PRINCÍPIOS DO TREINAMENTO E PERIODIZAÇÃO APLICADO AO TREINAMENTO DE FORÇA

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TREINAMENTO DESPORTIVO

Segundo Matveiev (1972):

" Preparo físico, técnico-tático, psíquico e moral do praticante através de exercícios físicos"

Segundo Carl (1989):

" Processo ativo complexo regular planificado e orientado para a melhoria do aproveitamento e desempenho desportivos"

<u>PRINCÍPIOS BIOLÓGICOS</u>

<u>Princípio da unidade funcional</u> (Manso e colegas, 1996)

Aplicar os distintos métodos de treinamento, a partir do princípio que o organismo funciona como um todo.

<u>Princípio da multilateralidade</u> (Manso e colegas, 1996)

Treinamento que engloba muitos fatores (condutas motoras, qualidade de movimento, disposição maior para assimilar técnicas mais complexas).

Princípio da individualidade

(Manso e colegas, 1996)

Cada sujeito deve ser visto como um todo. Deve-se observar: aspectos funcionais, motores, psicológicos de adaptação ...
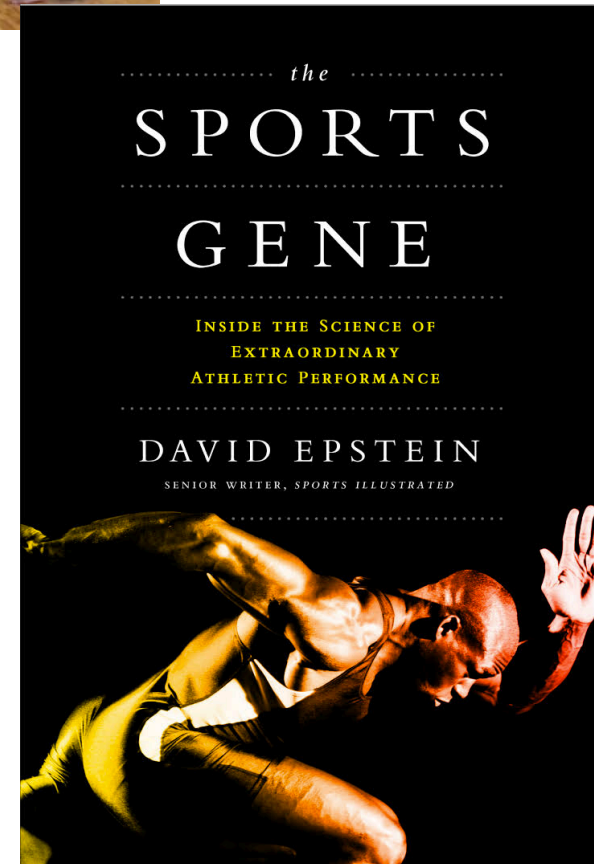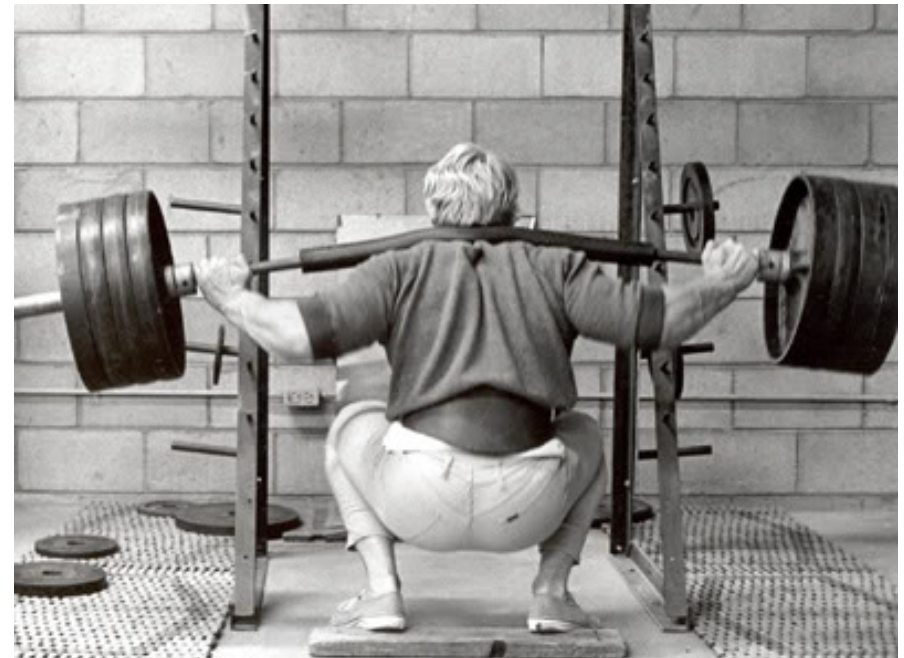
Princípio da sobrecarga

(Manso e colegas, 1996)

Estímulo suficiente para que haja uma resposta de adaptação desejada, sem produzir resposta indevida.
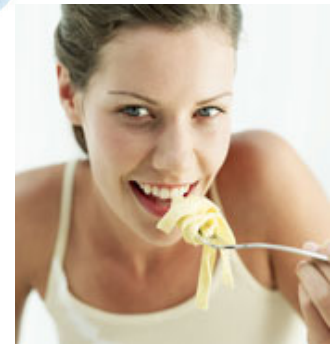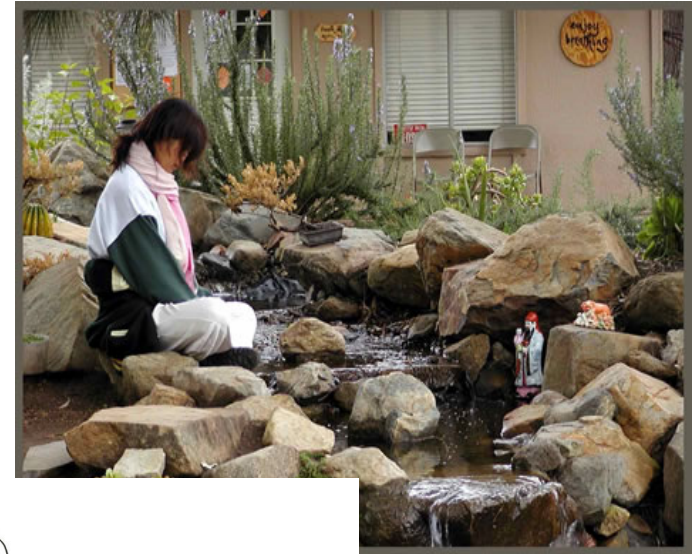
Necessidade de ajuste da carga periodicamente.

Princípio da recuperação

(Manso e colegas, 1996)

Período onde há a um descanso e recuperação, para que o praticante possa ter uma evolução.

Princípio da supercompensação

(Manso e colegas, 1996)

Resposta ao treinamento onde há alterações tanto estruturais como funcionais, que correspondem ao nível de recuperação com inclusão de melhora.
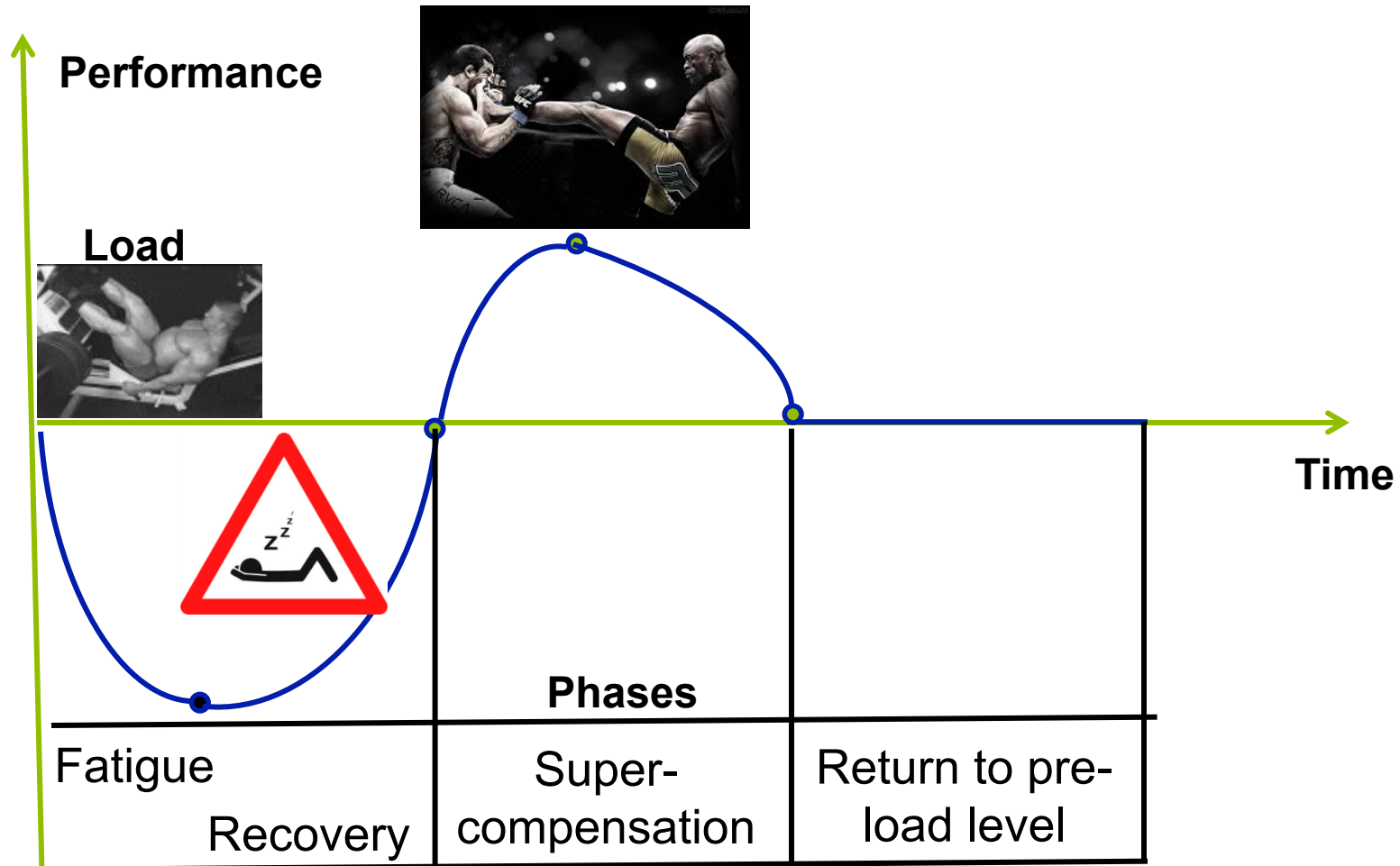
Model of supercompensation single load

