

**PROGRAMA DE PÓS-GRADUAÇÃO
STRICTO SENSU – EDUCAÇÃO FÍSICA**

Universidade
Católica de Brasília

**TÓPICOS ESPECIAIS – COMO UTILIZAR
OS MÉTODOS AVANÇADOS DE
TREINAMENTO NA PRÁTICA**

PROF. DR. JONATO PRESTES

Definição do tema: Impacto da escolha dos métodos avançados para melhora da função neuromuscular.

Objetivo da aprendizagem: proporcionar ao profissional da área do movimento os conhecimentos sobre a escolha acertiva dos dos métodos avançados para melhora de função muscular, prevenção e hipertrofia muscular.

Relevância da proposta: A escolha dos métodos pode auxiliar sobremaneira na melhora da função e prevenção de lesões musculares, bem como gerar hipertrofia muscular.

Idosa: Hedvirges Prestes, 70 anos, menopausada, massa corporal: 65 kg, % de gordura 30%. Objetivo de reduzir dor patelofemoral, dores lombares e melhorar a função muscular nas atividades diárias. **Outros casos serão mencionados para fortalecer o entendimento.**

O que devemos avaliar?

Teste de sentar e levantar, teste de caminhada de 6 minutos, TUG e avaliar o que grau de dependência.

Avaliar hitórico prévio de dores, qualidade de vida e exames bioquímicos.

Tentativas que funcionaram, exercícios e métodos preferidos, exercícios que parecem não funcionar

Pedido de vídeo para análise da técnica de execução para refinamento.

A importância do feedback a cada 30-40 dias. Perguntas sobre a progressão de cargas, cansaço e dores articulares.

O que devemos avaliar?

Teste de sentar e levantar, teste de caminhada de 6 minutos, TUG e avaliar o que grau de dependência.

The Timed Up and Go Test (TUG)

<https://youtu.be/grrYoBucNPE?si=HICDlanQZDht7nZn>

Teste de caminhada de 6 minutos

<https://youtu.be/Joltwfwswbm4?si=ICOsX3KlhBFVxnSB>

Teste de sentar e levantar

<https://youtu.be/sxPJ8vBCCvk?si=t1N8ysWmFrbU4J8>

Nível de classificação funcional de acordo com o nível de atividades de vida diária (Spirduso, 1995)

Nível I – Fisicamente incapaz; Fisicamente dependente Não realiza nenhuma AVD e tem total dependência dos outros
Nível II – Fisicamente Frágil; Indivíduos que podem fazer ABVD, mas não podem realizar nenhuma AIVD, como fazer compras, lavar e limpar a casa
Nível III – Fisicamente Independente; É capaz de realizar todas as AIVD e ABVD, sem sintomas de doença crônica, mas com baixo nível de saúde e condicionamento físico
Nível IV – Fisicamente Apto/ativo; Realiza trabalho físico moderado, esporte de resistência e jogos. Capaz de fazer todas as AAVD. Aparência física jovial
Nível V – Atletas; Realiza atividades competitivas, podendo competir em nível internacional e praticar esportes de risco

O que é a dor patelofemoral?

A dor patelofemoral (DPF) é definida como dor ao redor ou atrás da patela, agravada por atividades que sobrecarregam a articulação patelofemoral na ausência de outra patologia distinta do joelho

Acredita-se que desequilíbrios **na força e no ritmo** dos músculos do core e dos membros inferiores, especialmente o **quadríceps**, influenciem o alinhamento da patela durante a carga na articulação patelofemoral.

O tratamento da DPF não é cirúrgico e enfatiza a melhora da mecânica da articulação patelofemoral por meio de **exercícios**, frequentemente complementados por fitas, palmilhas, biofeedback e outros tratamentos

Hott et al. (2019)

A revisão sistemática da Cochrane concluiu que há evidências consistentes, mas de **baixa qualidade, recomendando exercícios como tratamento para PFP.**

Ainda é complexo recomendar um tipo específico de **exercício para PFP**, e não está claro quais pacientes se beneficiariam mais de qual tratamento.

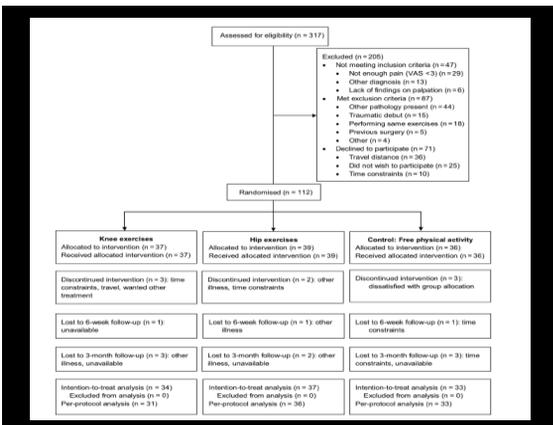
Hott et al. (2019)

Effectiveness of Isolated Hip Exercise, Knee Exercise, or Free Physical Activity for Patellofemoral Pain

A Randomized Controlled Trial

Alexandra Hott,^{†1} MD, Jens Ivar Brox,^{‡6} Prof., MD, PhD, Are Hugo Pripp,^{||} PhD, Niels Gunnar Juel,[§] MD, PhD, Gøran Paulsen,[†] PhD, and Sigurd Liavaag,[¶] MD, PhD
Investigation performed at the Department of Physical Medicine and Rehabilitation, Sørlandet Hospital Kristiansand, Kristiansand, Norway

The American Journal of Sports Medicine
2019;47(6):1312–1322



Group Allocation	Knee (n = 37)	Hip (n = 39)	Control (n = 37)
Age, y, mean ± (SD)	28.5 ± 6.2	27.8 ± 8.6	26.3 ± 7.0
Female:male	24:13	25:14	24:12
Body mass index, kg/m ²			
<25	12 (32)	21 (54)	18 (50)
25–30	19 (51)	19 (26)	10 (28)
>30	6 (16)	8 (21)	8 (22)
Unilateral: bilateral	10:27	13:26	8:28
Symptom duration, mo			
3–6	2 (5)	1 (3)	5 (14)
6–12	7 (19)	15 (31)	11 (31)
12–24	8 (22)	10 (25)	6 (17)
>24	20 (54)	23 (59)	14 (39)
Education >13 y	11 (30)	10 (25)	12 (33)
Sick listed	6 (16)	3 (8)	6 (16)
Regular use of analgesics	5 (14)	6 (15)	8 (22)
Use of insoles	4 (11)	3 (8)	9 (25)
Use of knee support or brace	5 (14)	9 (23)	5 (14)
Emotionally distressed (HSCL ≥1.8)	9 (24)	11 (28)	10 (28)
Expectation of effect (VAS, 0–10), mean ± (SD)			
For knee training	6.6 ± 2.3	7.0 ± 2.3	6.8 ± 2.4
For hip training	6.6 ± 2.6	6.9 ± 2.5	6.6 ± 2.3
For free activity	5.9 ± 2.3	6.9 ± 2.3	6.4 ± 2.6

^aData are presented as n (%), unless otherwise indicated. HSCL, Hopkins Symptom Checklist; VAS, visual analog scale.

3 sessões semanais durante 6 semanas:
1 sob supervisão do fisioterapeuta e
2 sessões em casa, com intervalo mínimo de 1 dia entre as sessões.

3 séries de 10 repetições para cada exercício, com progressão até um máximo de 3 a 20 repetições.

Cada repetição 2 a 3 s, com uma pausa de 2 s entre as repetições e uma pausa de 30 s entre as séries.

Resistência adicional foi obtida com **pesos ou tubos elásticos**, dependendo do exercício.

Exercícios focados no quadril: abdução do quadril em decúbito lateral, rotação externa do quadril (ostra) e extensão do quadril em decúbito ventral

Exercícios focados no joelho: elevação de perna estendida em decúbito dorsal, extensão de joelho em decúbito dorsal (de 10° de flexão até extensão total) e agachamento (45° de flexão) com as costas apoiadas na parede (para reduzir a necessidade de estabilização dos músculos do quadril).

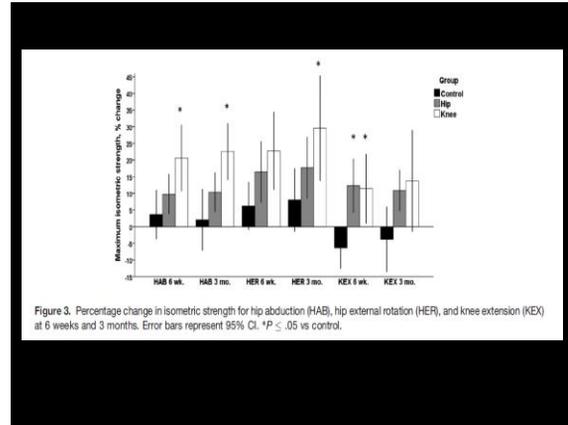
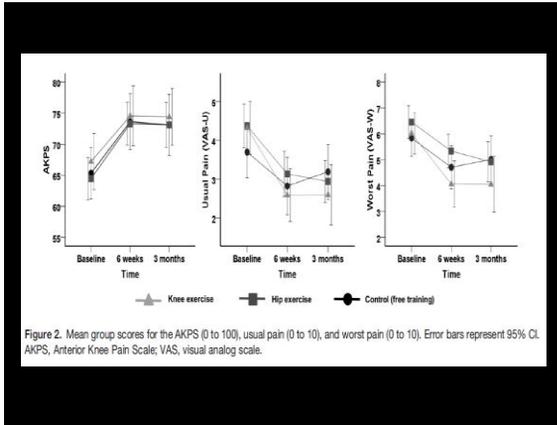
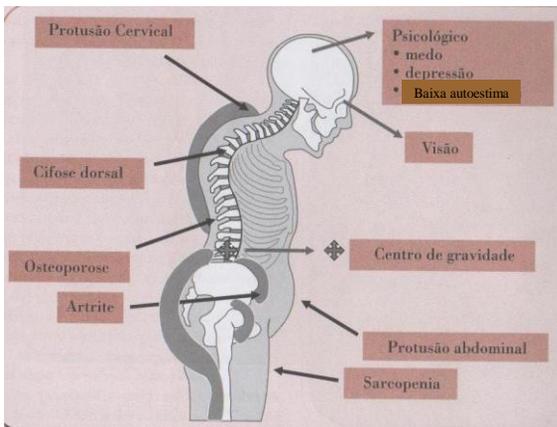
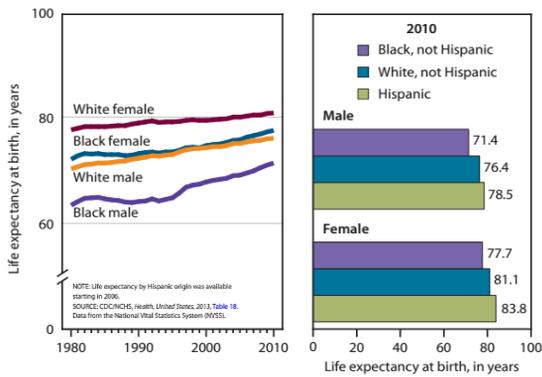
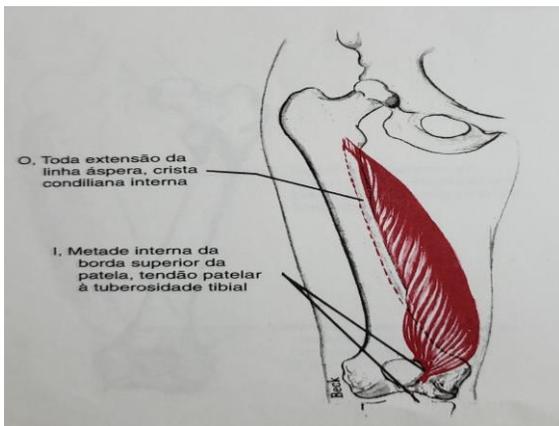
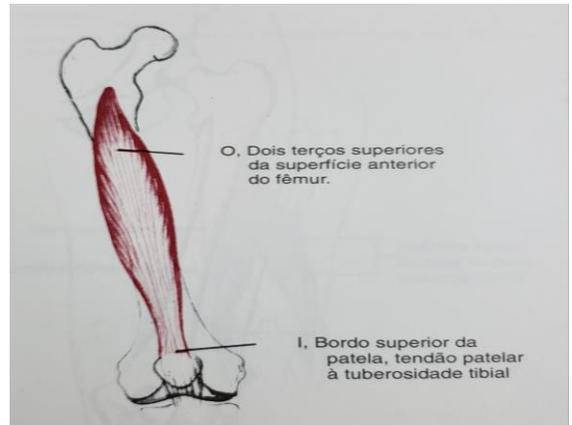
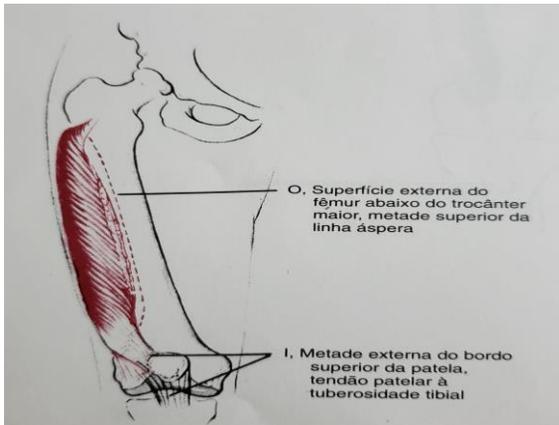
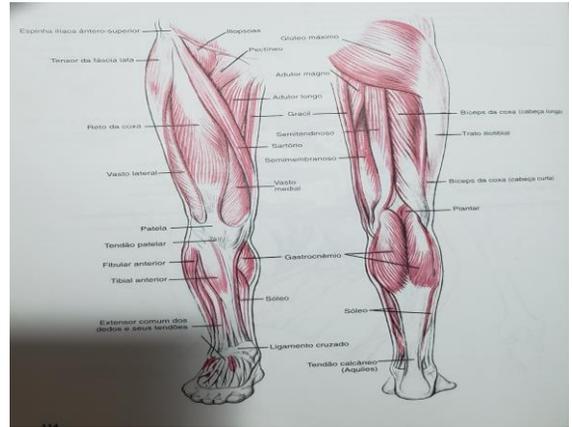
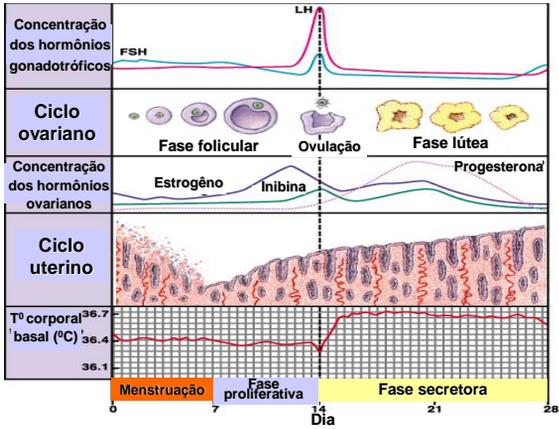


Figure 1. Life expectancy at birth, by selected characteristics: United States, 1980–2010



