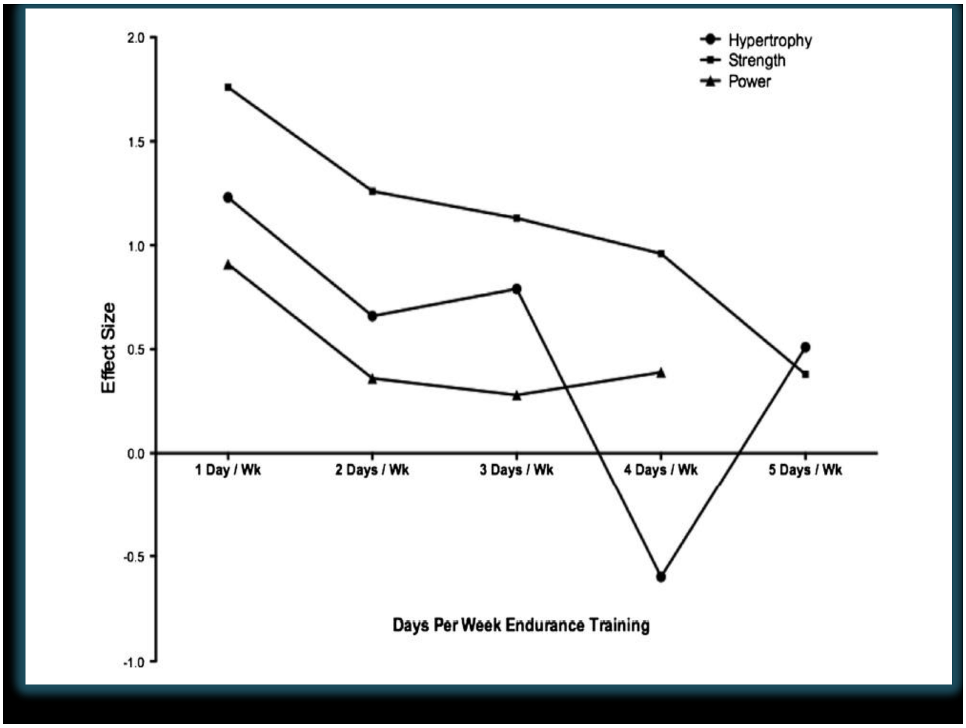
Jacob M. Wilson,[1] Pedro J. Marin,[2,3] Matthew R. Rhea,[4] Stephanie M.C. Wilson,[1] Jeremy P. Loenneke,[5] and Jody C. Anderson[1]

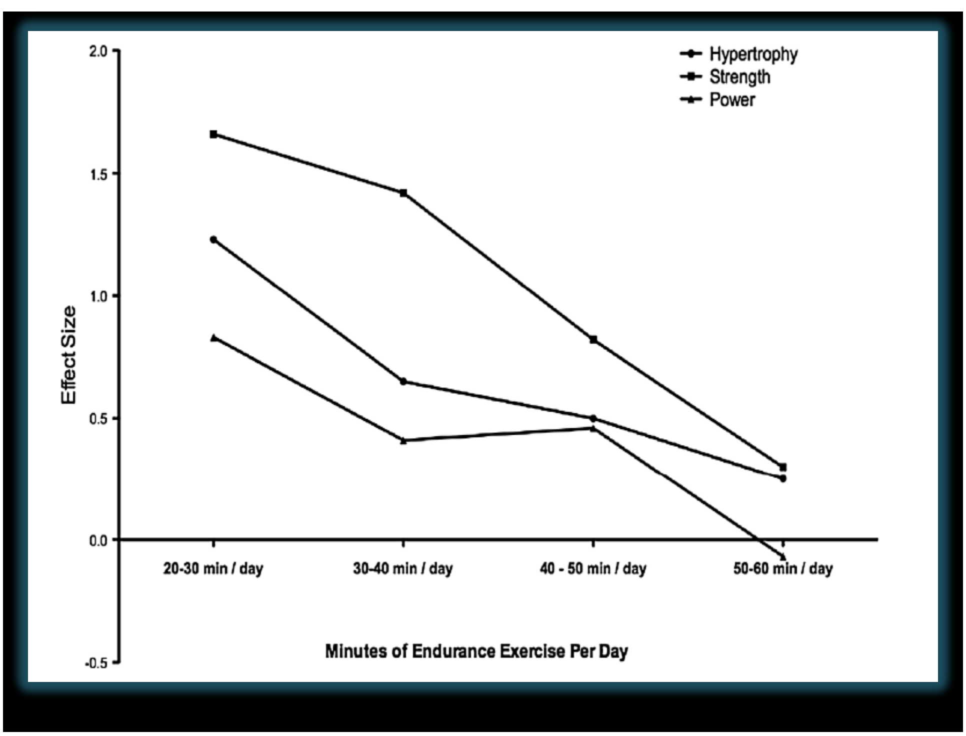
[1]Department of Health Sciences and Human Performance, The University of Tampa, Tampa, Florida; [2]Laboratory of Physiology, European University Miguel de Cervantes, Valladolid, Spain; [3]Research Center on Physical Disability, Valladolid, Spain; [4]Human Movement Program, A. T. Still University, Mesa,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

J Strength Cond Res 26(8): 2293–2307, 2012


Strength
Endurance
Concurrent
Effect Size
3
2
1
0
-1
*
&
*
&
*
*&
*
*
Lower Body Hypertrophy
Lower Body Strength
Lower Body Power
VO2max
Body Fat