Performance

Load

Time

Phases

| Fatigue Recovery | Super-compensation | Return to pre-load level |

Adapted from Yakolev (1955)
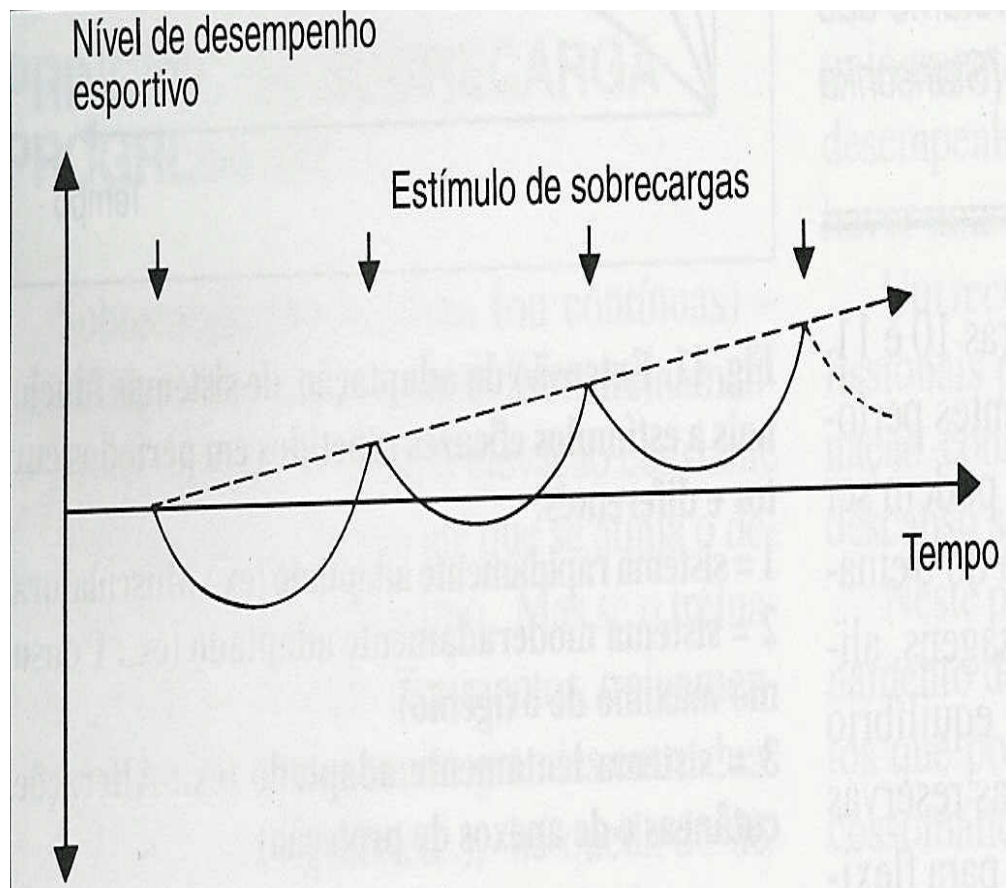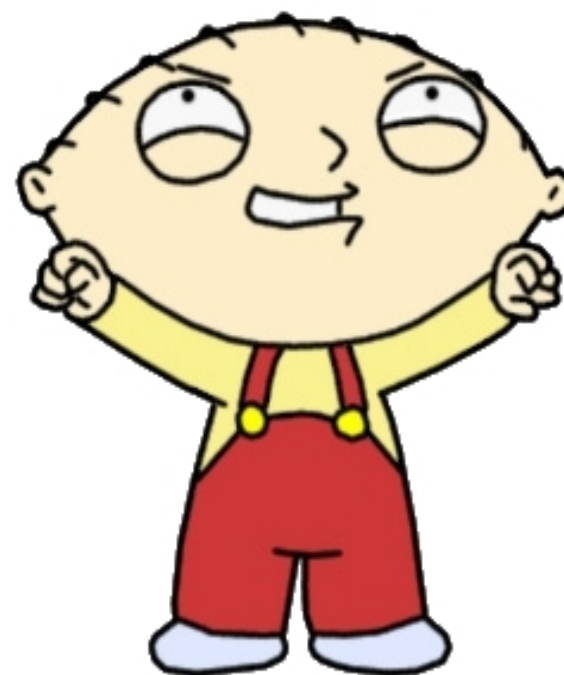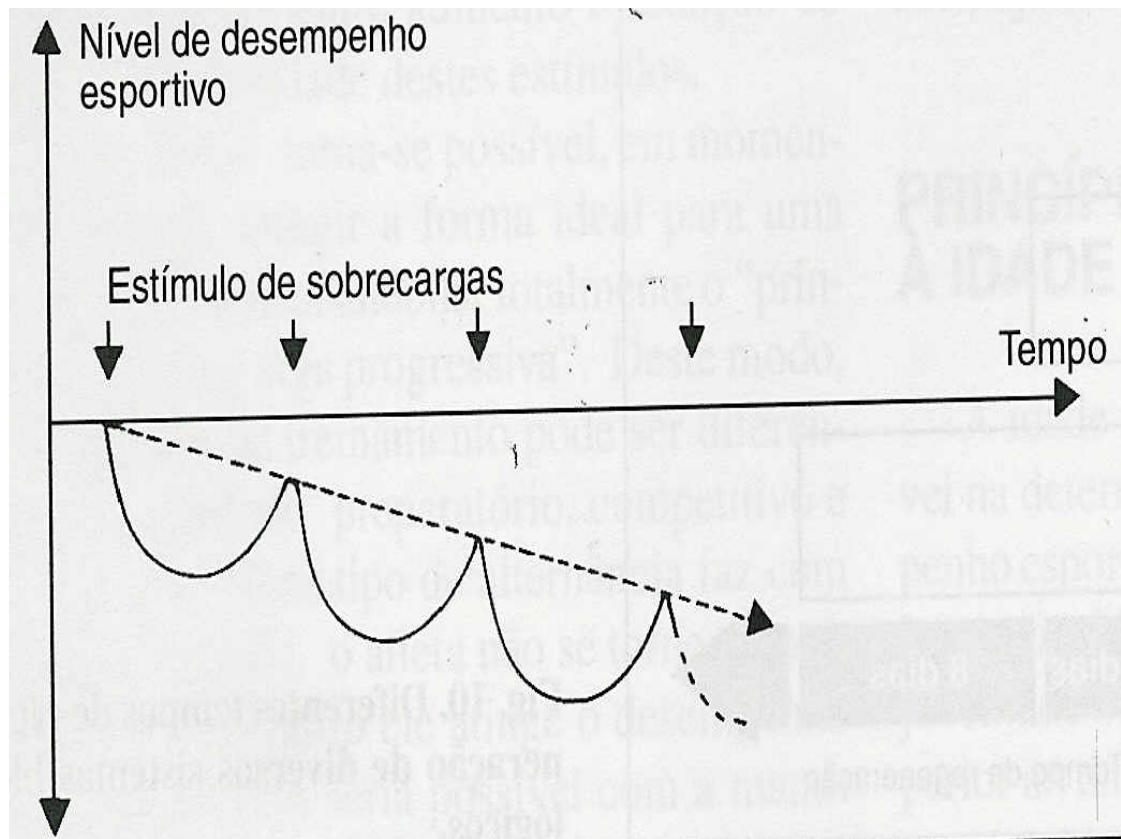
Overtraining

Overtraining

Acúmulo de treinamento ou não, resultando na diminuição da performance em um curto espaço de tempo com ou sem relato de sinais fisiológicos ou psicológicos, onde a restauração da performance pode levar **semanas ou até meses** (Kreider et al., 1998)**.**

Overreaching, os mesmos sinais, porém a recuperação leva dias.

Sinais e sintomas (Kreider et al., 1998).

- Diminuição da performance;
- Diminuição da força muscular;
- Perda da coordenação;
- Comportamento da P.A. e F.C. durante o repouso, atividade e na recuperação;
- Aumento da freqüência respiratória;
- Aumento do metabolismo basal;
- Fadiga crônica;
- Insônia;
- Anorexia nervosa;
- Bulemia;

Sinais e sintomas (Kreider et al., 1998).

- Amenorréia;
- Dores de cabeça;
- Lesões musculares;
- Depressão;
- Instabilidade emocional;
- Dificuldade de concentração no trabalho e treino;
- Medo das competições;
- Aumento na susceptibilidade de doenças;
- Balanço nitrogenado negativo.

Fig. 8. Efeito da eficácia somada.
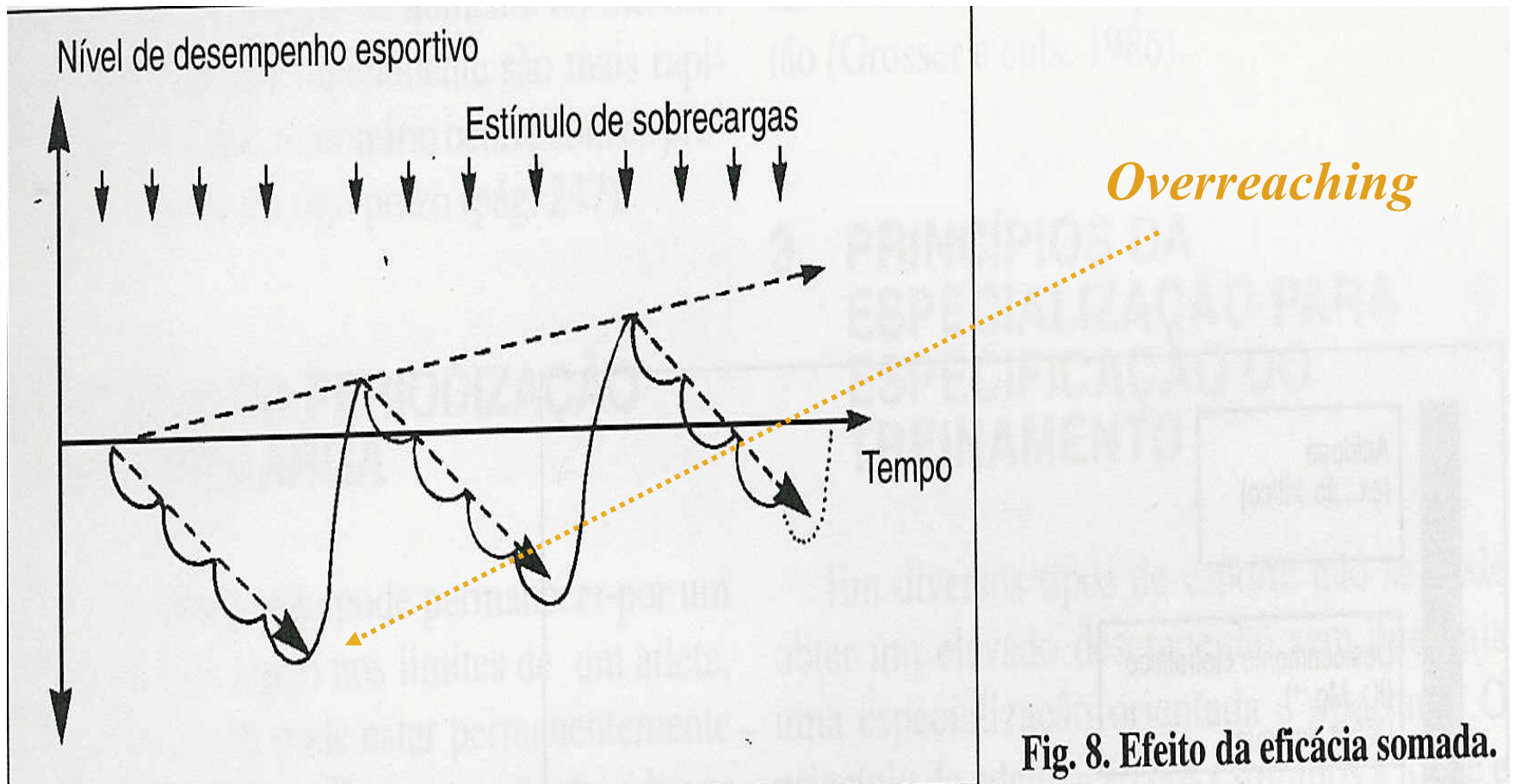
Princípio da continuidade (Manso e colegas, 1996)

Esse princípio está ligado a periodização.
Deve haver a continuidade de uma carga,
tanto no aspecto geral quanto específico.