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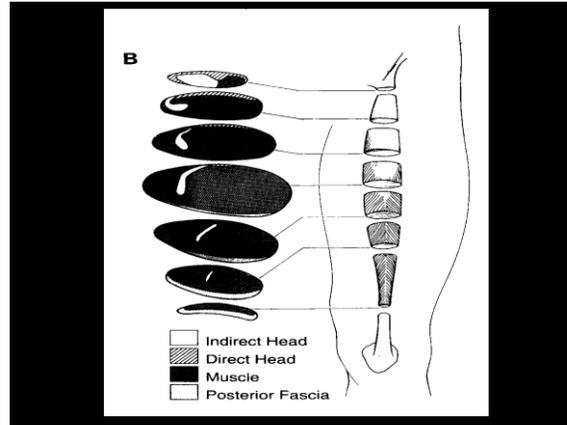
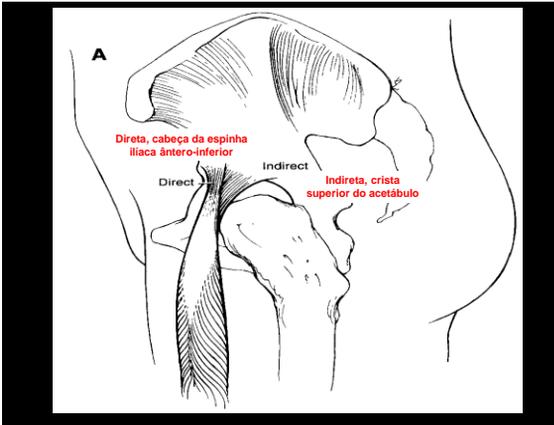
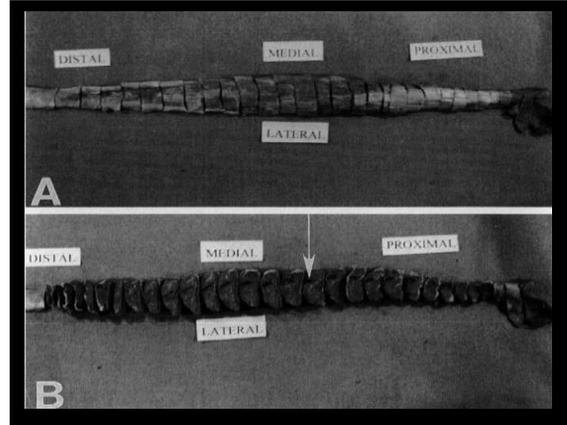
Dores de cabeça	Cabelos torna-se mais finos e perdem brilho
Perda de dentes	Seio cai e achata
Risco de doenças cardiovasculares	Bicos tomam-se menores e achatam
Dores nas costas	Pele e membranas mucosas tornam-se secas, e pele desenvolve textura grossa
Pêlos corporais e pubianos mais espessos e escuros	Abdômen perde tônus
Ossos perdem massa e tornam-se mais frágeis	Incontinência urinária
	Ressecamento e encolhimento vaginal



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An Explanation for Various Rectus Femoris Strain Injuries Using Previously Undescribed Muscle Architecture

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Age-related muscle atrophy in the lower extremities and daily physical activity in elderly women

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Table 1
 Characteristics of the subjects, n, mean ± S.D.

	Young group	Elderly group
Number	20	17
Age (years)	19.8 ± 0.8	83.2 ± 6.2
Height (cm)	158.3 ± 6.2	147.4 ± 7.1
Weight (kg)	53.8 ± 5.0	45.7 ± 7.3
BMI	21.5 ± 1.7	21.1 ± 3.7

Table 3
Comparison of muscle thickness (mm) between the young and elderly groups, mean ± S.D.

	Young group	Elderly group
Gluteus maximus	25.0 ± 2.98	15.5 ± 3.85**
Gluteus medius	22.9 ± 5.80	14.6 ± 3.98**
Gluteus minimus	19.3 ± 6.47	12.1 ± 4.11**
Psoas major	28.7 ± 4.11	13.6 ± 5.66**
Rectus femoris	22.9 ± 3.39	16.7 ± 3.71**
Vastus lateralis	22.0 ± 3.25	13.9 ± 4.03**
Vastus intermedius	21.5 ± 3.52	16.1 ± 3.79**
Biceps femoris	36.5 ± 4.87	17.9 ± 4.81**
Gastrocnemius	16.3 ± 2.31	11.1 ± 2.70**
Soleus	34.5 ± 6.11	29.7 ± 7.90

Note:
** Indicate significant differences at $p < 0.01$.

Table 4
The rate (%) of muscle thickness in the elderly, mean ± S.D.

Muscles	
Gluteus maximus	62.0 ± 15.4
Gluteus medius	63.7 ± 17.4
Gluteus minimus	62.8 ± 21.3
Psoas major	47.2 ± 19.7
Rectus femoris	72.9 ± 16.2 [†]
Vastus lateralis	63.0 ± 18.3
Vastus intermedius	74.9 ± 17.6 ^{†,††}
Biceps femoris	48.9 ± 13.2
Gastrocnemius	68.1 ± 16.5
Soleus	86.1 ± 22.9 ^{†,††}

Notes:
** $p < 0.01$ significant difference compared to psoas major.
†† $p < 0.01$ significant difference compared to biceps femoris.
† $p < 0.05$ significant difference compared to biceps femoris.

Table 5
Relationship between muscle thickness and LSA in elderly women.

	Correlation coeff. (95%CI)	<i>p</i>
Gluteus maximus	0.197 (-0.314-0.619)	0.450
Gluteus medius	0.528 (0.064-0.805)	0.029 [*]
Gluteus minimus	0.444 (-0.047-0.762)	0.075
Psoas major	-0.194 (-0.617-0.316)	0.456
Rectus femoris	-0.283 (-0.672-0.229)	0.271
Vastus lateralis	-0.167 (-0.599-0.341)	0.522
Vastus intermedius	-0.009 (-0.488-0.474)	0.973
Biceps femoris	0.086 (-0.411-0.544)	0.742
Gastrocnemius	-0.243 (-0.648-0.269)	0.347
Soleus	0.329 (-0.180-0.699)	0.198

Note:
^{*} Indicates significant correlation at $p < 0.05$.

Journal of Clinical Medicine MDPI

Article

Test-Retest Reliability of Ultrasonographic Measurements from the Rectus Femoris Muscle 1–5 Years after Anterior Cruciate Ligament Reconstruction in the Ipsilateral and Contralateral Legs: An Observational, Case-Control Study

Jorge Buelga-Suarez ¹, Pablo Alba-Martin ¹, Nicolas Cuenca-Zaldívar ^{2,3,4}, Maria Garcia-Escudero ⁴, Pilar Bierge-Sanclemente ⁵, Jaime Almazán-Polo ⁶, Samuel Fernández-Camero ^{7,8} and Daniel Pecos-Martin ^{7,9}

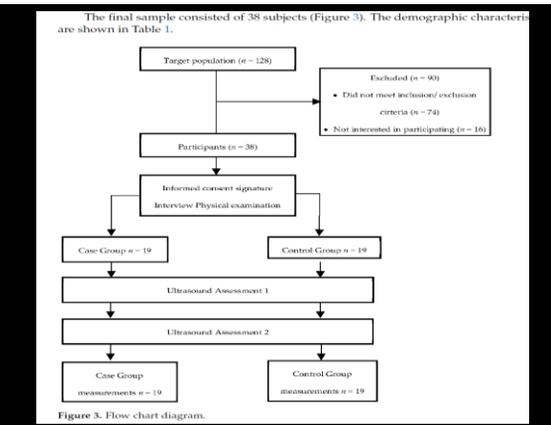
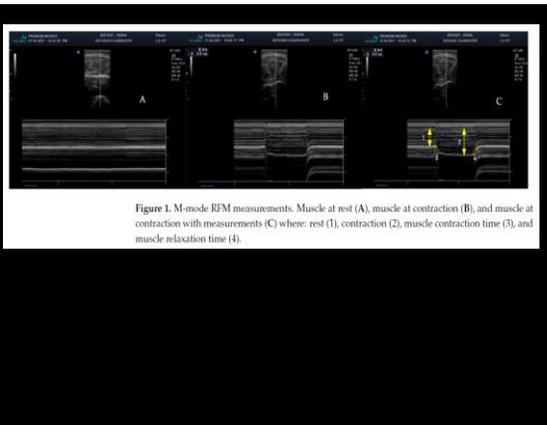


Table 1. Demographics characteristics.

Variable	Control (n = 19)	Case (n = 19)	p-Value
Age, years	33.84 (7.00)	32.47 (9.01)	0.60
Height, cm	170.21 (7.83)	173.47 (7.96)	0.21
Weight, kg	69.21 (7.55)	74.89 (9.09)	0.04
BMI, kg/m ²	20.31 (1.78)	21.56 (2.18)	0.06
Sex, woman (%)	9 (47.4)	3 (15.8)	0.04
Dominant side, n (%)			
Dominant	16 (84.2)	3 (15.8)	
Non-dominant	16 (84.2)	3 (15.8)	
Operated side, n (%)			
Right	11 (57.9)	-	
Left	8 (42.1)	-	
Associated injury, n (%)			
ACL	15 (39.5)	-	
ACL + IM	2 (10.5)	-	
ACL + EM	2 (10.5)	-	
Time, years, median (IQR)	2 (1.00-3.50)	-	
IPAQ			0.10
High	8 (41.1)	13 (68.4)	
Moderate	11 (57.9)	6 (31.6)	
Low	0	0	

Data are presented as mean (standard deviation) unless otherwise specified. Abbreviations: cm (centimeters), kg (kilograms), BMI (body mass index), ACL (anterior cruciate ligament), IM (internal meniscus), EM (external meniscus), IPAQ (International Physical Education Questionnaire).

Table 2. Reliability of ultrasound measurements.

Variable	Examiner 1 *	Examiner 2 *	ICC _{3,3} (95% CI)	SEM (%)	MDC95 (%)
Resting thickness					
Right	2.24 (0.24)	2.23 (0.24)	0.99 (0.99-1.00)	0.03 (1.16%)	0.07 (3.21%)
Left	2.26 (0.24)	2.24 (0.24)	0.99 (0.98-1.00)	0.03 (1.21%)	0.08 (3.37%)
Contraction thickness					
Right	2.72 (0.17)	2.71 (0.17)	0.99 (0.99-1.00)	0.01 (0.46%)	0.03 (1.28%)
Left	2.69 (0.17)	2.68 (0.17)	0.99 (0.99-1.00)	0.01 (0.33%)	0.02 (0.90%)
Muscle relaxation time					
Right	0.98 (0.32)	0.99 (0.34)	0.99 (0.96-1.00)	0.06 (5.78%)	0.16 (16.01%)
Left	0.89 (0.38)	0.91 (0.37)	0.99 (0.98-1.00)	0.05 (5.54%)	0.14 (15.36%)
Muscle contraction time+					
Right	1.12 (0.37)	1.13 (0.38)	0.99 (0.97-1.00)	0.06 (5.38%)	0.17 (14.92%)
Left	1.02 (0.45)	1.05 (0.43)	0.99 (0.98-1.00)	0.05 (5.22%)	0.15 (14.47%)

* Mean (standard deviation). Abbreviations: ICC, intraclass correlation coefficient; CI, confidence interval; SEM, standard error of the mean; MDC95, minimum detectable difference at 95% confidence.

Table 3. Differences adjusted for muscle thickness.

State	Control #	Case #	Difference, Mean (CI 95%)
Operated side			
Rest	2.26 ± 0.05	2.08 ± 0.05	-0.17 * (-0.33 to -0.02)
Contraction	2.69 ± 0.05	2.50 ± 0.05	-0.19 * (-0.32 to -0.05)
Difference, mean (CI 95%)	0.43 * (0.36 to 0.50)	0.42 * (0.35 to 0.49)	
Non-operated side			
Rest	2.26 ± 0.05	2.22 (0.04)	-0.04 (-0.17 to 0.09)
Contraction	2.69 ± 0.05	2.63 (0.04)	-0.06 (-0.19 to 0.07)
Difference, mean (CI 95%)	0.44 * (0.37 to 0.51)	0.41 * (0.34 to 0.48)	

Data are presented as mean ± standard error of the mean. * Statistically significant (p < 0.05). Abbreviations: CI, confidence interval.

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

ARTICLE

Eccentric Exercise as a Potent Prescription for Muscle Weakness After Joint Injury

Lindsey K. Lepley¹, Luke Stoneback¹, Peter C.D. Macpherson^{1,2}, and Timothy A. Butterfield^{3,4}

¹School of Kinesiology, University of Michigan, Ann Arbor, MI; ²Department of Molecular and Integrative Physiology, University of Michigan, Ann Arbor, MI; ³Department of Athletic Training and Clinical Nutrition, University of Kentucky, Lexington, KY; and ⁴Center for Muscle Biology, University of Kentucky, Lexington, KY

LEPLEY, L.K., L. STONEBACK, P.C.D. MACPHERSON, and T.A. BUTTERFIELD. Eccentric exercise as a potent prescription for muscle weakness after joint injury. *Exerc. Sport Sci. Rev.*, Vol. 51, No. 3, pp. 109-116, 2023. Lengthening contractions (i.e., eccentric contractions) are capable of uniquely triggering the nervous system and signaling pathways to promote tissue health/growth. This mode of exercise may be particularly potent for patients suffering from muscle weakness after joint injury. Here we provide a novel framework for eccentric exercise as a safe, effective mode of exercise prescription for muscle recovery. **Key Words:** eccentric, neural inhibition, surrogates, skeletal muscle hypertrophy, injury

EXERCÍCIO EXCÊNTRICO COMO UMA POTENTE FERRAMENTA PARA FRAQUEZA MUSCULAR APÓS LESÃO ARTICULAR

Proposed Paradigm of Neural & Morphological Events After Traumatic Joint Injury

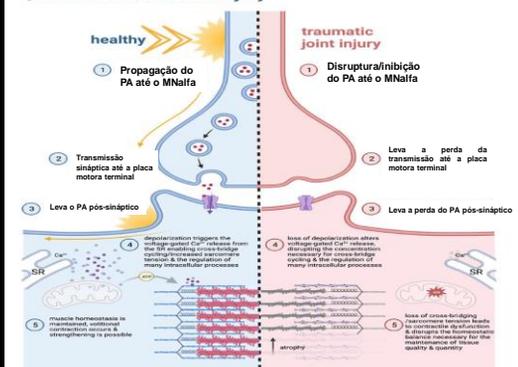


Table 1. Resistance training and changes in muscle architecture data for the conventional (CONV) and eccentric (ECC) training groups

	CONV group	ECC group
Training volume per subject: leg press (a.u.)	160 957 ± 62 013	124 810 ± 31 165
Training volume per subject: knee extension (a.u.)	36 766 ± 15 133	42 715 ± 10 294
Training volume per subject: total (a.u.)	197 722 ± 77 461	167 525 ± 47 790
Initial leg press SRM (kg)	178 ± 45	252 ± 56 ^{**}
Final leg press SRM (kg)	219 ± 55	358 ± 44 ^{**}
Leg press SRM increase (%)	23 ± 12	46 ± 26 ^{**}
Initial knee extension SRM (kg)	44 ± 12	69 ± 23 ^{**}
Final knee extension SRM (kg)	49 ± 14	103 ± 21 ^{**}
Knee extension SRM increase (%)	14 ± 9	55 ± 24 ^{**}
Fascicle length change pre- versus post-training (%)	8 ± 8	20 ± 14 [*]
Pennation angle change pre- versus post-training (%)	35 ± 15	5 ± 6 ^{**}
Muscle thickness change pre- versus post-training (%)	12 ± 13	11 ± 10

See Methods section for calculation of training volume. Values are means ± s.d.; a.u., arbitrary units. ^{*}P < 0.05 and ^{**}P < 0.01 between the groups.