Running Concurrent
Cycling Concurrent
Strength
Effect Size
3
2
1
0
-1
*
*
*
*
Lower Body Hypertrophy
Lower Body Strength
Lower Body Power
VO2max
Body Fat


Hypertrophy
Strength
Power
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Effect Size
1 Day / Wk
2 Days / Wk
3 Days / Wk
4 Days / Wk
5 Days / Wk
Days Per Week Endurance Training


Hypertrophy
Strength
Power
2.0
1.5
1.0
0.5
0.0
-0.5
Effect Size
20-30 min / day
30-40 min / day
40 - 50 min / day
50-60 min / day
Minutes of Endurance Exercise Per Day

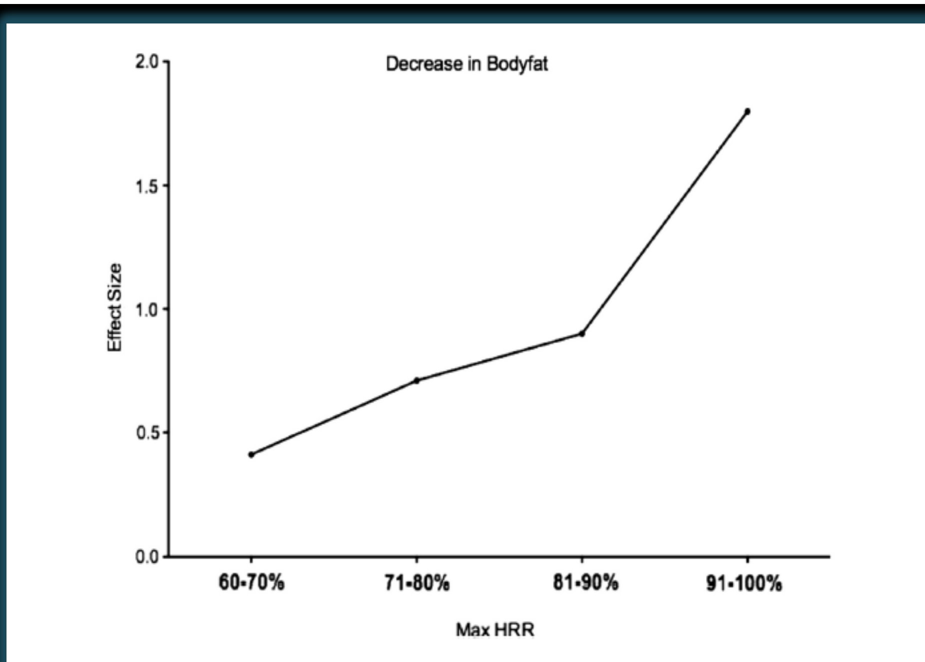


TABELA 29. Exemplo de um macrociclo de 12 meses para hipertrofia muscular com os mesociclos 1, 2, 3 e 4. Os modelos dos mesociclos 3 e 4 podem ser independentes dos mesociclos 1 e 2 e utilizados para indivíduos intermediários e avançados

MACROCICLO – HIPERTROFIA MUSCULAR																								
MESOCICLO 1 Resistência de força - Hipertrofia									MESOCICLO 2 Hipertrofia															
JANEIRO					FEVEREIRO				MARÇO				ABRIL				MAIO				JUNHO			
MICRO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
SÉRIES			1-3	1-3	3-4	3-4	3-4	3-4	3-4	3-4	3-4		3-4	3-4	3-4	3-4	3-4	3-4	3-4	3-4	3-4	3-4	3-4	
RM	ADP	ADP	12-15	12-15	10-15	10-15	10-15	10-15	10-12	10-12	10-12	**R-AV.**	8-12	8-12	8-12	8-12	8-10	8-10	8-10	8-10	6-10	6-10	6-10	**R-AV.**
Modelo linear																								

MACROCICLO – HIPERTROFIA MUSCULAR (*continuação*)															
MESOCICLO 3 Hipertrofia – Força máxima									MESOCICLO 4 Hipertrofia - Resistência de força - Força máxima						
MESO	JULHO				AGOSTO				SETEMBRO A DEZEMBRO						
MICRO	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33 a 47**						**48**
SÉRIES	5x	4x	4x	3x	5x	4x	4x	**R-AV.**	**Segunda** Treino A 4x 8-10RM	**Terça** Treino B 4x 8-10RM	**Quarta** Treino C 4x 8-10RM	**Quinta** Treino A 3x 12-15RM	**Sexta** Treino B 3x 12-15RM	**Sábado** Treino C 3x 12-15RM	**R-AV.**
									Segunda Treino A 5x 4-6RM	**Terça** Treino B 5x 4-6RM	**Quarta** Treino C 5x 4-6RM	**Quinta** Treino A 4x 8-10RM	**Sexta** Treino B 4x 8-10RM	**Sábado** Treino C 4x 8-10RM	
RM	4-6	8-10	10-12	12-15	4-6	8-10	10-12		**Segunda** Treino A 3x 12-15RM	**Terça** Treino B 3x 12-15RM	**Quarta** Treino C 3x 12-15RM	**Quinta** Treino A 5x 4-6RM	**Sexta** Treino B 5x 4-6RM	**Sábado** Treino C 5x 4-6RM	
MOD	Linear reversa								Ondulatório diário						

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