Princípio da progressão (Manso e colegas, 1996)

Define-se como o aumento gradual das cargas
de treinamento (aumentar volume ou
intensidade)

Destreinamento

(Bompa, 2002)

Caso não haja estímulos intensivos de treinamento. Existem razões como: doenças, lesões...

A perda das capacidades acontece desde semanas a meses, perda total após 2 meses. Distúrbios funcionais: dores de cabeça, isônia, exaustão, falta de apetite e depressão.

Princípio da especificidade

(Manso e colegas, 1996)

Realizar o treinamento em condições específicas do desporto.
- Movimento, capacidades envolvidas, local, clima e temperatura, implementos, aspectos psicológicos...
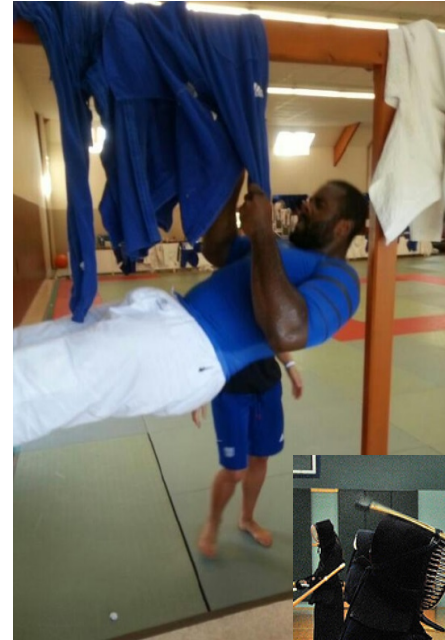
Resistance training muscular adaptations

Resistance training muscular adaptations

- **Strength;**
- **Hypertrophy;**
- **Power;**
- **Local endurance.**

Muscular strength

Maximum voluntary contraction and is also termed peak isometric force.

97-year-old woman

http://www.womenshealthmag.com/fitness/97-year-old-woman-doing-squats

Ratamess et al. (2009) Progression Models in Resistance Training or Healthy. MSSE

Muscle hypertrophy

Increase in the net accretion of the contractile proteins actin and myosin as well as other structural proteins.

Ratamess et al. (2009) Progression Models in Resistance Training or Healthy. MSSE
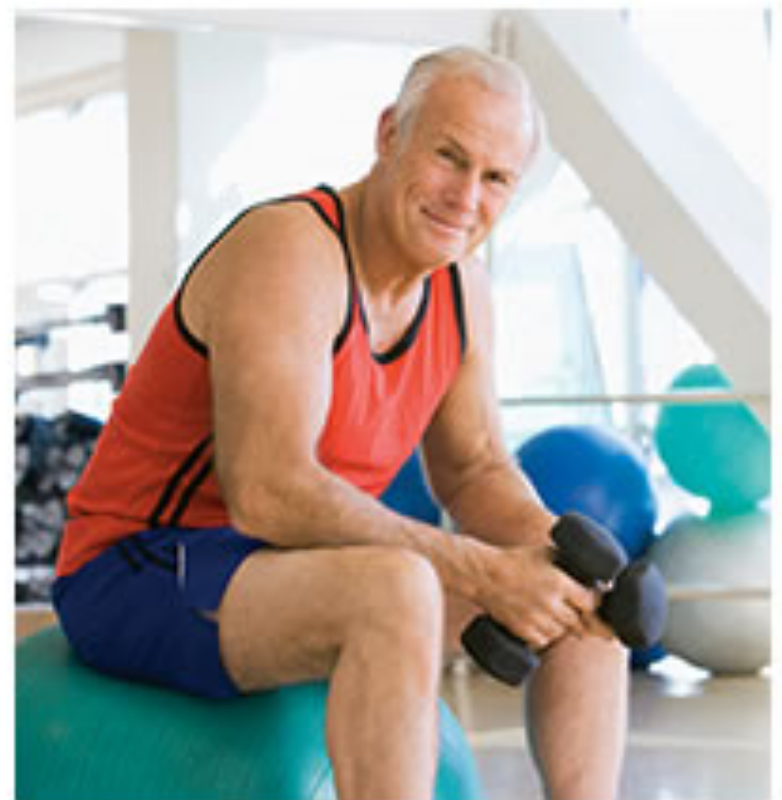
Muscle power (Power = force x velocity)

Muscular power is the scalar product of force generation and movement velocity, is demonstrated as the highest power output attainable during a given movement/repetition,
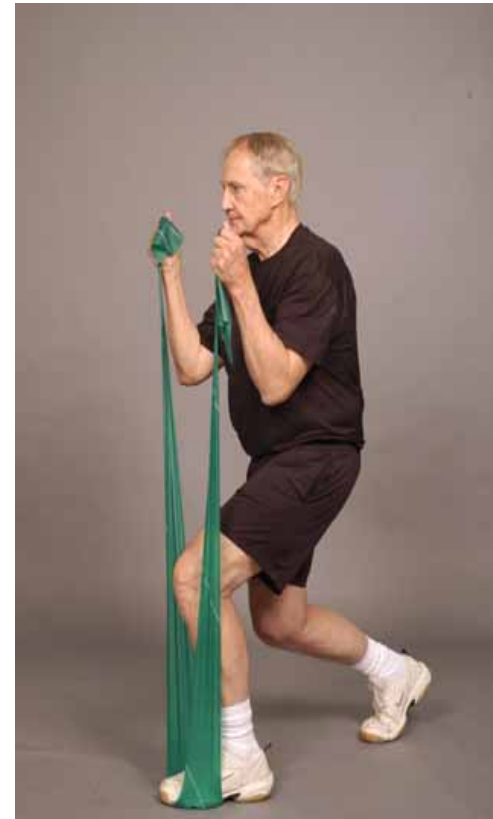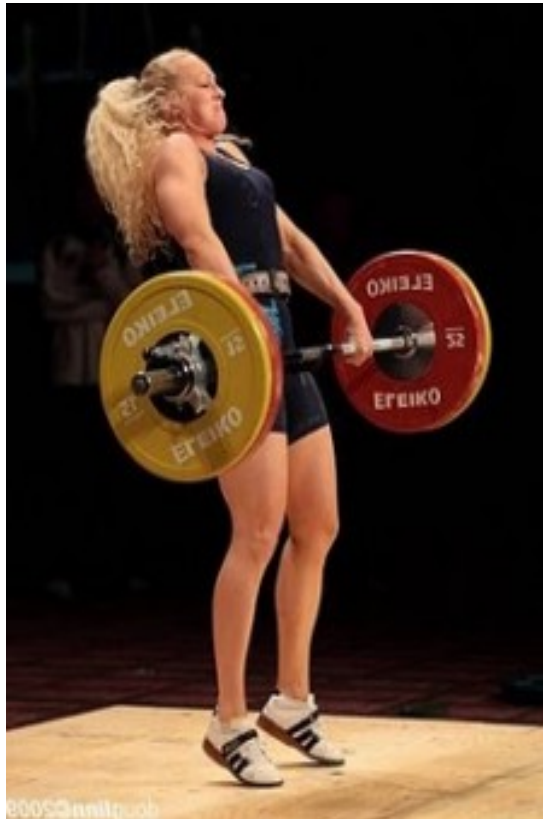
Local muscular endurance

It is the ability of a muscle or group of muscles to sustain repeated contractions against a resistance for an extended period of time.

Ratamess et al. (2009) Progression Models in Resistance Training or Healthy. MSSE

RT acute variables

- The proper manipulation of program variables can help to improve muscular fitness, health and sports performance;
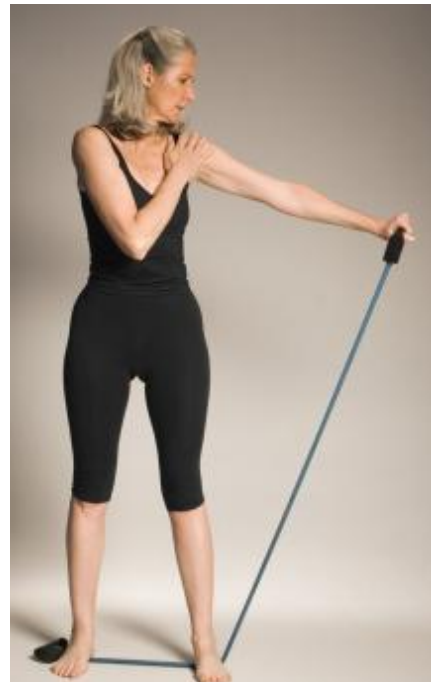
Ratamess et al. (2009) Progression Models in Resistance Training or Healthy. MSSE

RT in health and fitness program

- Increase strength and power;

- Increase muscle mass;

- Improves cardiovascular function;

- Promotes better glycemic control;

- Prevents osteoporosis;

- Promotes weight loss and maintenance;

- Improves dynamic stability and preserves functional capacity;

- Prevents injuries;

- Promote psychological well-being.

Ratamess et al. (2009) Progression Models in Resistance Training or Healthy. MSSE

Manipulating Resistance Training Program Variables to Optimize Maximum Strength in Men: A Review

Journal of Strength and Conditioning Research, 1999, 13(3), 289–304

BENEDICT TAN

Sports Medicine and Research Centre, Singapore Sports Council, 15 Stadium Road, National Stadium, Singapore 397718.

Sports Med 2005; 35 (10): 841-851

Designing Resistance Training Programmes to Enhance Muscular Fitness

A Review of the Acute Programme Variables

Stephen P. Bird, Kyle M. Tarpenning and *Frank E. Marino*

School of Human Movement Studies, Charles Sturt University, Bathurst, New South Wales, Australia

Med. Sci. Sports Exerc., Vol. 36, No. 4, pp. 674–688, 2004.

Fundamentals of Resistance Training: Progression and Exercise Prescription

WILLIAM J. KRAEMER[1] and NICHOLAS A. RATAMESS[2]

[1]*Human Performance Laboratory, Department of Kinesiology, University of Connecticut, Storrs, CT;* and [2]*Department of Health and Exercise Science, The College of New Jersey, Ewing, NJ*

AMERICAN COLLEGE of SPORTS MEDICINE

Progression Models in Resistance Training for Healthy Adults

POSITION STAND

This pronouncement was written for the American College of Sports Medicine by Nicholas A. Ratamess, Ph.D.; Brent A. Alvar, Ph.D.; Tammy K. Evetoch, Ph.D., FACSM; Terry J. Housh, Ph.D., FACSM (Chair); W. Ben Kibler, M.D., FACSM; William J. Kraemer,

MEDICINE & SCIENCE IN SPORTS & EXERCISE (2009)

BASIC PRINCIPLES OF PROGRESSION

• For improvements to occur, the program used must be systematically altered so that the human body is "forced" to adapt to the changing stimuli (Kraemer and Ratamess, 2003).

• Three general principles of progression are:

1) Progressive overload;

2) Variation;

3) Specificity (Kraemer and Ratamess, 2003).