Sports Medicine
https://doi.org/10.1007/s40279-025-02176-8

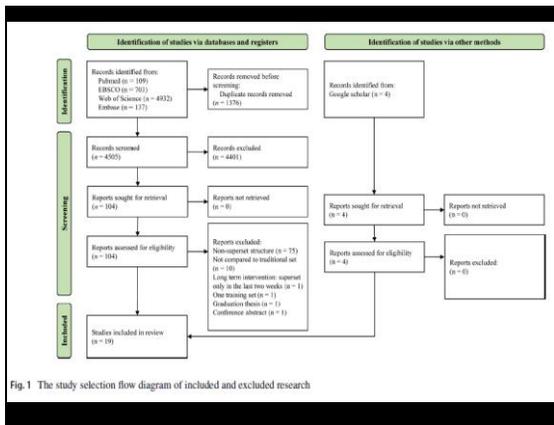
SYSTEMATIC REVIEW



Superset Versus Traditional Resistance Training Prescriptions: A Systematic Review and Meta-analysis Exploring Acute and Chronic Effects on Mechanical, Metabolic, and Perceptual Variables

Xing Zhang¹ · Jonathon Weakley^{2,3,4} · Hansen Li⁵ · Zhaoqian Li¹ · Amador García-Ramos^{1,6}

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RESULTADOS

- (1) número total de repetições e volume-load semelhante com uma duração de sessão mais curta e maior eficiência;
- (2) maior concentração de lactato sanguíneo durante e após o TF;
- (3) maior custo de energia durante TF;
- (4) concentração de CK após o TF, eletromiografia de superfície, inchaço muscular agudo e pressão arterial similares;
- (5) maior percepção de esforço e recuperação percebida semelhante;
- (6) adaptações crônicas semelhantes na força máxima, resistência de força e hipertrofia muscular.

RESULTADOS

A análise de subgrupo revelou que **super-séries agonistas-antagonistas** levam a um aumento significativo no número de repetições que podem ser realizadas em comparação ao TF tradicional;

Já **super-séries com exercícios de biomecânica semelhante** resultam em menor volume-load em comparação ao tradicional.

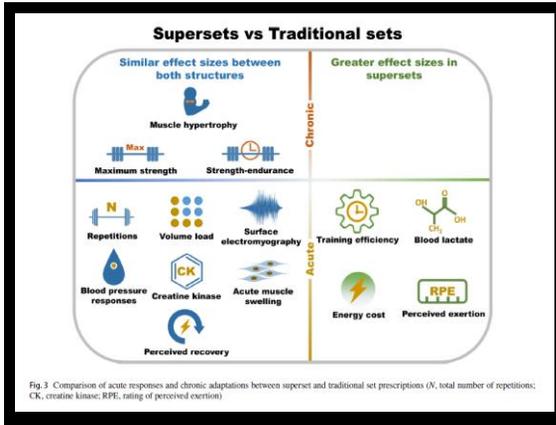
PONTOS-CHAVES

Super-séries podem aumentar a eficiência do treinamento reduzindo a duração sem comprometer o volume, a ativação muscular ou a recuperação percebida.

Comparado ao TF tradicional, o método induz cargas internas mais altas, danos musculares mais exacerbados e maior esforço percebido.

Super-séries resultam em adaptações crônicas comparáveis ao treino tradicional na força máxima, resistência de força e hipertrofia muscular.

Zhang et al. (2025)



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Practical Application of Traditional and Cluster Set Configurations Within a Resistance Training Program

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Type of Set	Graphic Description	Inter-set Rest (s)	Inter-repetition Rest (s)	Intra-set Rest (s)	Total Rest (s)
Traditional Set		180	0	0	180
Cluster Set (1)		180	30	0	360
Cluster Set (2)		180	0	30	240
Rest-Distribution (1)		100	10	0	180
Rest-Distribution (2)		20	0	0	180

Figure 1 Two sets of 4 repetitions with 5 different set configurations. Green bars indicate repetitions performed in a set. Blue bars indicate inter-set rest intervals, whereas red bars indicate inter-repetition or intra-set rest intervals.

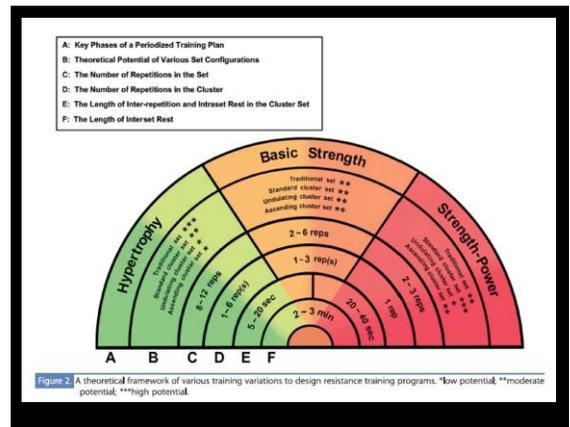


Table 2
Several examples of set manipulation during a hypertrophy phase of a periodized training plan

Type of set	Sets	Reps	Intensity (%)	Rest intervals between clusters (s)
Traditional	3	10	55-65	0
Standard cluster	3	10/1	65-75	5
	3	10/2	65-75	15
Ascending cluster	3	10/5	65-75	30
	3	10/10	65-75	30

10 = A total of 10 repetitions that are performed in a continuous manner without any rest interval within the set; 10/1 = A total of 10 repetitions with inter-repetition rest intervals; 10/2 = A total of 10 repetitions with intra-set rest intervals placed between each 2 repetitions; 10/5 = A total of 10 repetitions with an intra-set rest interval placed between each 5 repetitions. All training loads are determined based on 1 repetition maximum power clean. Strength and conditioning professionals should construct cluster sets based on the focus of the training session, training loads used, the exercise selected, and the athlete's level of development.

Source: Adapted from Haff et al. (35,36).

Table 3
Several examples of set manipulation during a basic strength phase of a periodized training plan

Type of set	Sets	Reps	Intensity (%)	Rest intervals between clusters (s)
Traditional	3-5	5	70-80/5	0
	3-5	6	65-75/6	0
Standard cluster	3-5	5/1	75-85/1	20
	3-5	6/2	70-80/2	30
	3-5	6/3	70-80/3	40
Undulating cluster	3-5	5/1	72.5-82.5/1	30
	3-5	6/2	72.5-82.5/2	40
Ascending cluster	3-5	5/1	70-80/1	30
	3-5	6/2	70-80/2	40

5 = A total of 5 repetitions that are performed in a continuous manner without any rest interval within the set; 5/1 = A total of 5 repetitions with inter-repetition rest intervals; 6/2 = A total of 6 repetitions with intra-set rest intervals placed between each 2 repetitions. All training loads are determined based upon one repetition maximum power clean. Strength and conditioning professionals should construct cluster sets based on the focus of the training session, training loads employed, the exercise selected, and the athlete's level of development.

Source: Adapted from Haff et al. (35,36).

Table 4
Several examples of set manipulation during a strength-power phase of a periodized training plan

Type of set	Sets	Reps	Intensity (%/rep)	Rest intervals between clusters (s)
Traditional	3-5	3	80-90/3	0
Standard cluster	3-5	3/1	85-93/1	85-93/1
Ascending cluster	Set 1	3/1	78-81/1	81-84/1
	Set 2	3/1	81-84/1	84-87/1
	Set 3	3/1	84-87/1	87-90/1

3 = A total of 3 repetitions that are performed in a continuous manner without any rest interval within the set; 3/1 = A total of 3 repetitions with inter-repetition rest intervals. All training loads are determined based upon one repetition maximum power clean. Strength and conditioning professionals should construct cluster sets based on the focus of the training session, training loads employed, the exercise selected, and the athlete's level of development.

Source: Adapted from Haff et al. (35,36).

Table 5
Practical integrations of standard cluster set into accentuated eccentric load training programs during key phases of a periodized training plan

Training variation	Hypertrophy	Basic strength	Strength-power
Eccentric load (%1RM)	80-120	100-120	≥120
Concentric load (%1RM)	60-70	70-80	≥80
Number of reps in a set	8-12	2-6	2-3
Number of reps in a cluster	3-6	1-3	1
Number of rest intervals between clusters	1-2	1-2	1-2
Length of rest intervals between clusters (s)	20	30	30-40

All concentric and eccentric training loads are determined based on 1 repetition maximum back squat in articles published by Wagle et al. (123,124) and Merrigan et al. (83) and the book by Veshohansky (122). For example, if an athlete performs 10 repetitions of back squats with a 120% 1RM eccentric load and a 65% 1RM concentric load, 10 repetitions can be broken into 2 clusters of 5 repetitions and a 30s intraset rest interval can be added between clusters. In this case, supramaximal eccentric loads (120% 1RM) are imposed on the athlete at the first and sixth repetition of the set of back squats.

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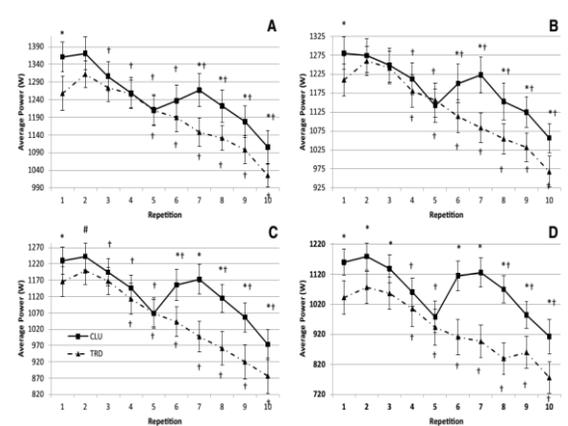
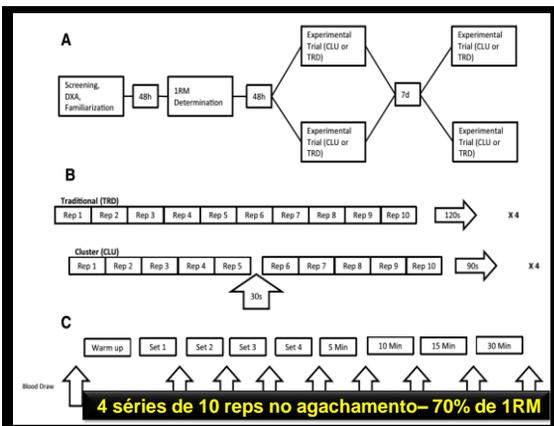
ORIGINAL ARTICLE

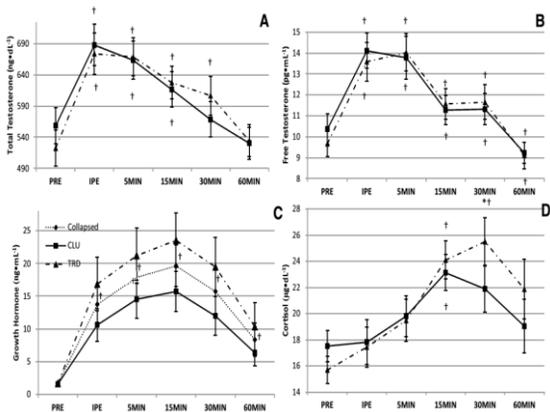
Acute response to cluster sets in trained and untrained men

Jonathan M. Oliver¹ · Andreas Kreuzter¹ · Shane Jenke¹ · Melody D. Phillips¹ · Joel B. Mitchell¹ · Margaret T. Jones²

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





EFFECTS OF CLUSTER TRAINING ON BODY COMPOSITION AND STRENGTH IN RESISTANCE-TRAINED MEN

Salvador Vargas-Molina^{1,2}, Ramón Romance¹, Brad J. Schoenfeld³, Manuel García², Jorge L. Petro⁴, Diego A. Bonilla⁵, Richard B. Kreider⁶, Fernando Martín-Rivera⁷, Javier Benítez-Porres¹

Isokinetics and exercise science, May 2020

Table 1. Baseline values of the anthropometric variables, body composition and strength of the study participants

	CL1	CL2	CL3	CON	p
BM (kg)	75.1 ± 11.7	75.8 ± 9.8	74.6 ± 10.2	75.2 ± 8.8	0.997
Height (cm)	173.3 ± 7.7	176.3 ± 9.5	178.9 ± 9.8	176.5 ± 7.5	0.667
BMI (kg.m ⁻²)	24.9 ± 2.7	24.3 ± 1.1	23.3 ± 2.4	24.1 ± 1.5	0.523
% FM	16.6 ± 3.3	16.8 ± 2.7	15.7 ± 4.0	15.2 ± 2.9	0.909
FFM (kg)	62.5 ± 9.0	63.1 ± 8.0	63.2 ± 7.9	63.2 ± 5.7	0.997
LL-FFM (kg)	30.0 ± 5.0	30.7 ± 4.4	31.1 ± 3.9	31.4 ± 3.0	0.916
Squat (kg)	113.0 ± 16.8	112.3 ± 15.6	100.9 ± 21.1	117.7 ± 11.2	0.324
CMJ (cm)	39.9 ± 6.1	35.5 ± 4.5	36.3 ± 6.1	38.5 ± 5.9	0.440

BM, body mass; BMI, body mass index; FM, fat mass; FFM, fat-free mass; LL-FFM, fat-free mass of lower limbs; CMJ, jump counter movement

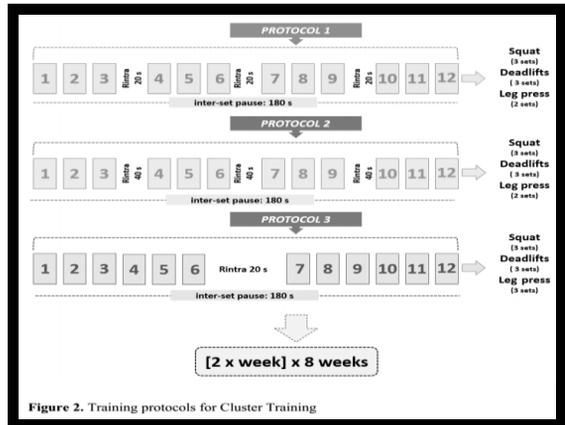
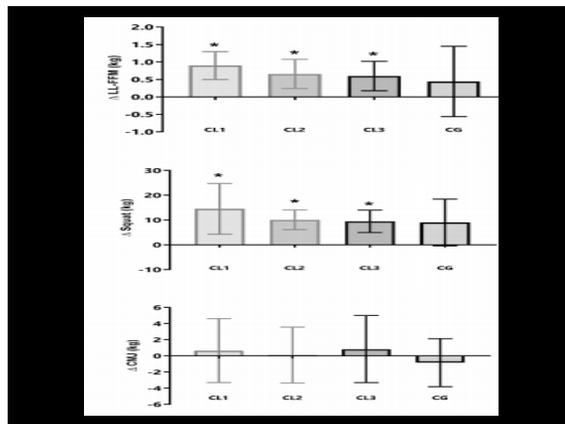


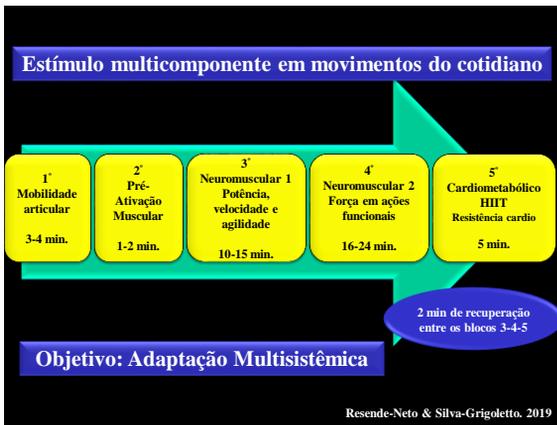
Figure 2. Training protocols for Cluster Training

464 **Table 2.** Results of the study variables

	Before	After	Δ	p	
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD; (CI)$		
FFM-LL (kg)	CL 1	30.0 ± 5.0	30.9 ± 5.3	0.9 ± 0.5(0.5 – 1.3)	0.001*
	CL 2	30.7 ± 4.4	31.3 ± 4.5	0.6 ± 0.5(0.2 – 1.1)	0.010*
	CL 3	31.1 ± 3.9	31.7 ± 4.2	0.6 ± 0.4(0.2 – 1.0)	0.011*
	CG	31.4 ± 3.0	31.9 ± 3.4	0.4 ± 1.1(-0.6 – 1.5)	0.323
Squat (kg)	CL 1	113.0 ± 16.8	127.5 ± 17.5	14.5 ± 12.3(4.2 – 24.8)	0.012*
	CL 2	112.3 ± 15.6	122.4 ± 16.0	10.1 ± 4.3(6.1 – 14.0)	0.001*
	CL 3	100.9 ± 21.1	110.4 ± 18.4	9.5 ± 4.9(5.0 – 14.0)	0.002*
	CG	117.7 ± 11.2	126.7 ± 18.6	9.0 ± 9.0(-0.4 – 18.5)	0.057
CMJ (cm)	CL 1	39.9 ± 6.1	39.0 ± 4.5	0.7 ± 4.3(-3.3 – 4.6)	0.698
	CL 2	35.5 ± 4.5	35.6 ± 3.7	0.1 ± 3.7(-3.4 – 3.6)	0.941
	CL 3	36.3 ± 6.1	37.1 ± 5.8	0.8 ± 4.5(-3.3 – 5.0)	0.640
	CG	38.5 ± 5.9	37.6 ± 5.7	-0.8 ± 3.2(-3.8 – 2.1)	0.517



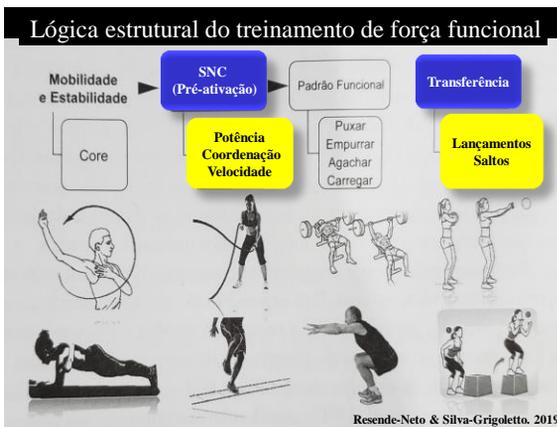
PRINCIPAIS COMPONENTES DA APTIDÃO FUNCIONAL PARA UM BOM DESEMPENHO NAS ATIVIDADES DIÁRIAS



NECESSIDADES PRIMÁRIAS DAS ARTICULAÇÕES

Tornozelo	Mobilidade
Joelho	Estabilidade
Quadril	Mobilidade
Lombar	Estabilidade
Torácica	Mobilidade
Escápula	Estabilidade
Ombro	Mobilidade

Resende-Neto & Silva-Grigoletto, 2019



PROPOSTA DE ESTRUTURAÇÃO DE TREINO DE FORÇA FUNCIONAL

Exercícios	Séries	Repetições	Carga
1- Mobilidade	1	8 segundos	-
2- Prancha no banco	2-3	15 respirações	-
3- Escada Lateral	2-3	30 segundos	-
4- Corda náutica	2-3	20 segundos	-
5- Supino com elástico	2-3	8-12	-
6- Lançamento horizontal	2-3	10-15	-
7- Sentar e levantar da cadeira	2-3	8-12	-
8- Levantamento terra	2-3	8-12	-
9- Leg press 45°	2-3	8-12	-
10- Cadeira abdução	2-3	8-12	-
11- Salto sob step (10cm)	2-3	10-15	-
12- Puxada com elástico	2-3	8-12	-
13- Remada baixa	2-3	8-12	-
14- Lançamento ao solo	2-3	10-15	-

Resende-Neto & Silva-Grigoletto, 2019

Original Research Journal of Strength and Conditioning Research

Resistance Training for Older Adults: Position Statement From the National Strength and Conditioning Association

Maren S. Fragala,¹ Eduardo L. Cadore,² Sandor Dorgo,³ Mikel Izquierdo,⁴ William J. Kraemer,⁵ Mark D. Peterson,⁶ and Eric D. Ryan⁷

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J Strength Cond Res Aug;33(8):2019-2052, 2019.

VARIÁVEL	RECOMENDAÇÃO	DETALHES
Séries	1-3 por exercício	1 série para iniciantes ou idosos frágeis – progressão para 2-3 por exercício
Repetições	8-12 ou 12-15	Saudáveis de 6-12 repetições
Intensidade	70-85% de 1RM	12-15 com intensidade leve para iniciantes. Tolerância, progressão e periodização. Considerar doenças e utilizar repetições de reserva.
Seleção dos exercícios	8-10 exercícios	Multiarticulares. Considerar déficits e lesões.
Modalidade	Pesos livres ou máquinas	Frágeis e com doenças podem se beneficiar das máquinas e elásticos. Saudáveis pesos livres.
Frequência	2-3 x semana por grupo muscular	2 a 3 dias não consecutivos.
Treino explosivo	40-60% de 1RM	Movimentos de alta velocidade
Movimentos funcionais	Exercícios similares as atividades diárias	Idosos saudáveis, base multicomponente com movimentos em diferentes posições do corpo

Definição do tema: Impacto da seleção dos exercícios para a hipertrofia regional

Objetivo da aprendizagem: proporcionar ao profissional da área do movimento os conhecimentos sobre a escolha acertiva dos exercícios para correção e melhora de pontos fracos.

Relevância da proposta: A escolha correta dos exercícios pode auxiliar sobremaneira na correções de regiões musculares com maior dificuldade de desenvolvimento.

Esse padrão pode ser intermuscular e intramuscular

Atleta: Angela, 35 anos, massa corporal: 65 kg, % de gordura 8-10%. Objetivo de competição Internacional Arnold Ohio. Categoria Wellness. **Outros casos de atletas serão mencionados para fortalecer o entendimento.**



O que devemos avaliar na inspeção visual?

Fotos

Dieta prévia, volume prévio, divisão de treino e recursos bioquímicos utilizados

Tentativas que funcionaram, exercícios preferidos, exercícios que parecem não funcionar

Pedido de vídeo para análise da técnica de execução para refinamento, avaliação de mobilidade e possíveis músculos que precisem de intervenção não só de treino.

A importância do feedback a cada 30-40 dias. Perguntas sobre a progressão de cargas, cansaço e dores articulares.

POSSÍVEIS MÉTODOS DE CONTROLE DE CARGA E RECUPERAÇÃO

Escala de recuperação TQR

Como você se sente em relação à sua recuperação?

Índice	Descritor
6	Em nada recuperado
7	Extremamente mal recuperado
8	-
9	Muito mal recuperado
10	-
11	Mal recuperado
12	-
13	Razoavelmente recuperado
14	-
15	Bem recuperado
16	-
17	Muito bem recuperado
18	-
19	Extremamente bem recuperado
20	Totalmente bem recuperado (Kenttä; Hassmén, 1998)

Escala Subjetiva de Recuperação

	5	4	3	2	1
FADIGA	Muito descansado	Descansado	Normal	Mais cansado do que o normal	Muito cansado
QUALIDADE DO SONO	Sono tranquilo e revigorante	Boa	Dificuldade em adormecer	Sono agitado	Insônia
DORES MUSCULARES	Sentindo-se ótimo	Sentindo-se bem	Normal	Dolorido ou palpitação com dor	Muito dolorido
NÍVEL DE ESTRESSE	Muito relaxado	Relaxado	Normal	Sentindo-se estressado	Muito estressado
HUMOR	Humor muito positivo	De um modo geral bom humor	Menos interessado em outras atividades que o habitual	Mal humorado com familiares e colegas de trabalho	Muito irritado

(McLean et al.2010)

Aplicação prática dos métodos avançados

Aula 01 – FST-7

Aula 02 – GVT

Aula 03 – SST



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 fásia seria aumentada “inflada” e abriria mais espaço para a fibras musculares crescerem



Maximizing Hypertrophy: Possible Contribution of Stretching in the Inter-set Rest Period

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VOLUME 33 | NUMBER 1 | FEBRUARY 2011

INTERSET STRETCHING VS. TRADITIONAL STRENGTH TRAINING: EFFECTS ON MUSCLE STRENGTH AND SIZE IN UNTRAINED INDIVIDUALS

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 ANGÉLICA CASTILHO ALONSO,^{4,2} CAUE VASQUEZ LA SCALA TEIXEIRA,^{5,6} TANUJ WADHI,³
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J Strength Cond Res . 2019 Jul;33 Suppl 1:S159-S166

TABLE 1. Subjects' characteristics (mean \pm SD).*

Variable	TST (<i>n</i> = 17)	ISS (<i>n</i> = 12)
Height (cm)	178.2 \pm 8.1	171.5 \pm 7.3
Body mass	81.8 \pm 14.2	75.8 \pm 11.9
BMI (kg·m ⁻²)	25.7 \pm 3.8	25.6 \pm 2.9
Body fat (%)	18.4 \pm 7.3	18.0 \pm 6.7
Fat mass (kg)	15.8 \pm 8.3	14.0 \pm 6.6
Lean body mass (kg)	66.0 \pm 7.8	61.8 \pm 8.2

*TST = traditional strength training; ISS = interset stretching; BMI = body mass index.

METODOLOGIA

29 sujeitos destreinados

8 semanas, 2 x semana - 90 s de descanso entre as séries

TABLE 2. Strength and flexibility training regimens throughout 8 weeks.*

Strength training program		
Exercises	Sets	Repetitions
Bench press	4	8–12RM
Seated row	4	8–12RM
Seated dip machine	4	8–12RM
Arm curl	4	8–12RM
Knee extension	4	8–12RM
Knee flexion	4	8–12RM
Passive stretch program		
Agonist muscles stretched	Repetitions	Duration
Chest	4	30 s
Latissimus dorsi	4	30 s
Biceps	4	30 s
Triceps	4	30 s
Quadriceps	4	30 s
Hamstrings	4	30 s

*RM = repetition maximum.

**TABLE 3.** Summary of study outcomes (mean \pm SD).*

Variable	Group	Pre	Post	ES	<i>p</i> (time)	<i>p</i> (group)	<i>p</i> (group by time)
Bench press (1RM) (kg)	ISS	32.9 \pm 6.6	40.6 \pm 7.0	0.86	0.0001	0.31	0.82
	TST	36.2 \pm 10.2	44.2 \pm 11.0	0.89			
Knee extension (1RM) (kg)	ISS	40.3 \pm 8.0	50.6 \pm 7.8	1.18	0.0001	0.82	0.39
	TST	40.5 \pm 9.0	48.9 \pm 9.5	0.96			
BIMT (mm)	ISS	32.2 \pm 7.2	34.5 \pm 6.7	0.39	0.0001	0.55	0.14
	TST	31.3 \pm 4.7	32.8 \pm 4.6	0.25			
TRMT (mm)	ISS	22.4 \pm 4.6	25.2 \pm 5.1	0.55	0.0001	0.45	0.19
	TST	24.4 \pm 5.1	26.1 \pm 5.2	0.35			
RFMT (mm)	ISS	16.0 \pm 4.0	18.0 \pm 4.3	0.53	0.0001	0.75	0.20
	TST	15.8 \pm 3.4	17.3 \pm 3.4	0.39			
VLMT (mm)	ISS	18.0 \pm 4.7	21.1 \pm 16.0	0.66	0.0001	0.74	0.02
	TST	19.8 \pm 4.6	21.2 \pm 4.4	0.31			
ΣMT (mm)	ISS	89.5 \pm 11.8	98.9 \pm 14.9	0.74	0.0001	0.95	0.01
	TST	91.4 \pm 13.2	97.6 \pm 13.1	0.48			

*ES = within-group effect size; 1RM = 1 repetition maximum; ISS = interset stretch group; TST = traditional group; BIMT = biceps muscle thickness; TRMT = triceps muscle thickness; RFMT = rectus femoris muscle thickness; VLMT = vastus lateralis muscle thickness; ΣMT = sum of the 4 muscle thickness sites.

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

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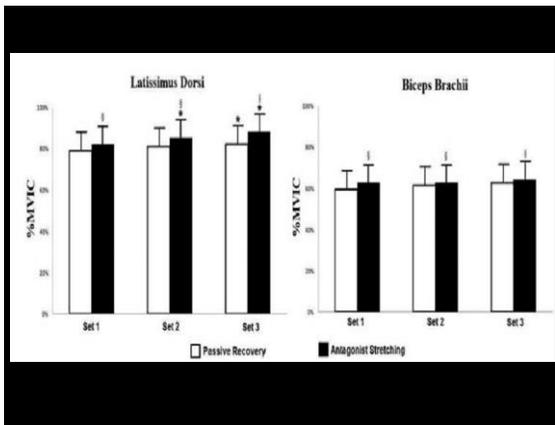
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METODOLOGIA

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.

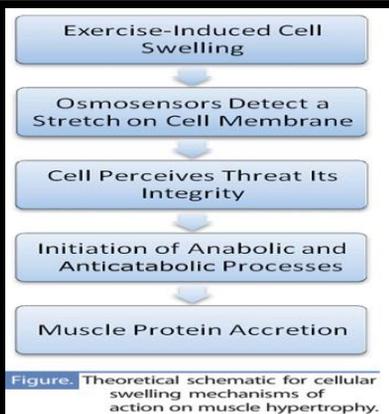


The Muscle Pump: Potential Mechanisms and Applications for Enhancing Hypertrophic Adaptations

VOLUME 0 | NUMBER 0 | MONTH 2013

Brad J. Schoenfeld, MSc, CSCS, CSPS, NSCA-CPT¹ and Bret Contreras, MA²
¹Department of Health Sciences, Program of Exercise Science, City University of New York, Lehman College, New York, New York; and
²Department of Sport Performance, Auckland University of Technology, Auckland, New Zealand

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



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

VARIAÇÕES DAS CONTRAÇÕES:

O SST-CT 10RM até a falha, 2 séries com intervalos de 20 s, sem retirada de peso.

Remoção de 20% do peso e 20 s, 1 série até a falha com 1 s de fase concêntrica e 4 s de excêntrica.

Outra remoção de 20% e 20 s, 1 série com 4 s de fase concêntrica e 1 s de fase excêntrica até a falha.