BASIC PRINCIPLES OF PROGRESSION

1. Load:

1. **Load (resistance)** may be increased,

2. **Repetitions** may be added to the current load,

3. **Repetition speed** with submaximal loads may be altered according to goals,

4. **Rest periods** may be shortened for local muscular endurance improvements or lengthened for strength and power training,

5. **Volume** may be increased within reasonable limits;

6. **Any combination of the above.**

BASIC PRINCIPLES OF PROGRESSION

2) Variation (Kraemer and Ratamess, 2003).

• Theory (*general adaptation syndrome*) proposes that the body adapts via three phases when confronted with stress:

1) Shock,

2) Adaptation,

3) Staleness (performance plateau is encountered) (Kraemer and Ratamess, 2003).

• Variation is necessary for long-term resistance training progression;

BASIC PRINCIPLES OF PROGRESSION

• Muscular strength (over periods from 4 wk to 2 yr) increases approximately(Kraemer and Ratamess, 2003):

✓ 40% - "untrained,"

✓20% - "moderately trained,"

✓16% - "trained,"

✓10% - "advanced,"

✓2% - "elite".

General-to-Specific Model

Specific →

Elite Athletes

Advanced

Trained

Intermediate

Novice

Non-Specific

FIGURE 1—General-to-specific model of resistance training progression.
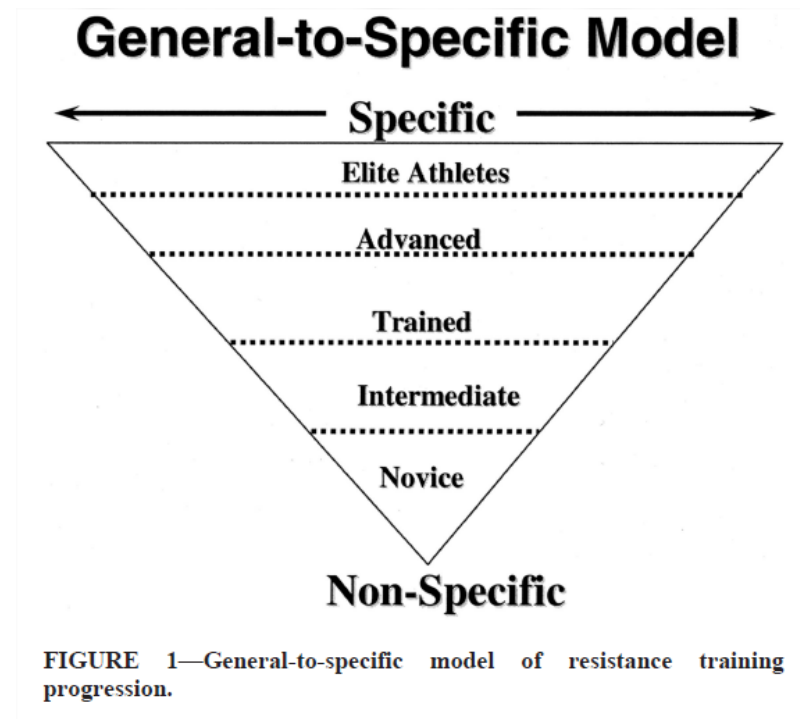
BASIC PRINCIPLES OF PROGRESSION

2) Variation

• It has been shown that systematically varying **volume** and **intensity** is most effective for long-term progression (Kraemer and Ratamess, 2003).

• Variation, or periodization allow for the training stimulus to remain challenging and effective (Ratamess et al. 2009);

BASIC PRINCIPLES OF PROGRESSION

3) Specificity (Kraemer and Ratamess, 2003).

All training adaptations are specific to the stimulus applied. The physiological adaptations to training are specific to the

1) Muscle actions involved;

2) Speed of movement;

3) Range of motion;

4) Muscle groups trained;

5) Energy systems involved;

6) Intensity and volume of training..

Variables of resistance training

1. Intensity

- It is the load or resistance used;
- Relative intensity is the percentage of the 1Repetition Maximum (**1RM**) test (Tan, 1999; Bird et al. 2005);

	Table 1		
Basic overview of threshold number of sets, intensity of the exercise, and frequency of training for gains in strength of different training levels constructed from data by Peterson et al. (2005)			
Training level	**Intensity (% of 1 repetition maximum)**	**Number of sets per muscle group**	**Minimum frequency**
Untrained	50–75%	3	1–3
Trained	75–85%	4–5	2–3
Athletes	80–85%	6–8	3

Kraemer et al. 2015 (SCJ)

1. Intensity

- The training load can be determined by either **RM** (i.e. the greatest amount of weight lifted with correct technique for a specified number of repetitions);

- To enhance maximum strength, it is important that all sets be maximal to ensure that a high level of neural activation or drive is used to stimulate the muscles (Tan, 1999);

1. Intensity

- It is recommended that training load is increased by 2–10% when the individual can perform the current load for one to two repetitions over the desired number repetitions or some percentage of the one repetition maximum (1RM) (Bird et al. 2005);

Session RPE, Internal load

A New Approach to Monitoring Resistance Training

Michael R.McGuigan,PhD; Carl Foster,PhD

Strength and Conditioning Journal

Volume 26, Number 6, pages 42–47December 2004.

Internal load (IL)=
Sets x Reps x session RPE

e.g.:

Session 1: 10 sets x 10 reps x 5 (RPE)

IL = 500 AU (arbitrary unit).

UCHIDA, Marco C. et al. Does the timing of measurement alter session-RPE in boxers?. Journal of sports science & medicine, v. 13, n. 1, p. 59, 2014.

Table 1
Modification of the category ratio rating of perceived exertion (RPE) scale. The athlete is shown the scale approximately 30 minutes after the conclusion of the training bout and asked "How was your workout?"

Rating	Descriptor
0	Rest
1	Very, Very Easy
2	Easy
3	Moderate
4	Somewhat Hard
5	Hard
6	–
7	Very Hard
8	–
9	–
10	Maximal

Applications of Monitoring session-RPE:

- Monitor Periodisation & Feedback on Training

- Coach *vs.* Athletes Perception

- Weekly periodisation reports

- Annual periodisation

- Loads on players not in main squads (i.e. injured players return)

- Coach *vs.* Athletes Perception

- Fatigued players…

Research article

Does The Timing of Measurement Alter Session-RPE in Boxers?

Marco C. Uchida [1]✉, **Luis F. M. Teixeira** [2], **Vladmir J. Godoi** [3], **Paulo H. Marchetti** [4.8], **Marcelo Conte** [3,5], **Aaron J. Coutts** [6] **and Reury F. P. Bacurau** [7]

[1] Faculty of Physical Education, State University of Campinas, Campinas, Brazil; [2] Faculty of Physical Education - UNIFIEO, Osasco, Brazil; [3] Faculty of Physical Education, Anhanguera Educational, Sorocaba, Brazil; [4] Methodist University of Piracicaba, Piracicaba, Brazil; [5] School of Physical Education of Jundiaí, Jundiaí, Brazil; [6] Faculty of Health, University of Technology Sydney, Sydney, Australia; [7] School of Arts, Sciences and Humanities, University of São Paulo, São Paulo, Brazil; [8] Faculty of Physical Education, YMCA, Sorocaba, Brazil

Table 3. Session-RPE (10 minutes and 30 minutes), Session-RPE load, TRIMP during the training intensities (Easy, Moderate and Hard) and effect size between 10 minutes and 30 minutes. Data are means (± standard deviation).

		Training Intensity		
		Easy	**Moderate**	**Hard**
Session-RPE (AU)	10 minutes	1.3 (1.0)	2.7 (1.6)	5.7 (1.0) *
	30 minutes	1.7 (1.0)	2.5 (0.9)	5.8 (1.9) * †
	Effect Size	.39	- .15	.06
Session-RPE Load (AU)	10 minutes	61.8 (47.7)	118.1 (67.7)	258.7 (46.5) *†
	30 minutes	78.7 (46.5)	112.5 (41.6)	264.3 (88.1) *†
	Effect Size	.35	- .09	.07
TRIMP (AU)	10 minutes	35.8 (12.4)	79.4 (29.6)	151.6 (21.6) *
	30 minutes	38.2 (12.7)	76.9 (11.6)	123.6 (28.9) *
	Effect Size	.19	.02	- 1.09

RPE = Rating of Perceived Exertion; AU = Arbitrary Unit. Effect Size between 10 minutes and 30 minutes.
* Different from Easy training intensity ($p < 0.05$). † Different from Moderate training intensity ($p < 0.05$)

Example: 2 time/week, load distribuition (all muscle groups/session)
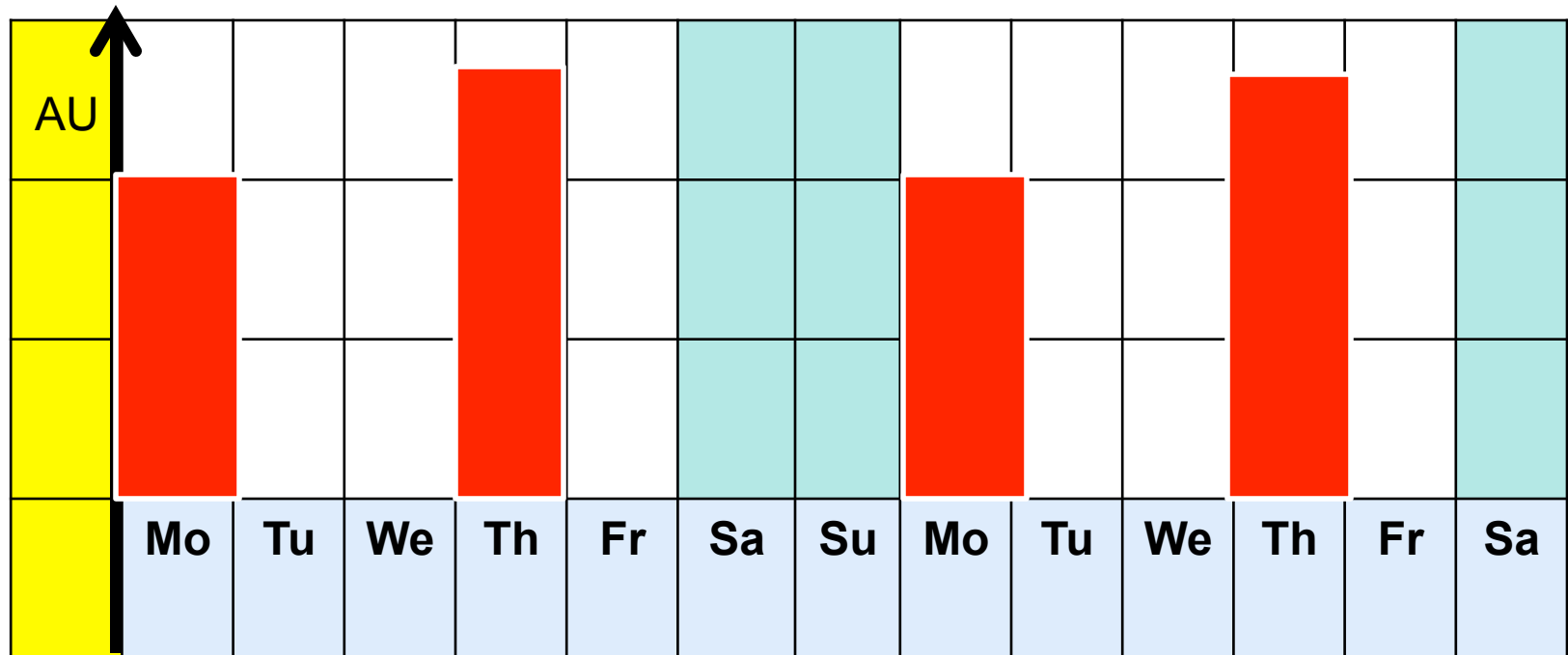
Clinical Study