Outra pausa de 20 s e remoção de 20% 1 contração isométrica foi realizada até a falha



VARIAÇÕES DO INTERVALO DE DESCANSO:

O SST-RIV consiste de uma série inicial com 10RM até a falha

Seguida de intervalos de descanso programados sem remoção de carga sempre até a falha: 45, 30, 15, 5, 5, 15, 30 e 45 s,

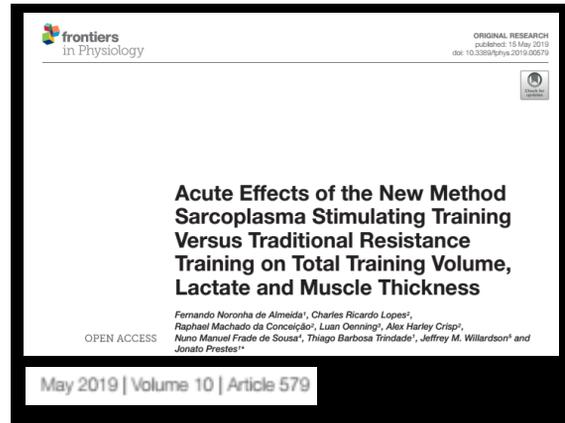


Table 1. Mean \pm SD total training volume of elbow flexors, and elbow extensors for sarcoplasmic stimulating training contraction type (SST-CT), SST rest interval variable (SST-RIV), and traditional resistance training (TRT) sessions.

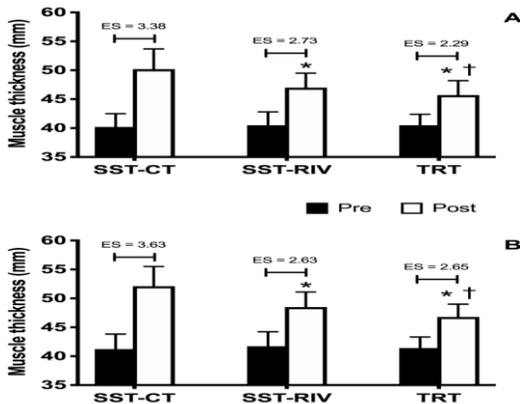
Sessions	Elbow flexors	Elbow extensors
SST-CT, AU	1444 \pm 397	1957 \pm 737
SST-RIV, AU	789 \pm 237*	1035 \pm 298*
TRT, AU	1531 \pm 447†	2476 \pm 1002*†

AU, arbitrary units. * $p \leq 0.05$ for SST-CT; † $p \leq 0.05$ for SST-RIV

Table 2. Mean \pm SD, percentage of change, and effect size (ES) of blood lactate pre and post sarcoplasmic stimulating training contraction type (SST-CT), SST rest interval variable (SST-RIV), and traditional resistance training sessions (TRT).

Sessions	Pre	Post	Change (Δ)	ES
SST-CT	1.9 \pm 0.5	8.4 \pm 1.5*	6.5 \pm 1.7	5.73
SST-RIV	1.8 \pm 0.5	8.3 \pm 1.6*	6.5 \pm 1.5	5.34
TRT	1.8 \pm 0.4	8.5 \pm 1.3*	6.7 \pm 1.1	7.13

* $p \leq 0.05$ for Pre intervention



European Journal of Applied Physiology
<https://doi.org/10.1007/s00421-019-04181-y>

ORIGINAL ARTICLE

Effects of squat training with different depths on lower limb muscle volumes

Keitaro Kubo¹ · Toshihiro Ikebukuro¹ · Hideaki Yata²

Received: 10 January 2019 / Accepted: 19 June 2019
 © Springer-Verlag GmbH Germany, part of Springer Nature 2019

METODOLOGIA

17 sujeitos destreinados

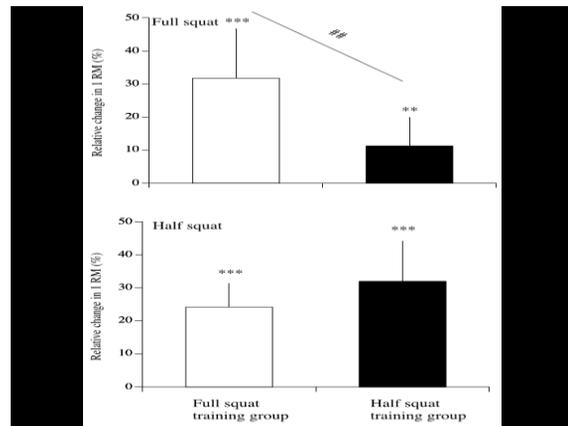
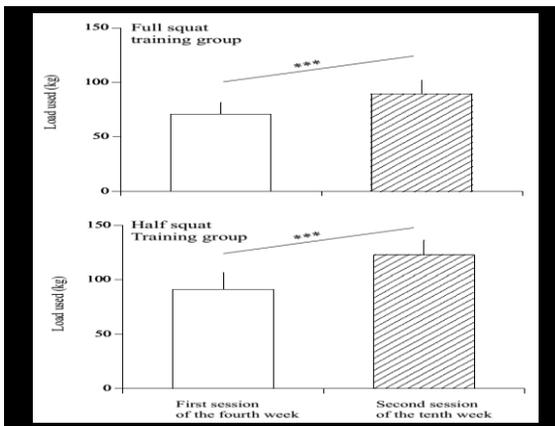
Agachamento completo 140º de flexão dos joelhos e meio agachamento 90º

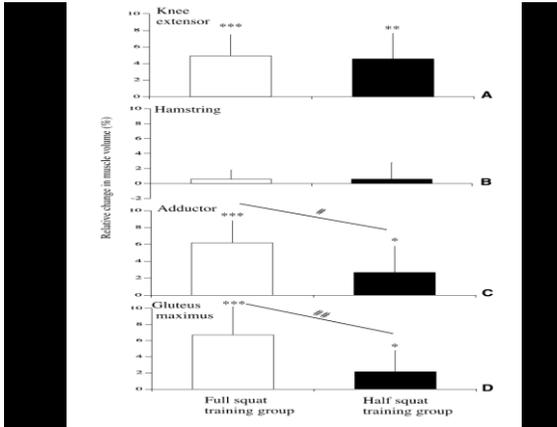
10 semanas, 2 x semana, semana 2 – 3 x 10 com 60% de 1RM, semana 2 – 3 x 8 com 70% de 1RM, semana 80% de 1RM e da 4 até a 10 - 90% de 1RM

Table 1 Age, physical characteristics, and 1RM before training in both groups mean (sd)

	Full squat training group (n=8)	Half squat training group (n=9)
Age (years)	20.7 (0.4)	20.9 (0.8)
Height (cm)	173.6 (4.1)	172.3 (5.8)
Body mass (kg)	63.2 (6.6)	64.1 (6.1)
1RM of full squat (kg)	78.8 (14.6)	82.8 (15.2)
1RM of half squat (kg)	95.0 (16.0)	96.7 (15.0)

1RM one repetition maximum





	Full squat training group (n=8)		Half squat training group (n=9)	
	Before	After	Before	After
Rectus femoris muscle (cm ²)	291.8 (46.5)	290.9 (39.7)	286.2 (31.7)	287.3 (38.8)
Vastus lateralis muscle (cm ²)	639.0 (95.9)	682.7 (93.1)***	653.9 (71.5)	694.1 (83.3)**
Vastus intermedius muscle (cm ²)	556.3 (99.0)	576.0 (94.3)**	499.8 (63.7)	523.8 (63.0)**
Vastus medialis muscle (cm ²)	480.2 (72.5)	512.5 (72.5)***	457.5 (56.0)	488.1 (63.1)***

*Significantly different from before (**p < 0.01, ***p < 0.001)

	Full squat training group (n=8)		Half squat training group (n=9)	
	Before	After	Before	After
Biceps femoris short head muscle (cm ²)	106.2 (20.2)	106.1 (20.3)	104.6 (22.2)	105.4 (22.2)
Biceps femoris long head muscle (cm ²)	194.0 (29.4)	195.2 (27.7)	192.3 (31.9)	193.4 (27.3)
Semitendinosus muscle (cm ²)	179.7 (26.9)	182.1 (24.7)	187.5 (39.4)	186.5 (36.1)
Seminembranosus muscle (cm ²)	237.7 (36.9)	238.2 (39.9)	214.9 (31.2)	217.0 (27.8)

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:

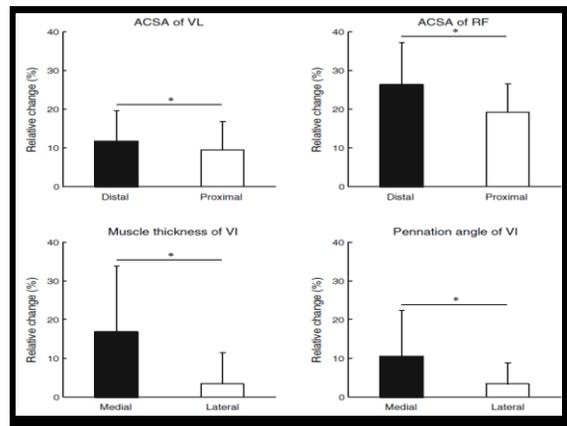
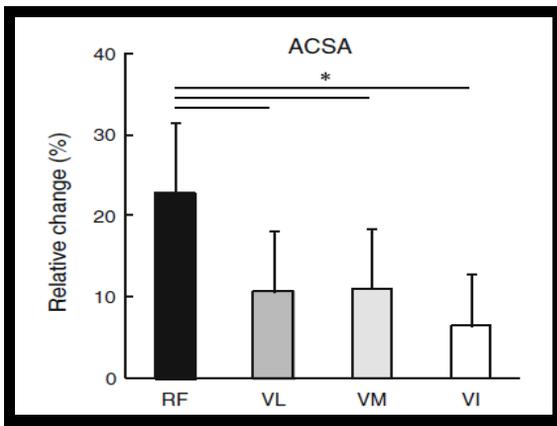
Extensão dos joelhos (2 s conc. e 2 s na exc.)

3 x semana

5 x 8 reps a 80% de 1RM

1,5 min intervalo entre as séries

1RM ajustada a cada 2 semanas



European Journal of Applied Physiology
 https://doi.org/10.1007/s00421-023-05156-w

ORIGINAL ARTICLE

Hip flexion angle affects longitudinal muscle activity of the rectus femoris in leg extension exercise

Hiroku Mitsuya¹ · Koichi Nakazato¹ · Takayoshi Hakkaku¹ · Takashi Okada¹

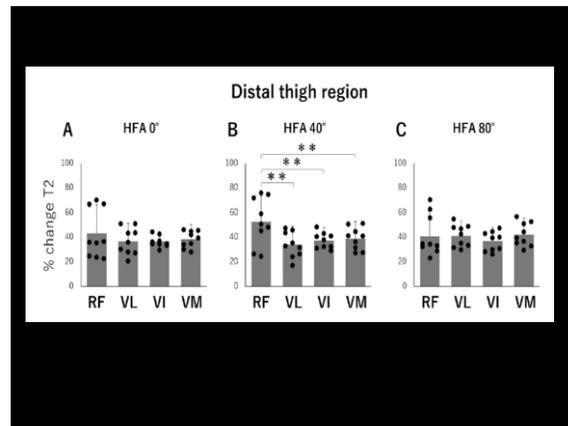
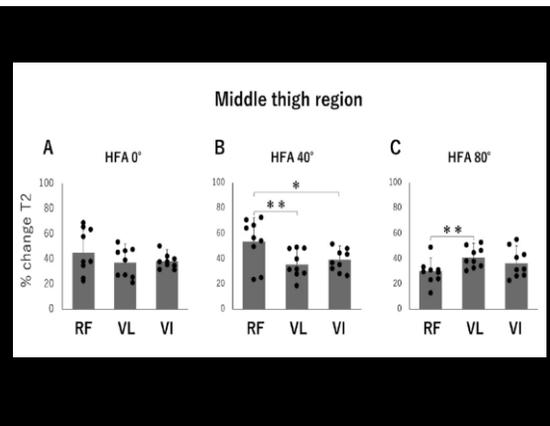
Received: 21 October 2022 / Accepted: 8 February 2023
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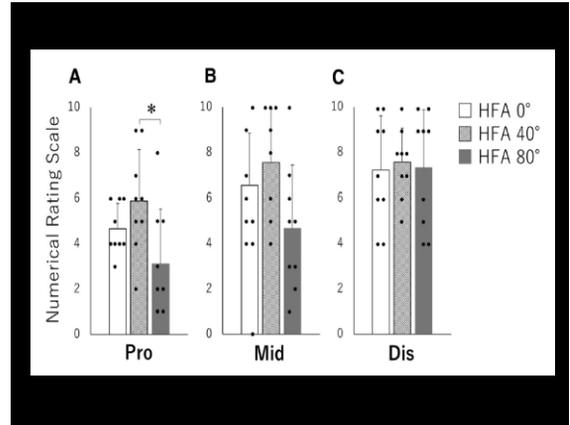
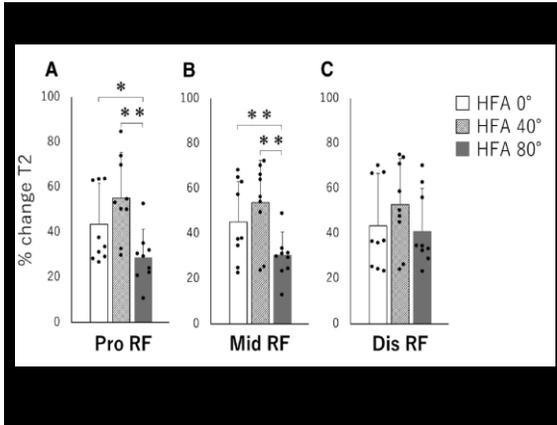
9 fisiculturistas com média de 5 anos de carreira.

Fig. 1 Schematic illustrations of the leg extension exercise. The unilateral leg extension exercise that extends the knee joint from 90° flexion to 0° was performed with a randomly selected leg. The hip flexion angles were set to 0°, 40°, and 80°

Fig. 2 The schedule for the measurements. At least 3 days prior to exercise, IRM was measured at each HFA and IRM measurements of each HFA were taken at least 72 h apart. The HFAs were measured in a randomly selected order. The LEE was performed at a randomly selected HFA, and the LEE for the next HFA was performed at least 72 h later. The measurement schedule did not overlap with the participant's daily leg exercises. IRM = 1-repetition maximum. HFA hip flexion angle, LEE leg extension exercise

Fig. 3 Example of T2 MRI at the proximal (7th slice of 25), middle (13th slice of the center of the femur), and distal (16th slice of 25) regions of RF before and after the LEE at 0° HFA. The black dotted line indicates the border of the quadriceps femoris. The brighter the color, the higher the T2 value. This image is the 25 ms image of the four TRs (25, 50, 75 and 100 ms). RF rectus femoris, VL vastus lateralis, VI vastus intermedius, VM vastus medialis





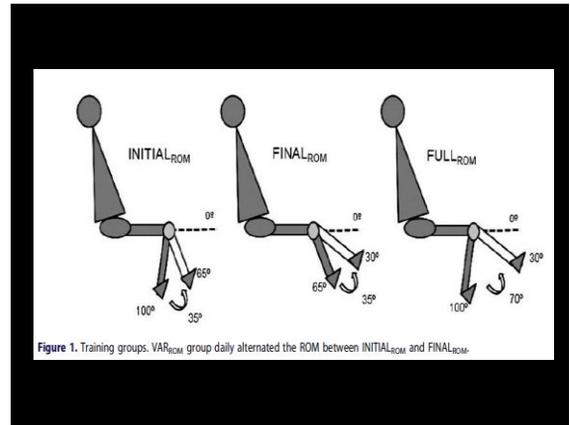
European Journal of Sport Science

Partial range of motion training elicits favorable improvements in muscular adaptations when carried out at long muscle lengths

Gustavo F. Pedrosa, Fernando V. Lima, Brad J. Schoenfeld, Lucas T. Lacerda, Marina G. Simões, Mariano R. Pereira, Rodrigo C.R. Diniz & Mauro H. Chagas

To cite this article: Gustavo F. Pedrosa, Fernando V. Lima, Brad J. Schoenfeld, Lucas T. Lacerda, Marina G. Simões, Mariano R. Pereira, Rodrigo C.R. Diniz & Mauro H. Chagas (2021): Partial range of motion training elicits favorable improvements in muscular adaptations when carried out at long muscle lengths, European Journal of Sport Science, DOI: 10.1080/17461391.2021.1927199

To link to this article: <https://doi.org/10.1080/17461391.2021.1927199>



45 mulheres destreinadas

TREINAMENTO DE 3 MESES:

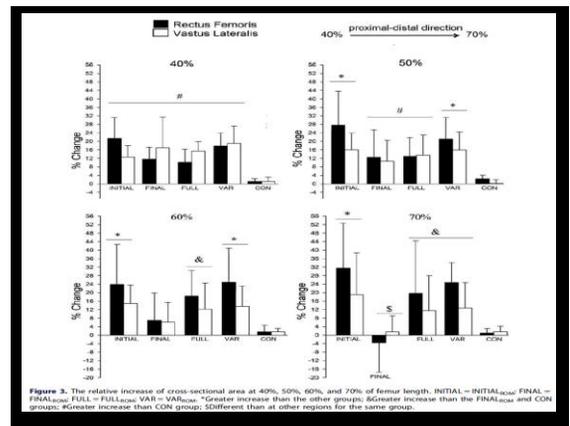
Extensão dos joelhos (2 s conc. e 2 s na exc.)

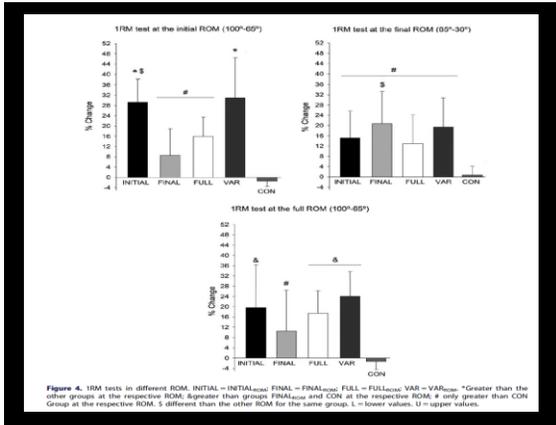
3 x semana

3-6 x 7 reps a 60% de 1RM

3 min intervalo entre as séries

1RM ajustada a cada 2 semanas na ADM específica treinada

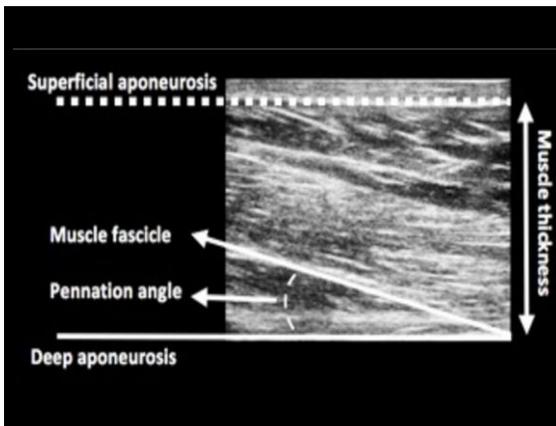
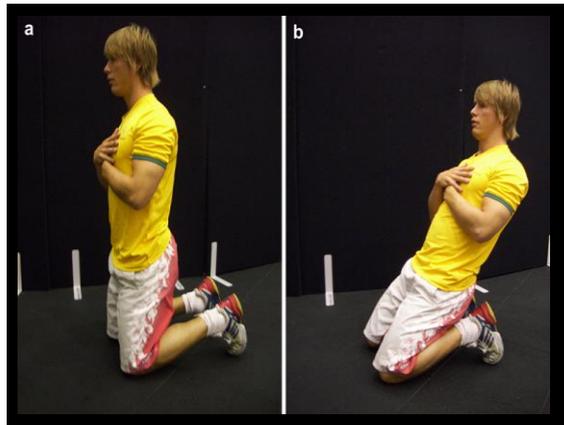
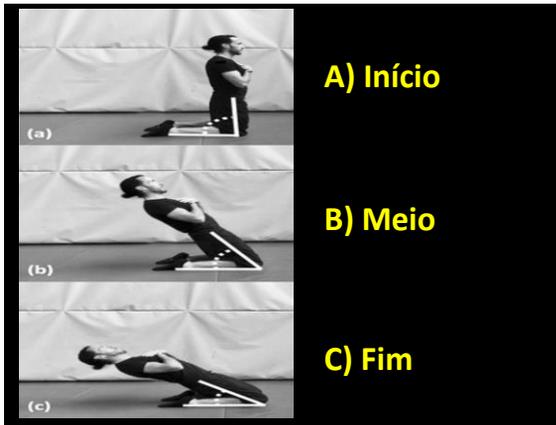




Changes in rectus femoris architecture induced by the reverse nordic hamstring exercises

Diego ALONSO-FERNANDEZ, Rosana FERNANDEZ-RODRIGUEZ, Rocío ABALO

The Journal of Sports Medicine and Physical Fitness 2018 Oct 01
DOI: 10.23736/S0022-4707.18.08873-4



TABLES

Table I.— Characteristics of participants (mean ± standard error of the mean)

N	Age (years old)	Weight (kg)	Height (m)
26	24.7 ± 2.9	77.6 ± 8.7	1.79 ± 0.08

Table II.—
Eccentric training progression with RNHE

Week	Number of sessions/week	Sets	Repetitions	Total number of repetitions	Rest between sets
1	2	2	6	24	2 min
2	2	2	8	32	2 min
3	3	3	6	54	2 min
4	3	3	8	72	2 min
5	3	3	8	72	2 min
6	3	3	10	90	2 min
7	3	3	10	90	2 min
8	3	3	10-12	90-108	2 min

Table III.— Eccentric protocol with RNHE (n = 26)

	M1	M2	M3	% Change	
	(Week 1)	(Week 9)	(Week 13)	M1-M2	M2-M3
FL (cm)	7.82±1.88	8.57±1.14**	8.18±1.35##	9.59	-4.55
RFL	3.70±0.35	3.74±0.38	3.72±0.34	1.08	-0.53
PA (°)	12.44±2.98	13.82±3.81*	13.26±2.02#	11.09	-4.05
MT (cm)	2.1±0.19	2.28±0.31**	2.18±0.26##	8.57	-4.38
CSA (cm2)	9.21±1.86	10.02±1.98**	9.61±1.37##	8.79	-4.26

Table note: * = P < .05 vs M1, ** = P < .001 vs M1, # = P < .05 vs M2, ## = P < .001 vs M2.
 FL = Fascicle length, RFL = fascicle length relative to muscle thickness, PA = pennation angle,
 MT = muscle thickness, CSA = cross-sectional area

ARTICLE IN PRESS

Science & Sports (2020) xxx, xxx–xxx

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ORIGINAL ARTICLE

Effects of eccentric exercise on the quadriceps architecture

Effets de l'exercice excentrique sur l'architecture du quadriceps

D. Alonso-Fernandez^a, R. Abalo-Núñez^{b,*}, C. Mateos-Padorno^c, M.J. Martínez-Patiño^a

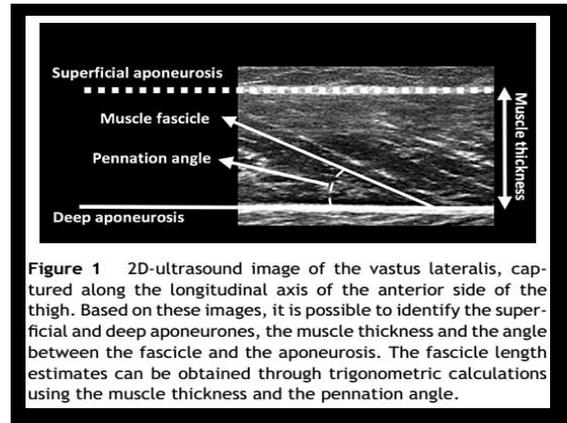
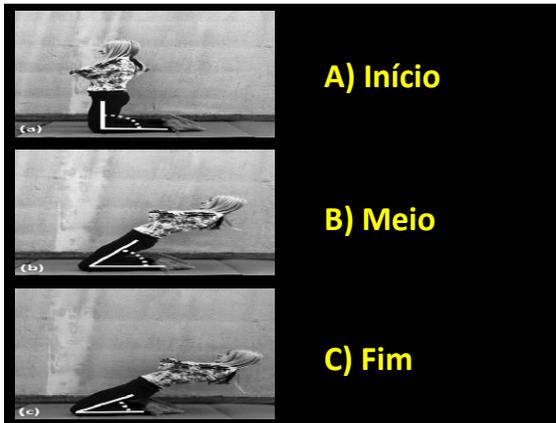


Table 1 Eccentric training progression based on the RNHE.

Week	Nr. sessions/week	Sets	Repetitions	Total nr. of repetitions	REST between sets
1	2	2	6	24	2min
2	2	2	8	32	2min
3	3	3	6	54	2min
4	3	3	8	72	2min
5	3	3	8	72	2min
6	3	3	10	90	2min
7	3	3	10–12	90–108	2min

Table 2 Changes in the muscle architecture of the vastus lateralis and the vastus medialis before week 1 and after week 8 the intervention and after the detraining period, week 12, (mean ± SD).

	Eccentric protocol with RNHE (N = 28)				
	Week 1	Week 8	Week 12	% Change Week 1–2	% change Week 2–2
Vastus lateralis					
FL (cm)	10.88 ± 1.42	11.14 ± 1.51*	11.03 ± 1.54#	2.39	-0.99
RFL	5.07 ± 0.69	5.03 ± 0.75	5.05 ± 0.77	-0.79	0.39
PA (°)	14.21 ± 1.89	14.84 ± 2.03*	14.55 ± 2.11#	4.43	-1.95
MT (cm)	2.15 ± 0.13	2.24 ± 0.14*	2.19 ± 0.14#	4.18	-2.23
Vastus medialis					
FL (cm)	11.89 ± 1.27	12.29 ± 1.33**	11.96 ± 1.31f##	3.36	-2.68
RFL	4.27 ± 0.55	4.30 ± 0.57	4.25 ± 0.55	0.71	-1.16
PA (°)	14.77 ± 1.98	15.29 ± 1.81*	14.94 ± 2.02#	3.52	-2.29
MT (cm)	2.81 ± 0.33	2.99 ± 0.37*	2.84 ± 0.34#	6.41	-5.02

SD, standard deviation; RNHE, Reverse Nordic Hamstring Exercise; FL, fascicle length; RFL, fascicle length relative to muscle thickness; PA, pennation angle; MT, muscle thickness. Footnote: * = P < 0.05 vs. week 1, ** = P < 0.001 vs. week 1, # = P < 0.05 vs. week 2, ## = P < 0.001 vs. week 2.

ACTA PHYSIOLOGICA

Acta Physiol 2014, 210, 643-654

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 Valls¹ and M. V. Narici¹

¹ School of Graduate Entry Medicine and Health, MRCARUK Centre of Excellence for Musculoskeletal Ageing Research, University of Nottingham, Derby, UK
² School of Healthcare Sciences, Institute for Biomedical Research into Human Movement and Health, Manchester Metropolitan University, Manchester, UK
³ Department of Orthopaedics, University of Zurich, Balgach University Hospital, Zurich, Switzerland

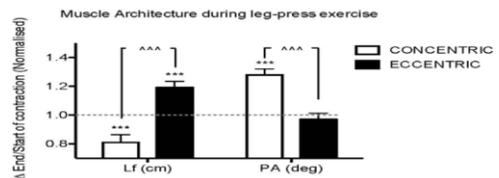
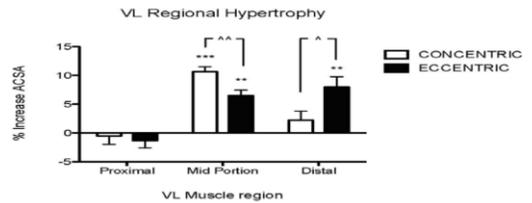
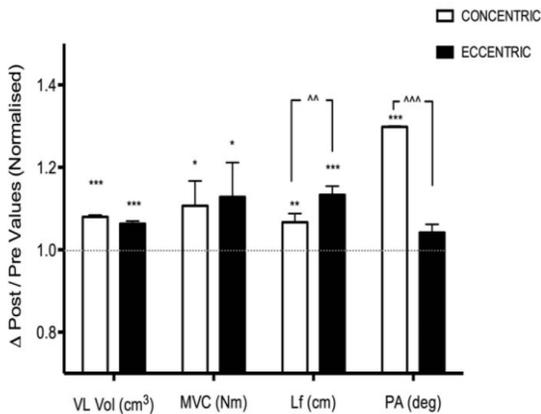
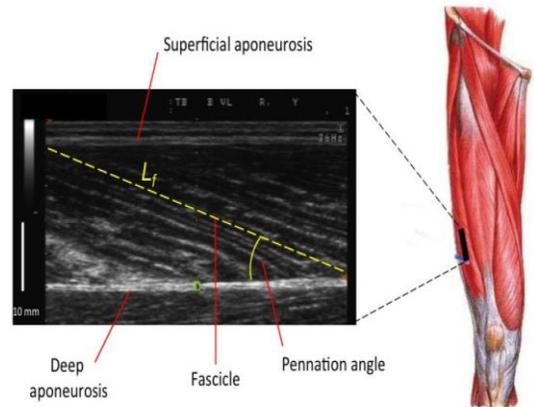
Respostas estruturais, funcionais e moleculares ao TF concêntrico e excêntrico no músculo humano

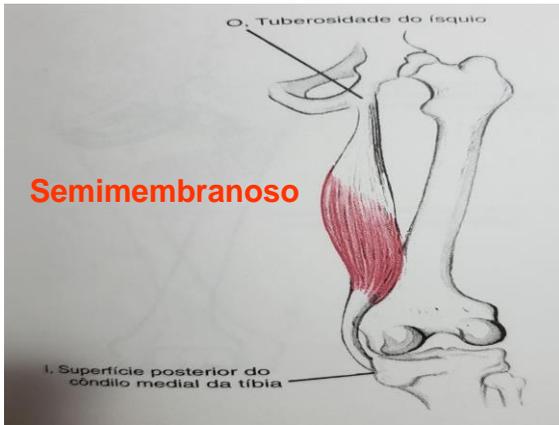
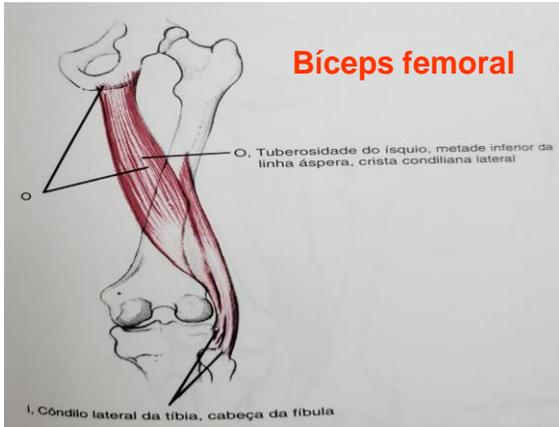


Table 1. Maximum lifting or lowering ability changes for the CON Group (CON) and the ECC one (ECC). EMG values were recorded only at baseline during 1RM leg-press for concentric and eccentric phases. Load ratio is also showed and calculated as the ratio of pre and post ECC/CON training loads.