The Use of Session RPE to Monitor the Intensity of Weight Training in Older Women: Acute Responses to Eccentric, Concentric, and Dynamic Exercises

Sandro S. Ferreira,[1] Kleverton Krinski,[2] Ragami C. Alves,[1] Mariana L. Benites,[1] Paulo E. Redkva,[1] Hassan M. Elsangedy,[3] Cosme F. Buzzachera,[4] Tácito P. Souza-Junior,[1] and Sergio G. da Silva[1]

[1] *Department of Physical Education, Federal University of Parana, Caixa Postal 92, JD Botânico, 80215-370 Curitiba, PR, Brazil*
[2] *Federal University of Sao Francisco Valley, 56304205 Petrolina, PE, Brazil*
[3] *Center for Health Sciences, Federal University of Rio Grande do Norte, Caixa Postal 3000, Lagoa Nova, 59078970 Natal, RN, Brazil*
[4] *University Norte of Parana, Caixa Postal 675, JD Piza, 86041-100 Londrina, PR, Brazil*

Correspondence should be addressed to Sergio G. da Silva; sergiogregorio@ufpr.br

Novidades do nosso grupo

ALTERNATIVAS:

- **Técnica do movimento;**
- **Velocidade da execução;**
- **Expressão facial.**

Prof. Renato Carvalho
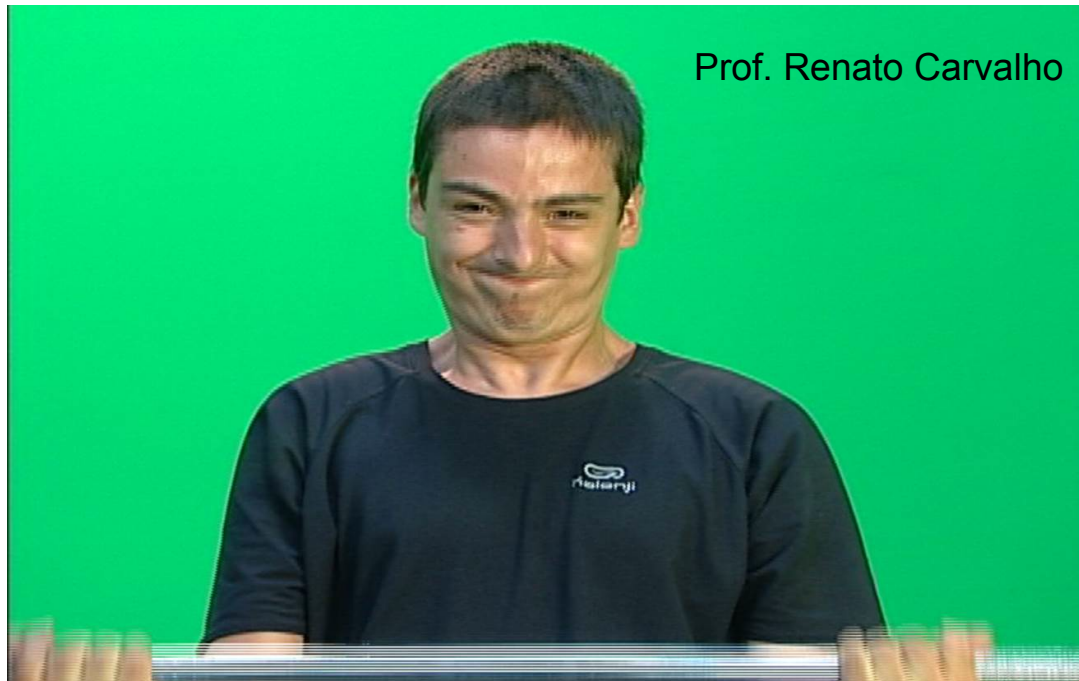
Expressão facial e diferentes intensidades
(dados não publicados, mas já submetido a uma revista)

- Exercício rosca direta;
- 2 intensidades
- 50 e 85%1-RM;
- Execução até a fadiga;
- Avaliações:
- EMG – músculos Zigomático maior e Epicranio maior;
- *Facial Action Coding System* (Ekman, Freisen and Ancoli, 2001).

2. Volume

- Several systems including the nervous, metabolic, hormonal, and muscular have been shown to be sensitive to training volume (Kraemer and Ratamess, 2003; Ratamess et al. 2009);

- Total repetitions and volume load are simple estimations for training volume that are used more commonly (Tan, 1999; Bird et al. 2005);

  - a) Total repetitions = sets X repetitions;
  - b) Volume load = sets x repetitions x weight used;

  It is recommended that one to three sets per exercise be used by novice individuals (Ratamess et al. 2009).

3. Rest interval between sets

- Rest interval length is dependent upon training intensity, goals, fitness level, and targeted energy system utilization (Kraemer and Ratamess, 2003);

- The amount of rest between sets and exercises significantly affects physiological responses;

- And performance of subsequent sets and training adaptations. (Kraemer and Ratamess, 2003).

3. Rest interval between sets

- The rest period length not only determines how much of the ATP-CP (full recovery, 3-5 minutes) is recovered but also how high lactate concentrations increase in blood (Bird et al. 2005);

- Bodybuilders use very short interset recovery periods of 30–60 sec (Tan, 1999);

- Powerlifters and weightlifters tend to use longer intervals, 2–5 minutes (Tan, 1999);

- Rest period length is strongly related to the load lifted (Bird et al. 2005);

4. Muscle actions

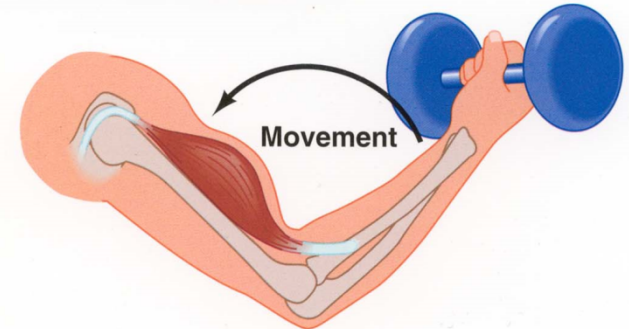Most RT programs primarily include **dynamic repetitions** (Tan, 1999; Ratamess et al. 2009):

• Concentric (CON; muscle shortening);

• Eccentric (ECC; muscle lengthening) muscle actions;

Static:

• Isometric (ISOM; no net change in muscle length).

Concentric contraction

Movement

Eccentric contraction

Movement

(c)

No movement
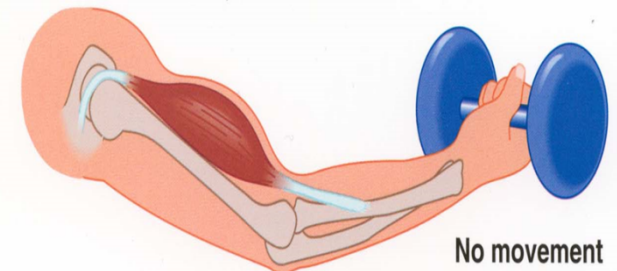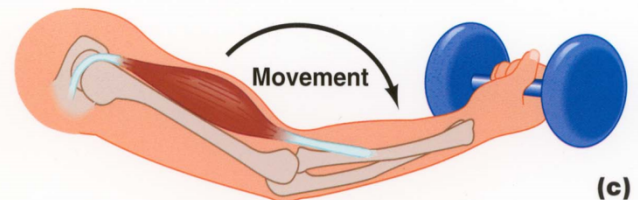
Concentric

Concentric

Eccentric

Eccentric

4. Muscle actions

- ECC actions, greater force per unit of muscle size is produced during. Eccentric actions involve less motor unit activation per specific level of tension, require less energy per level of force; (Kraemer and Ratamess, 2003; Ratamess et al. 2009)

- Certain ISOM actions have been recommended for promoting low back health and have been demonstrated effective for the selective recruitment of postural, spinal-stabilization musculature;

5. Speed of the muscle contraction

• The velocity (i.e., cadence) affects the neural, hypertrophic, and metabolic responses to resistance exercise (Kraemer and Ratamess, 2003).

• High speed of contraction will necessitate a higher degree of motor unit recruitment;

• Loading may be moderate to heavy, the intent to lift the weight as fast as possible has been shown to be critical for maximizing strength increases (Tan, 1999; Ratamess et al. 2009);

• This technique requires the individual to accelerate the load maximally throughout the range of motion during the CON action to maximize bar velocity;

5. Speed of the muscle contraction

- Unintentional slow velocities are used during high-intensity. The individual exerts maximal force but due to the heavy loading or onset of fatigue, the resultant velocity is slow (Kraemer and Ratamess, 2003);

- Significant reductions in force production are observed when the intent is to perform the repetition slowly. It suggests that motor unit activity may be limited when intentionally contracting at a slow velocity.

5. Speed of the muscle contraction

- Hypertrophy response depends not only on the intensity of the exercise but also on the length of time that the muscles is under tension (Bird et al. 2005);

- Suggestion for hypertrophy cadence – 2 sec CON; 1 sec pause; 4 sec ECC) (Westcott et al);

6. Type of the exercise

- Two general types of **free weight or machine; and single- and/or multiple-joint** (Tan, 1999, Bird et al. 2005);

- **Weight machines**:

- Safer to use, easy to learn, help stabilize the body and limit movement about specific joints (Ratamess et al. 2009);

- They have demonstrated less neural activation when matched for intensity for most comparisons to freeweight exercises (Ratamess et al. 2009);

6. Type of the exercise

- **Free weights**:

- Free weights may result in a pattern of intra- and intermuscular coordination that mimics the movement requirements of a specific task (Ratamess et al. 2009);

- For novice to intermediate training, it is recommended that machine and free-weight exercises are included (Ratamess et al. 2009);

6. Type of the exercise

- **Single joint exercises** have typically been used to target specific muscle groups and are thought to pose less risk of injury due to the reduced level of skill and technique involved (Tan, 1999, Bird et al. 2005);

- **Multiple-joint exercises** involve a more complex neural activation and coordination, and due to the larger muscle mass involvement (Tan, 1999, Bird et al. 2005);

- Another way to vary exercise selection is to include unilateral as well as bilateral exercises (Ratamess et al. 2009).

7. Order of exercises

- Perform **large muscle group** exercises <u>before</u> **small muscle group** exercises;
- Perform **multiple-joint** exercises before **single-joint exercises**;
- **Pre exaustion** method (first single then after multiple joint);

1st Exercise

2nd Exercise
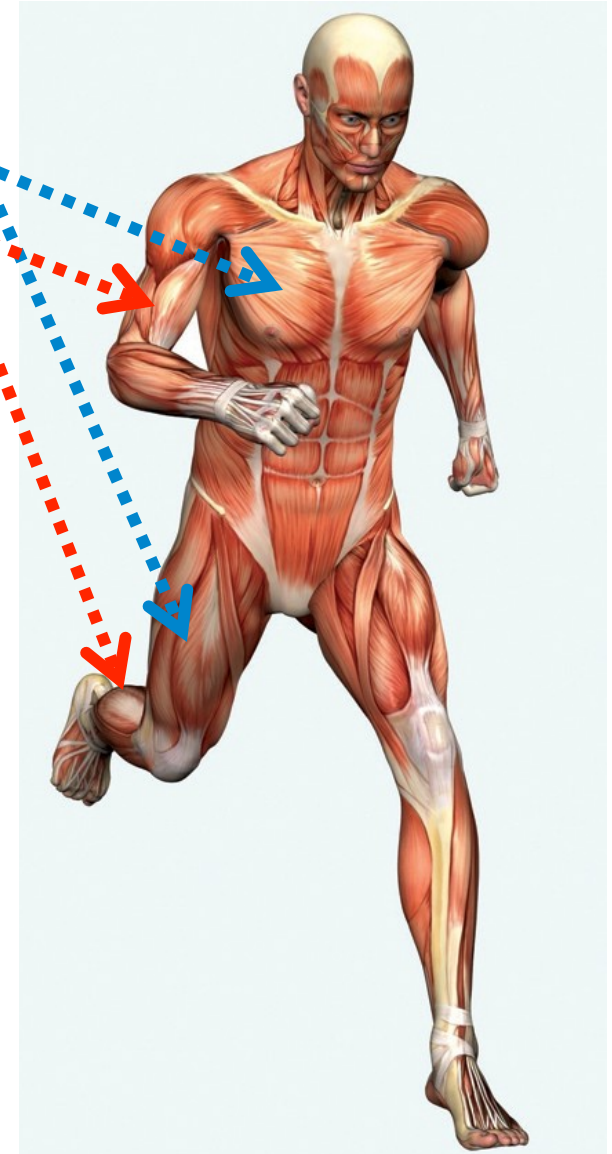
7. Order of exercises

- From **most to least complex** (e.g. before basic exercises such as the squat or bench press);

- Before **perform power or higher-intensity**;

- **Rotate upper** and **lower body** exercises or opposing (**agonist-antagonist relationship**) exercises (Kraemer and Ratamess, 2003).

8. Frequency (sessions/week)

- Frequency, number of times certain exercises or muscle groups are trained per week (Kraemer and Ratamess, 2003);

- Physiological changes after a single bout of exercise return to baseline levels after a certain time (Kraemer and Ratamess, 2003).

- Muscle groups split routines during a workout are common (Kraemer and Ratamess, 2003);

8. Frequency (sessions/week)

- Two days/week training frequency allows more time for recuperation, is less time consuming and therefore my enhance adherence (Bird et al., 2005);

- Each major muscle group may be trained

2 to 3 x/wk despite the large number of workouts (Kraemer and Ratamess, 2003);

- The 1–2 sessions per week were sufficient for maintaining strength gains (Tan, 1999; Kraemer and Ratamess, 2003).

Bird et al. (2005)
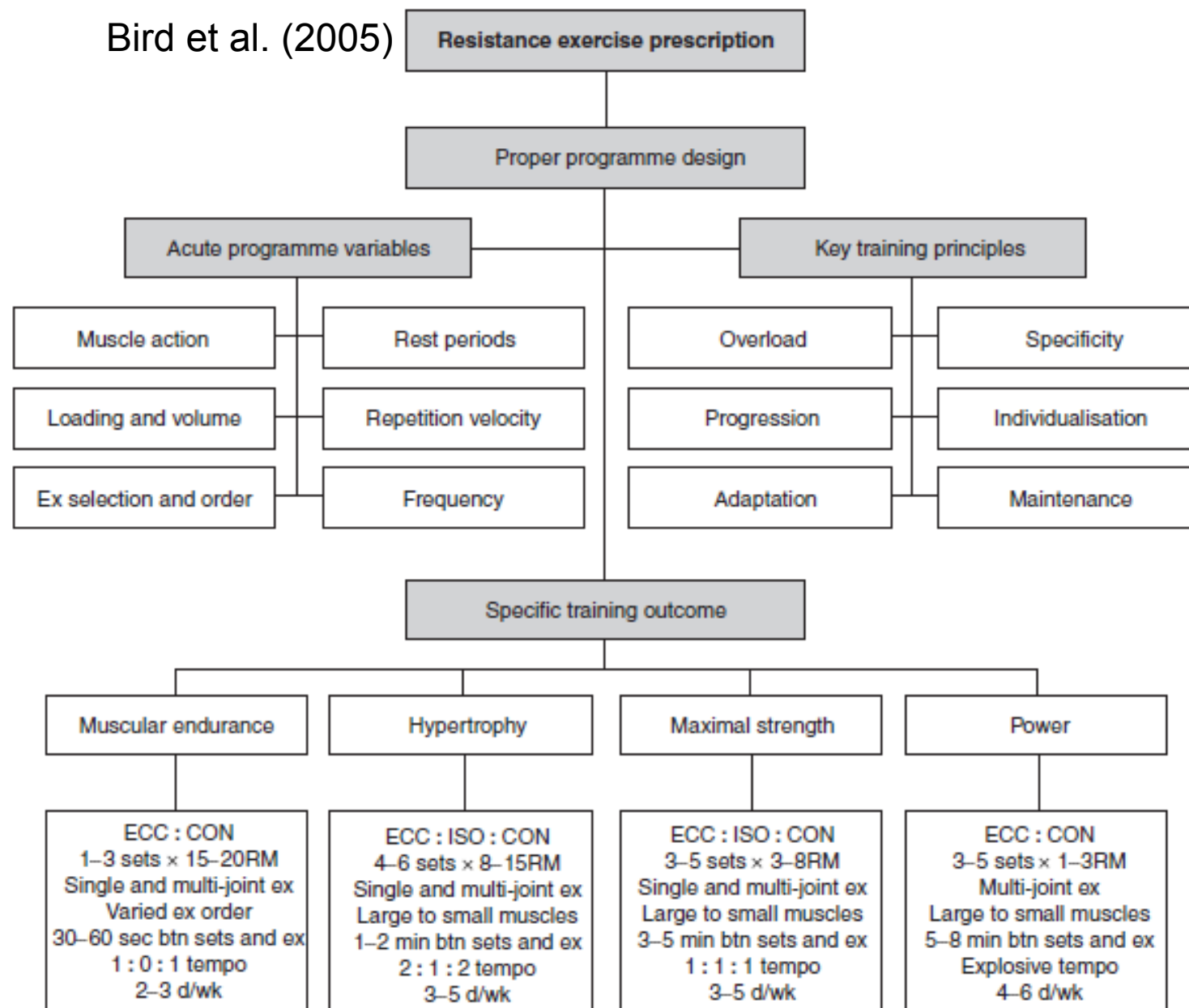
Fig. 1. Proper programme design of resistance exercise for specific training outcomes incorporates the acute programme variables and key training principles.[2,4,11] **btn** = between; **CON** = concentric; **ECC** = eccentric; **ex** = exercise; **ISO** = isometric; **RM** = repetition maximum.

Trainable Characteristics

Objective	Loading and Volume (%1RM, RM, Sets)	Rest Periods	Frequency (days/week)	Repetition Velocity (sec) (Conc:Ecc)
Muscular Endurance	30-50%1RM 15–25 reps or more * Min.1 set (muscle group)	1 to 2 min	2d to 3 d (muscle group split routines) min. interval 24h	Slow to Moderate (1–2: 1-2)
Muscular Hypertrophy	70-85%1RM 12RM to 6RM * Min.3 sets (muscle group)	30 sec to 2 min	2d (muscle group split routines) min. interval 48h	Slow to Moderate (1–2: 1-2)

Adapted from Ratamess et al. (2009) Progression Models in Resistance Training or Healthy. MSSE

Example: Resistance Training
Aim: muscular endurance

Exercise	Sets	Reps
Bench press	1 to 2	15 to 20
Leg Press	1 to 2	15 to 20
Seated row	1 to 2	15 to 20
Lateral raise	1 to 2	15 to 20
Standing calf raise	1 to 2	15 to 20
Arm curl	1 to 2	15 to 20
Back extension	1 to 2	15 to 20
Triceps extension	1 to 2	15 to 20
Abdominal (crunch)	1 to 2	15 to 20

Example: Resistance Training
Aim: muscular hypertrophy and strength

Exercise	Sets	Reps
Bench press	2 to 3	8 to 12
Leg Press	2 to 3	8 to 12
Seated row	2 to 3	8 to 12
Lateral raise	2 to 3	8 to 12
Standing calf raise	2 to 3	8 to 12
Arm curl	2 to 3	8 to 12
Back extension	2 to 3	8 to 12
Triceps extension	2 to 3	8 to 12
Abdominal (crunch)	2 to 3	8 to 12

Trainable Characteristics

Objective	Loading and Volume (%1RM, RM)	Rest Periods	Frequency (days/week)	Repetition Velocity (sec) (Conc:Ecc)
Muscular Strength (advanced individuals)	85-100%1RM 6RM to 1RM * Min. 3 sets (muscle group)	At least 3 to 5 minutes	2d - 3d muscle group split routines min. interval 48h	Moderate (1–2: 1-2) Unintentional slow (fatigue)
Muscular Power (force x velocity)	30–60% 1RM for upper body 0–60% 1 RM for lower body * Min. 3 sets (muscle group)	At least 2 to 3 minutes	2d - 3d muscle group split routines min. interval 48h	Explosive velocity (Conc.)

Adapted from Ratamess et al. (2009) Progression Models in Resistance Training or Healthy. MSSE

Example: Resistance Training
Aim: muscular power
(you can use rubber bands)

Chest Press

Bent Row

Shoulder Press

Bicep Curl

Exercise	Sets	Reps
Chest press	2 to 3	8 to 10
Squat (body)	2 to 3	8 to 10
Bent row	2 to 3	8 to 10
Shoulder press	2 to 3	8 to 10
Standing calf raise	2 to 3	8 to 10
Arm curl	2 to 3	8 to 10
Triceps extension	2 to 3	8 to 10
Abdominal (crunch) regular	2 to 3	8 to 10
The moviments should be fast.		

Considerations:

1. Attention with the aim of your training and goal of the patient.

2. There are so many variables to control and monitoring: intensity, volume, rest between sets, sessions/week, speed and type of muscle contractions..

3. Break the homeostasis but also planning the recovery;

4. Try to figure out the best exercises not only thinking about physiology or biomechanics but also whether the patient enjoy to do.

5. Think about adherence of the physical activity program.

Periodização no treinamento de força

PERIODIZAÇÃO

É a forma de estruturar o treinamento, em um determinado tempo, através de períodos lógicos que compreendem a preparação do praticante (Forteza e Ranzola, 1988).

Processo que divide um ano completo de treinamento em pequenos e distintos períodos com tamanho mais controlável, cada um com alvos de desempenho e desenvolvimento específicos (Rowbottom, 2003).

Periodization

Periodization training:

- Division of the entire preparation process into separate periods of general and more specialized training;

- The theory of periodization was first proposed in the former USSR, by Lev P. Matveyev in the 1950s;

- Generalized concept of load-recovery interaction;

- Alternate days of high load and lower load, sequencing large, medium and small workloads.

- The landmark of periodization: volume and intensity (volume loads) are inversely related.

Razões fundamentais para os períodos de treinamento:

- O praticante não pode manter por muito tempo a forma ótima desportiva, devido as limitações biológicas.