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).





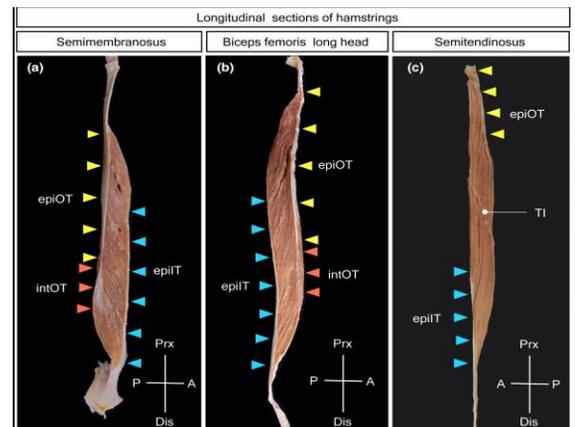
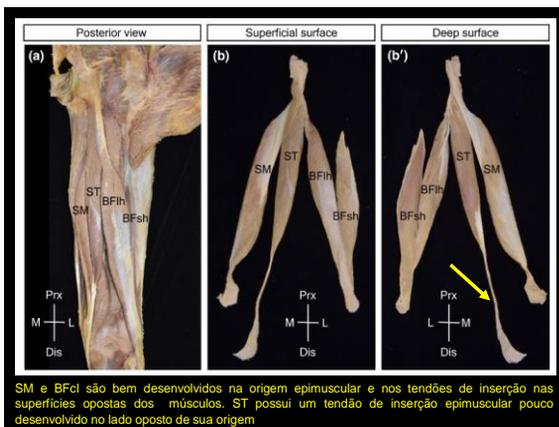
Received: 18 September 2022 | Revised: 22 February 2023 | Accepted: 24 February 2023
 DOI: 10.1111/joa.13860

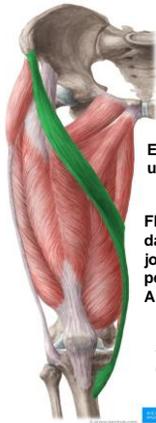
ORIGINAL ARTICLE

Journal of **Anatomy** ANATOMICAL SOCIETY WILEY

Unique morphological architecture of the hamstring muscles and its functional relevance revealed by analysis of isolated muscle specimens and quantification of structural parameters

Koichi Takeda¹ | Kota Kato¹ | Koichiro Ichimura¹ | Tatsuo Sakai^{1,2}





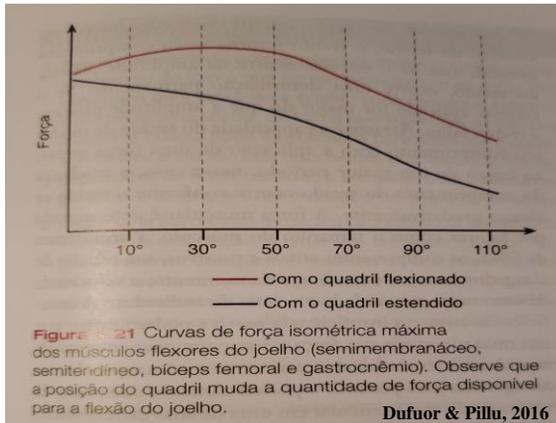
O músculo sartório se origina da espinha ilíaca anterior superior da pelve

Em todo o seu trajeto o músculo é recoberto por uma duplicação fascial da fáscia lata (Floyd, 2016).

Flexão do quadril, flexão do joelho, rotação lateral da coxa à medida que ela flexiona o quadril e o joelho, abdução do quadril, rotação anterior da pelve e rotação medial fraca do joelho.

A inervação é no nervo femoral (L2 e L3).

A sua inserção ocorre na pata anserina ([pata de ganso](#) ou pes anserinus) medialmente à tuberosidade tibial.



International Journal of Sports Physiology and Performance, 2009, 4, 84-96
© 2009 Human Kinetics, Inc.

Hamstring Activation During Lower Body Resistance Training Exercises

William P. Ebben

METODOLOGIA

34 atletas de futebol americano,

Contração isométrica voluntária máxima - 60° de flexão do joelho na flexora e na extensora para cálculo da razão I/Q

2 repetições com amplitude completa e carga referente a 6RM nos exercícios flexora sentada, flexão nórdica, good morning (bom dia), stiff bi e unilateral, e agachamento.

Table 1 Subject Characteristics

Variable	All Subjects	Women (N = 13)	Men (N = 21)
Age (y)	20.38 ± 1.78	20 ± 0.70	20.61 ± 0.71
Age range (y)	18–26	19–21	18–26
Weight (kg)	77.94 ± 18.30	63.64 ± 18.30	86.80 ± 17.90
Weight range (kg)	54.55–133.64	54.55–72.73	65.90–133.64
Training (days/week)	4.15 ± 1.79	4.00 ± 1.77	4.24 ± 1.84
Squat 6 RM (kg)	101.47 ± 34.08	68.18 ± 12.31	122.07 ± 25.65
Squat 6RM range (kg)	52.27–184.09	52.27–88.64	84.09–184.09

Values are mean ± SD.

Table 2 Percentage of H RMS EMG of the MVIC for Each of the Resistance Training Exercises Evaluated (Analysis of All Subjects; N = 34)

	Russian Curl (RC)	Seated Leg Curl (SLC)	Stiff Leg Dead Lift (SLDL)	Single Leg Stiff Leg Dead Lift (SGLDL)	Good Morning (GM)	Squat (S)
RMS normalized as % RMS MVIC	98.0 ± 39.0 ^a	81.0 ± 28.0 ^a	49.0 ± 27.0 ^b	48.0 ± 39.0 ^b	43.0 ± 16.0 ^c	27.0 ± 20.0 ^d

Table 3 Percentage of Q RMS EMG of the MVIC for Each of the Resistance Training Exercises Evaluated (Analysis of All Subjects; N = 34)

	Squat (S)	Single Leg Stiff Leg Dead Lift (SGLDL)	Good Morning (GM)	Stiff Leg Dead Lift (SLDL)	Seated Leg Curl (SLC)	Russian Curl (RC)
RMS normalized as % RMS MVIC	74.0 ± 40.0 ^a	20.0 ± 10.0 ^b	12.0 ± 8.0 ^b	12.0 ± 20.0 ^b	7.0 ± 5.0 ^d	5.0 ± 4.0 ^d

Table 4 H (% RMS EMG MVIC)-to-Q (% RMS EMG MVIC) Ratio for Each of the Resistance Training Exercises Evaluated (Analysis of All Subjects; N = 34)

	Russian Curl (RC)	Seated Leg Curl (SLC)	Stiff Leg Dead Lift (SLDL)	Good Morning (GM)	Single Leg Stiff Leg Dead Lift (SGLDL)	Squat (S)
Hamstring-to-quadriceps ratio	25.09 ± 14.47	14.85 ± 9.77	8.23 ± 5.18	4.87 ± 3.15	2.91 ± 1.56	0.37 ± 0.21

Values are mean ± SD. All exercises are significantly different from each other ($p < 0.05$).

Table 5 Gender Differences in H-to-Q Quadriceps Ratio Expressed as RMS EMG Normalized as a Percentage of RMS EMG of the MVIC

	Russian Curl (RC)	Seated Leg Curl (SLC)	Stiff Leg Dead Lift (SLDL)	Good Morning (GM)	Single Leg Stiff Leg Dead Lift (SGLDL)	Squat (S)
Men (N = 21)	29.14 ± 16.23	17.45 ± 8.80	8.96 ± 5.96	5.90 ± 3.38	3.36 ± 1.70	0.38 ± 0.20
Women (N = 13)	18.56 ± 7.90	10.65 ± 10.13	7.06 ± 3.50	3.18 ± 1.80	2.20 ± 0.98	0.34 ± 0.23
H:Q of women expressed as a percentage of male H:Q	64.7% ^a	61.0% ^a	78.8%	53.9% ^a	65.5% ^a	89.5%

Values are mean ± SD. H:Q, hamstrings-to-quadriceps ratio.

^aMean H:Q ratios are significantly different between men and women ($P < .05$).

Table 6 Gender Differences in H-to-Q Ratio Expressed as RMS EMG Normalized as a Percentage of RMS EMG of the MVIC for Strength Matched Men and Women

	Russian Curl (RC)	Seated Leg Curl (SLC)	Stiff Leg Dead Lift (SLDL)	Good Morning (GM)	Single Leg Stiff Leg Dead Lift (SGLDL)	Squat (S)
Men (N = 3)	46.96 ± 14.50	27.59 ± 10.90	17.21 ± 1.99	7.76 ± 1.21	5.86 ± 2.37	0.25 ± 0.07
Women (N = 3)	16.84 ± 7.58	17.78 ± 21.04	9.50 ± 3.87	3.12 ± 2.22	2.38 ± 0.10	0.19 ± 0.02
H:Q of women expressed as a percentage of male H:Q	35.9% ^a	64.4% ^a	55.2% ^a	40.2% ^a	40.6% ^a	76.0% ^a

Values are mean ± SD. H:Q, hamstrings-to-quadriceps ratio.

^aMean hamstrings to quadriceps ratios are significantly different between men and women ($P < .05$).

TITLE

Impact of the Nordic hamstring and hip extension exercises on hamstring architecture and morphology: implications for injury prevention

Authors

Matthew N. Bourne^{1,3,4}, Steven J. Duhig^{2,3}, Ryan G. Timmins⁵, Morgan D. Williams⁶, David A. Opar⁵, Aiman Al Najjar⁷, Graham K. Kerr^{2,3}, Anthony J. Shield^{2,3}.

Bourne MN et al. Impact of the Nordic hamstring and hip extension exercises on hamstring architecture and morphology: implications for injury prevention. *British Journal of Sports Medicine*, 51(9), 2016.

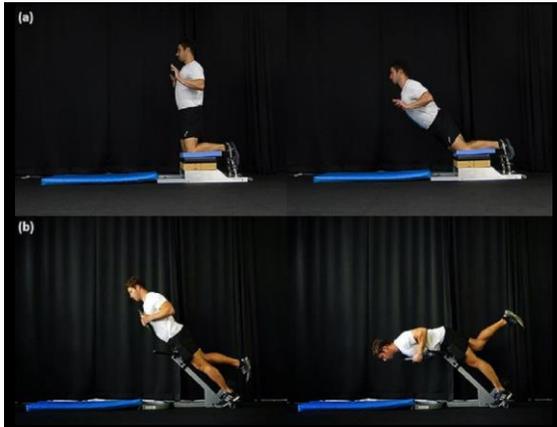


Table 3. Participant characteristics

Group	Age (years)	Height (cm)	Mass (kg)
HE	23.1±4.1	180±6.3	81.6±9.7
NHE	21.6±3.2	182.8±8.7	85.0±10.9
CON	21.3±3.7	178.5±5.4	75.9±11.8

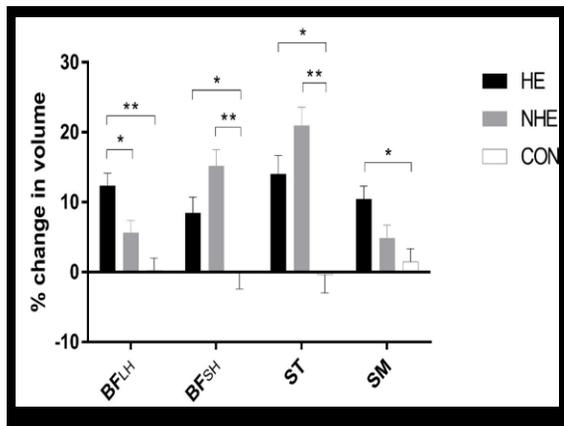
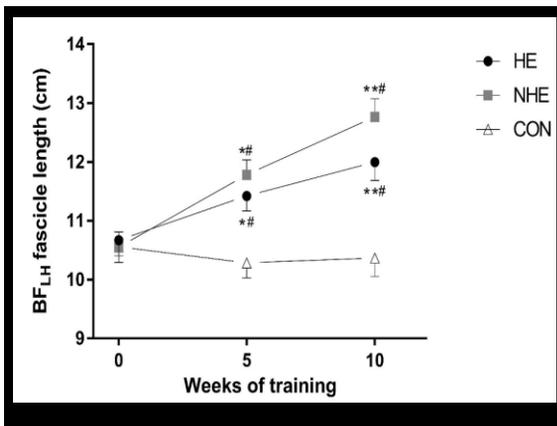
20 sessões, 2 x semana durante 10 semanas.

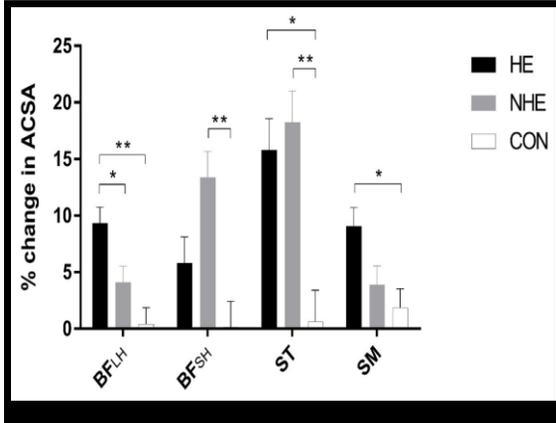
Os participantes realizaram de 2 até 6 séries com 6 até 10 repetições que variaram ao longo das 10 semanas.