- As trocas periódicas da estrutura de treinamento é uma condição necessária para o aperfeiçoamento desportivo.

- Aspecto motivacional;

- Evitar o *overtraining*.

Periodization

Table I. The hierarchical structure and content of periodized training cycles[5,6]	
Preparation component and its duration	**Content**
Multi-year preparation (years)	Long-lasting systematic athlete training composed of 2-year or 4-year (quadrennial) cycles
Macrocycle (months)	Large size training cycle (frequently annual cycle) that includes preparatory, competition and transition periods
Mesocycle (weeks)	Medium size training cycle consisting of a number of microcycles
Microcycle (days)	Small size training cycle consisting of a number of days; frequently 1 week
Workout (h/min)	A single training session that is performed individually or within a group

MACROCICLO DE TREINO

Geralmente um ano desportivo (e.g. 5 a 7 meses)

Período Preparatório:

Dividido em 2 fases:

• Geral, condicionamento físico geral
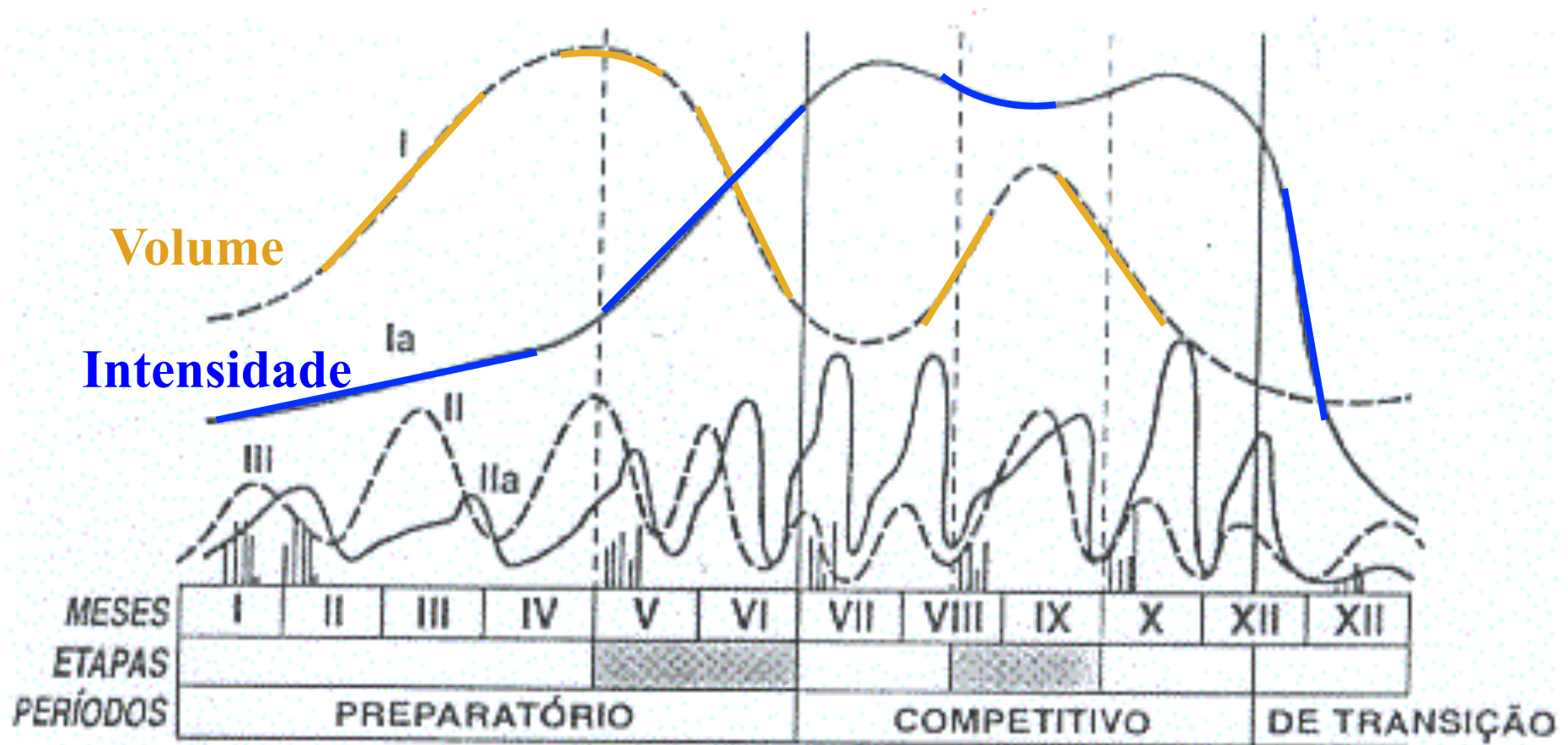
• Específico.

Período Competitivo:

• Desenvolvimento da performance.

Período de Transição:

• Redução da intensidade e volume, recuperação ativa.

	Plano anual			
Macro-ciclo	Preparatório		Competitivo	Transição
Meso-ciclo				
Micro-ciclo				

Volume

Intensidade

MESES | I | II | III | IV | V | VI | VII | VIII | IX | X | XII | XII
ETAPAS
PERÍODOS | PREPARATÓRIO | COMPETITIVO | DE TRANSIÇÃO

Mesociclo

- O Mesociclo (3 a 6 sem.) é composto de microciclos; Melhor controle dos atletas, recuperação a cada mesociclo (Rowbottom, 2003).

- **Incorporação**, inicio do ano, adaptação, cargas baixas e testes;

- **Básico**, dois a três mesociclos, bloco geral e específico, nova adaptação morfofuncional do praticante;

- **Estabilizador**, manutenção dos níveis de carga anterior, p/ assimilação saudável dos estímulos anteriores;

Mesociclo

- **Recuperativo**, recuperação completa das capacidades de trabalho, podendo chegar a supercompensação.

- **De controle**, série de testes e jogos amistosos, ou oficiais, para controlar os estado de preparação

- **Pré competitivo**, procura-se aproximar o máximo da realidade da competição, ser específico alta intensidade

- **Competitivo**, respeitar o momento da competição, pouco volume e alta intensidade

Microciclo

- **Choque**, cargas máximas e submáximas, 80 à 100% do máximo;

- **Ordinário**, cargas moderadas a alta, 60 à 80% do máximo;

- **Estabilizador**, cargas moderadas, 30 à 60% do máximo;

- **Recuperativo**, recuperação cargas 10 à 20% do máximo;

- **Pré competitivo**, assegurar as condições semelhantes da competição e boa recuperação;

- **Competitivo**, assegurar a melhor rendimento, competições.

Rowbottom (2003)
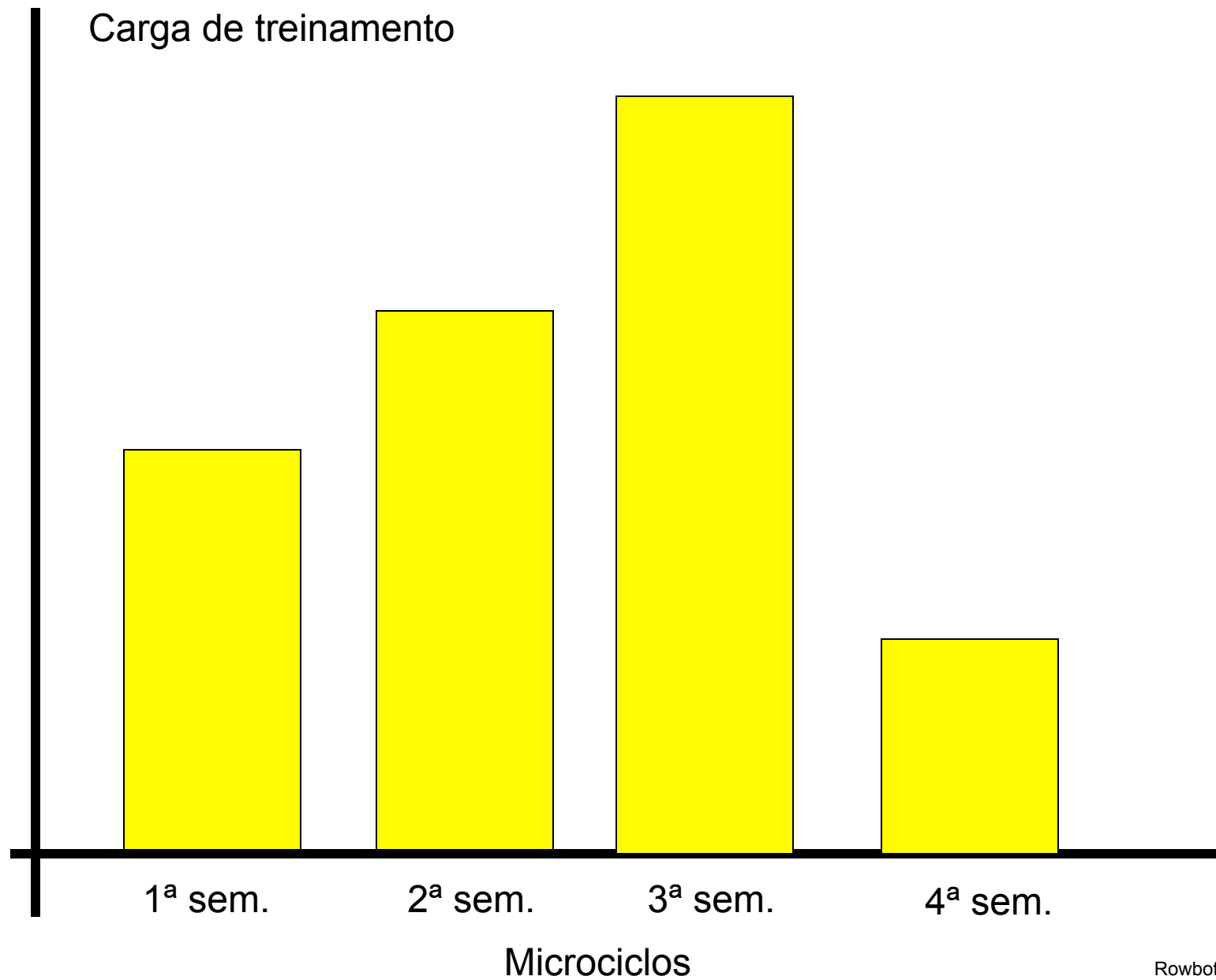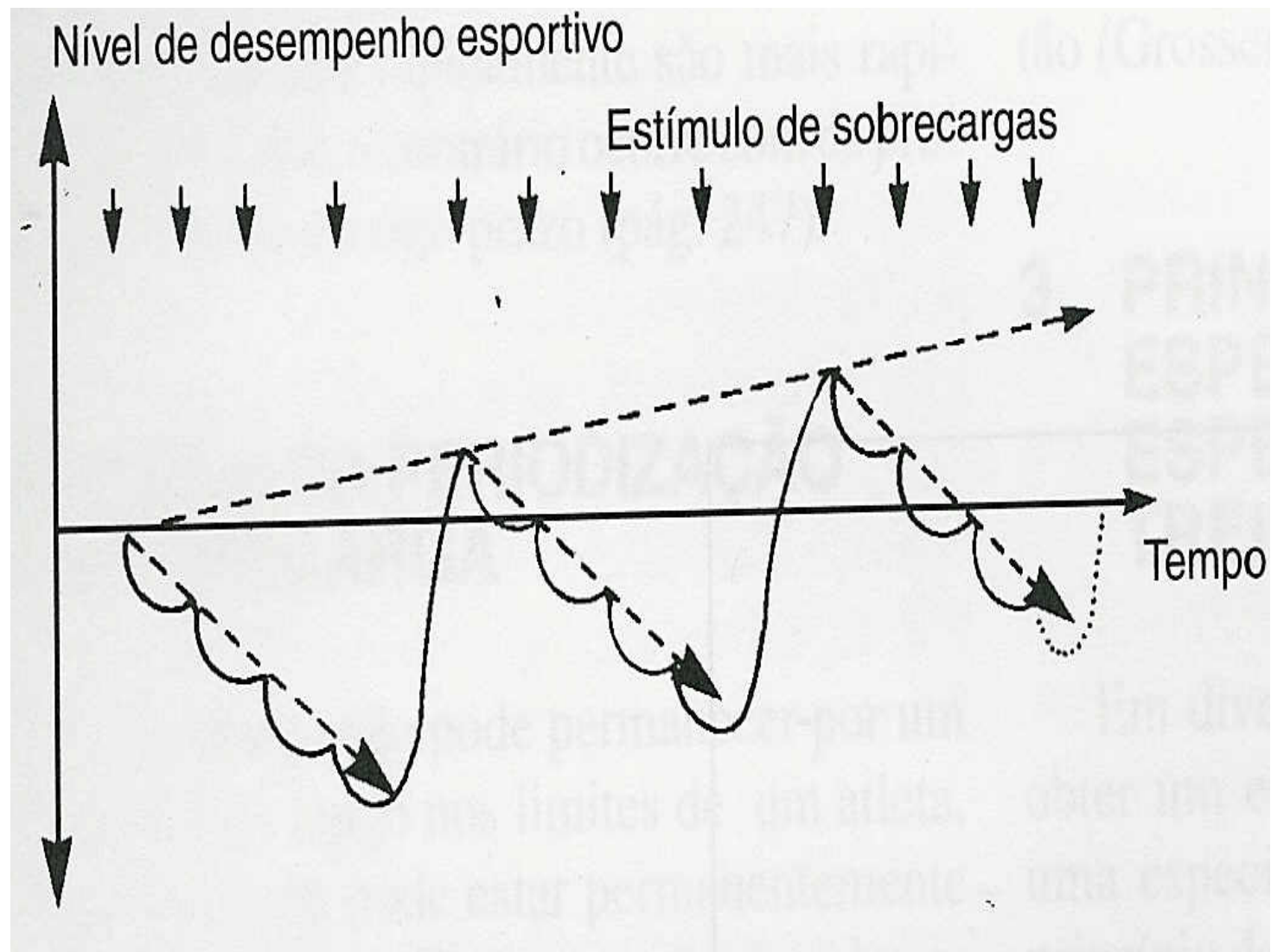
Pergunta...