Table 1. Training program variables for both the Nordic hamstring and hip extension training groups

Week	Frequency	Sets	Repetitions
1	2	2	6
2	2	3	6
3	2	4	8
4	2	4	10
5-8	2	5	8-10
9	2	6	6
10	2	5	5

Week	Training Intensity (Load)	
	Nordic Hamstring exercise	Hip extension exercise
1	Load was added to the chest in increments of 2.5kg when participants developed sufficient strength to stop at the end of the range of motion.	60-70% of 1-RM
2		70-80% of 1-RM
3		All exercise was completed at maximal intensity of effort. Loads were progressively increased when desired repetitions and sets were achieved.
4		
5-8		
9		
10		





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Greater Hamstrings Muscle Hypertrophy but Similar Damage Protection after Training at Long versus Short Muscle Lengths

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The Journal of Strength and Conditioning Research, September 2020

METODOLOGIA

20 sujeitos saudáveis sem experiência no treinamento de força

1 coxa flexora deitada e a outra flexora sentada. **Parte 1**

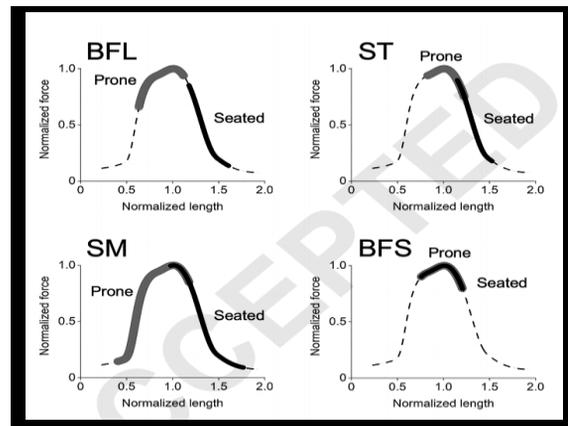
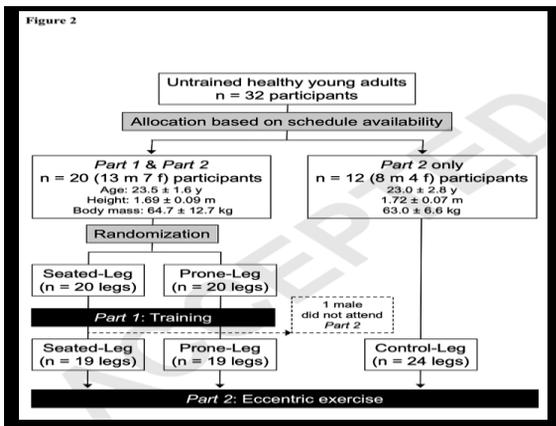
❖ 5 séries de 10 repetições com 50, 60 e 70% de 1RM
Cadência 2:2s, 120s de descanso, 2 s semana, 12 semanas

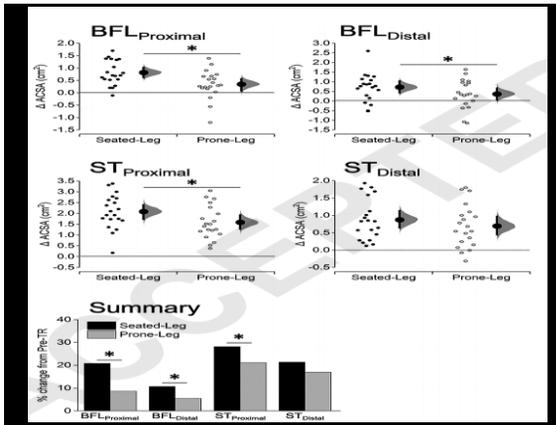
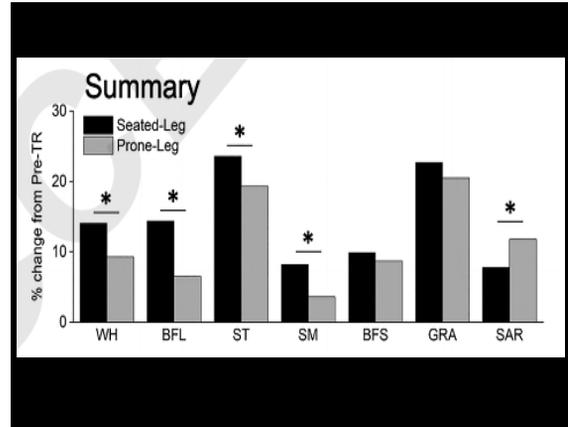
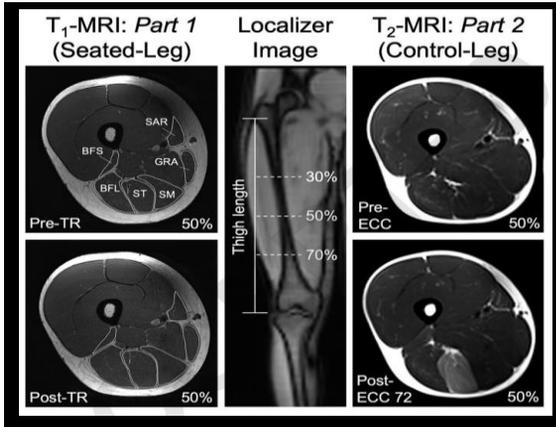
METODOLOGIA

19 sujeitos saudáveis da parte 1 e 12 destreinados controles

1 coxa flexora deitada e a outra flexora sentada. **Parte 2**

❖ 3 séries de 10 repetições com 90% de 1RM só excêntrico





APPLIED SCIENCES

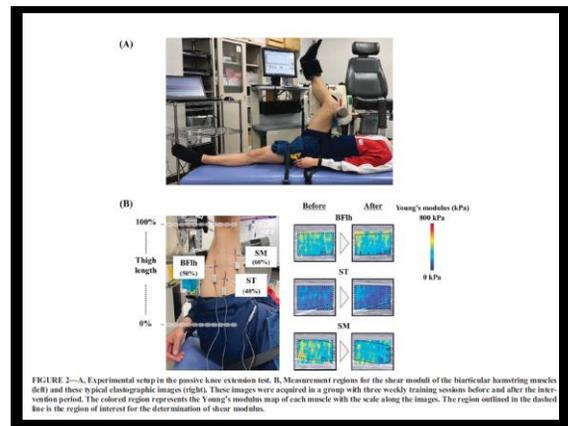
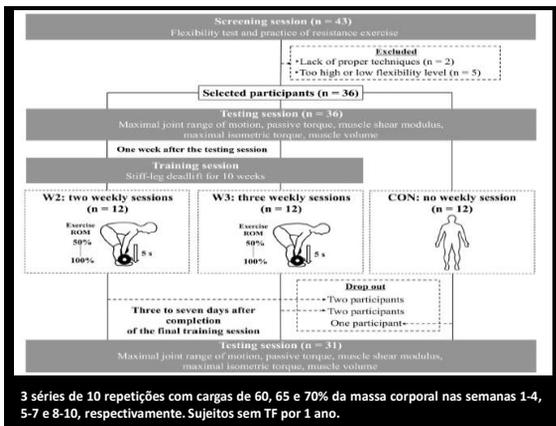
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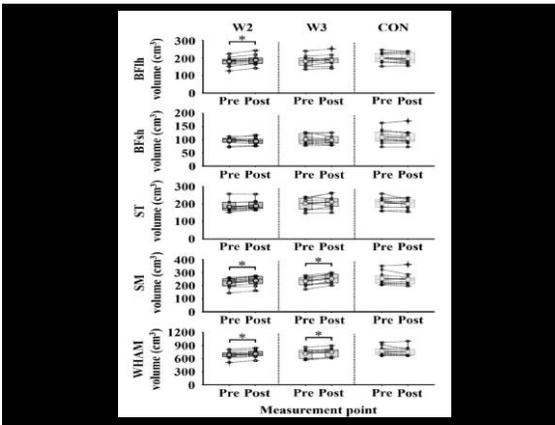
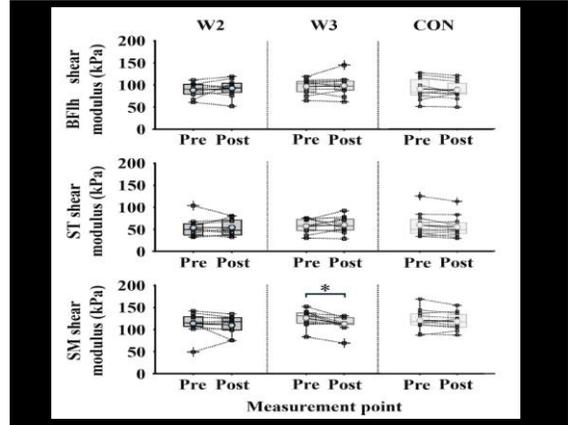
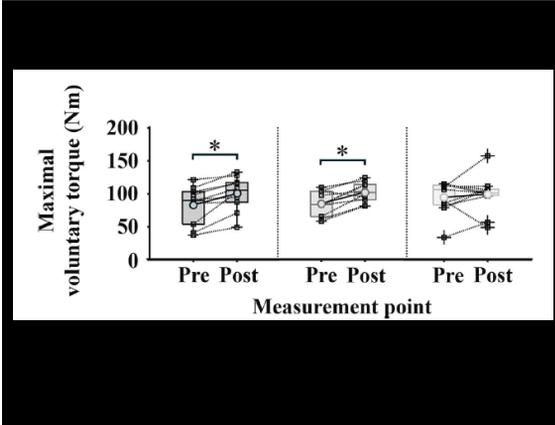
Can Eccentric-Only Resistance Training Decrease Passive Muscle Stiffness While Increasing Size and Strength of Hamstrings?

RAKI KAWAMA^{1,2}, KATSUKI TAKAHASHI¹, HARUKI IKIFUNE³, HIRONOSHIN TOZAWA⁴, TAKAFUMI OBATA⁵, RYO ITO⁶, TATSUYA HOJO⁷, and TAKU WAKAHARA^{1,4}

¹Faculty of Health and Sports Science, Doshisha University, Kyoto, JAPAN; ²Research Fellow of Japan Society for the Promotion of Science, Tokyo, JAPAN; ³Graduate School of Health and Sports Science, Doshisha University, Kyoto, JAPAN; and ⁴Human Performance Laboratory, Waseda University, Saitama, JAPAN

Med. Sci. Sports Exerc., Vol. 56, No. 12, pp. 2349–2361, 2024





EXEMPLO DE PROGRAMA DE TREINAMENTO COM DIVISÃO, VOLUME, EXERCÍCIOS E OUTROS DETALHES.

- TREINO DE GLÚTEO A**
- Levantamento terra sumô entre dois steps com halteres
 - Método FST-7
 - 7 séries de 8-12RM, pausa de 30-45 s entre as séries. Manter o glúteo abduzido na parte estrada do movimento nos últimos 20 s da pausa entre as séries
 - 2 – Agachamento sumô no arrem
 - 1 série de 15-20RM
 - 1 série de 10-12RM
 - 1 série de 8-10 RM
 - 1 série de 4-6 RM
 - 1,5 minutos de descanso entre as séries
 - 3 – Afundo com dois steps frente e trás usando pausa de 5 s no momento de maior estiramento em cada repetição.
 - 5 séries de 8-12RM
 - 1,5 minutos de descanso entre as séries
 - 4 – Elevação pélvica na máquina ou barra em bi-set com abdução (quadril 45°)
 - 1 série de 30RM em cada exercício.
 - 1 série de 20RM em cada exercício.
 - 1 série de 15RM em cada exercício.
 - 1 série de 10RM em cada exercício.
 - 5 – Agachamento unilateral búlgaro usando pausa de 5 s no momento de maior estiramento em cada repetição.
 - 5 séries de 8-12RM
 - 1,5 minutos de descanso entre as séries
 - 6 – Extensão de quadril na polia baixa com rotação externa
 - 1 série de 15-20RM
 - 1 série de 10-12RM
 - 1 série de 8-10 RM
 - 1 série de 6-10 RM
 - 1,5 minutos de descanso entre as séries
 - 7 – Mesa flexora com o banco alto
 - 3 séries de 10-12 repetições sem falha, 1 minuto de descanso entre as séries
 - 8 – Panturrilha em pé
 - Método FST-7
 - 7 séries de 8-12RM, pausa de 30-45 s entre as séries. Manter a panturrilha abduzida na parte estrada do movimento nos últimos 20 s da pausa entre as séries. Variar posição dos pés, aberto, fechado e neutro em cada série
 - 9 – Panturrilha sentada
 - 1 série de 15-20RM
 - 1 série de 10-12RM
 - 1 série de 8-10 RM
 - 1,5 minutos de descanso entre as séries
 - Variar posição dos pés, aberto, fechado e neutro em cada série

- Treino A – Glúteo
- 1- Leg press unilateral 45° ou horizontal (ou similar)
- 2 séries de 10-12 reps sem falha
- 1 série de 10-12RM
- 2 séries de 8-10 RM
- 1 série de 4-6RM
- 2-3 minutos de descanso entre as séries
- 2 – Frog reverso no Smith
- 4 séries de 8-10RM
- 2 minutos de descanso entre as séries
- 3 – Elevação pélvica livre ou máquina com band no joelho
- Método ondulatório
- 1 série acima de 15 repetições pausa de 2 minutos, 1 série abaixo de 6 repetições, pausa de 2 minutos, completar 4 séries acima de 15 reps e 4 séries abaixo de 6 reps.
- 2 minutos de descanso entre as séries
- 4 – Búlgaro na máquina articulada ou similar
- 3 séries de 10-12RM
- 2 séries de 6-8 RM
- 5 – Abdução na máquina quadril em 45°
- 5 séries de 8-12RM
- 1,5 minutos de descanso entre as séries
- 6 – Panturrilha em pé
- Método ondulatório
- 1 série acima de 15 repetições pausa de 2 minutos, 1 série abaixo de 6 repetições, pausa de 2 minutos, completar 4 séries acima de 15 reps e 4 séries abaixo de 6 reps.
- 2 minutos de descanso entre as séries

TRENO DE POSTERIORES – C

- 1 – Flexora deitada, Conocêntrica de 1-2 s e excêntrica de 3s.
- 1 série de 20RM
- 1 série de 20RM
- 1 série de 15RM
- 1 série de 10RM
- 1 série de 8RM
- 1,5 minutos de descanso entre as séries
- 2 – Siff na polia baixa com dois steps
- 1 série de 10-20RM
- 1 série de 10-12RM
- 1 série de 8-10 RM
- 1 série de 4-6 RM
- 1,5 minutos de descanso entre as séries
- 3 – Flexora sentada
- Método FST 7
- 7 séries de 8-12RM, pausa de 30-45 s entre as séries. Manter os posteriores e glúteos alongados entre as séries nos últimos 20 s
- 4 – Flexão nórdica
- 6 séries de 8-10RM
- 1,5 minutos de descanso entre as séries
- 5 – Apinhamento: sumô no smith sempre com as pausas de 5 s em cada repetição.
- 1 série de 10-12RM
- 1 série de 8-10 RM
- 1 série de 4-6 RM
- 1 série de 1-3 RM
- 2 minutos de descanso entre as séries
- 6 – Abdução com quadril em 45°
- 5 séries de 10-15RM
- 1,5 minutos de descanso entre as séries
- 7 – Panturrilha no leg
- Método FST 7
- 7 séries de 8-12RM, pausa de 30-45 s entre as séries. Manter a panturrilha alongada na parte estrada do movimento nos últimos 20 s da pausa entre as séries.
- Variar posição dos pés, aberto, fechado e neutro em cada série
- 8 – Panturrilha em pé
- 1 série de 20-30RM
- 1 série de 10-20RM
- 1 série de 8-12 RM
- 1,5 minutos de descanso entre as séries. Variar posição dos pés, aberto, fechado e neutro em cada série

TRENO DE POSTERIORES – C

- 1 – Siff barra livre
- 2 séries de 10-12 reps sem falha
- 1 série de 10-12RM
- 2 séries de 8-10 RM
- 1 série de 4-6RM
- 2-3 minutos de descanso entre as séries
- 2 – Flexora deitada
- Método ondulatório
- 1 série acima de 15 repetições pausa de 2 minutos, 1 série abaixo de 6 repetições, pausa de 2 minutos, completar 4 séries acima de 15 reps e 4 séries abaixo de 6 reps
- 2 minutos de descanso entre as séries
- 3 – Flexora sentada
- 4 séries de 8-12RM
- 1,5 minutos de descanso entre as séries
- 4 – Banco romano com os joelhos flexionados no smith
- 4 séries sem contar repetições
- 1,5 minutos entre as séries
- 5 – Abdução quadril tronco inclinado 10°
- 6 séries de 8-12RM
- 1,5 minutos de descanso entre as séries
- 6 – Abdução em pé na polia baixa com rotação externa do pé
- 2 séries de 10-12RM
- 2 séries de 8-10 RM
- 2-3 minutos de descanso entre as séries
- 7 – Panturrilha no leg.
- 2 séries de 10-12RM
- 2 séries de 8-10 RM
- 2 séries de 4-6 RM
- 1,5 minutos de descanso entre as séries
- Variar posição dos pés, aberto, fechado e neutro em cada série

**OBRIGADO!!!****E-mail: jonatop@gmail.com**