Como mensurar o microciclo?

Sessão de treinamento:

Inclui aquecimento, dificuldades de treinamento, execução e a recuperação após cada sessão.

Unidade de treino:

União de mais sessões de treino (mais de 1 treino por dia), treinar em bom estado de recuperação.

Periodization types

- Types of periodization: **traditional model or linear**, and **non-linear or undulating** periodization;

- **Traditional periodization** postulates a gradual progressive increase in intensity ;

- In contrast, the **nonlinear** (or undulating) model offers drastic variations of intensity within the **weekly** and **daily** program. It has been demonstrated to be superior for generating fitness;

- After every 12 weeks of training cycle it is recommended a planned rest period.
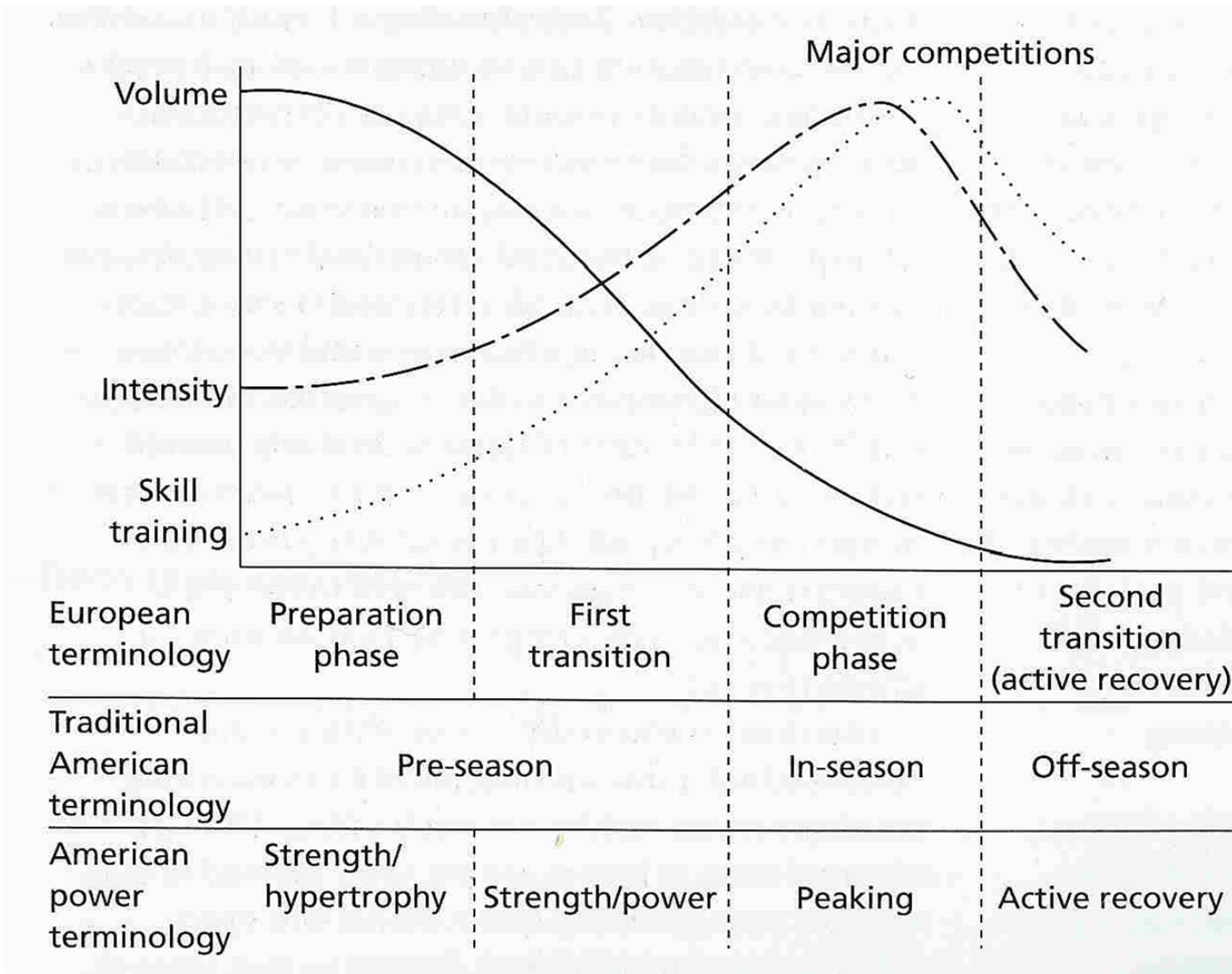
Periodization Strategies

Steven S. Plisk, MS, CSCS,*D
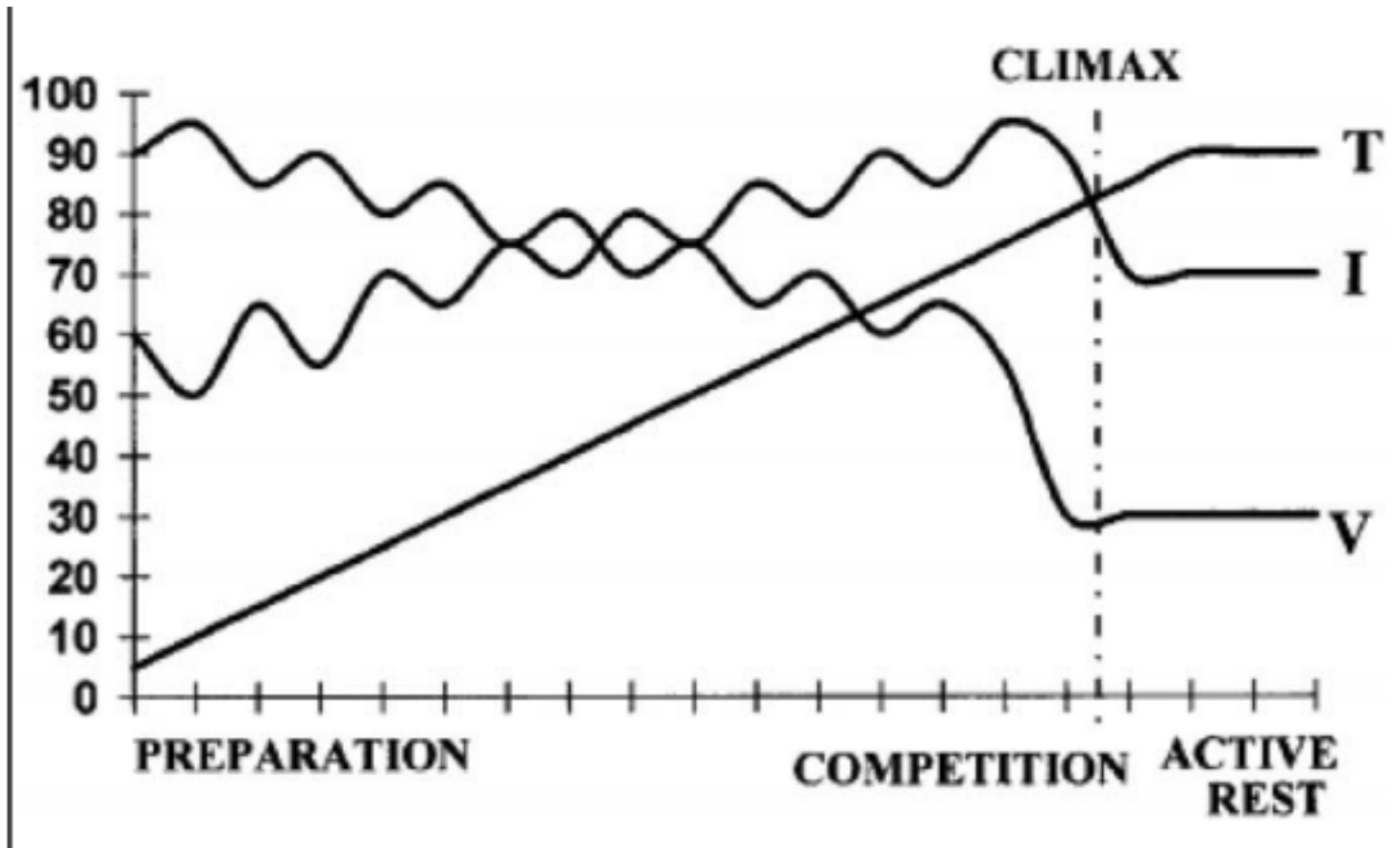Velocity Sports Performance
Trumbull, Connecticut

Michael H. Stone, PhD
U.S. Olympic Committee
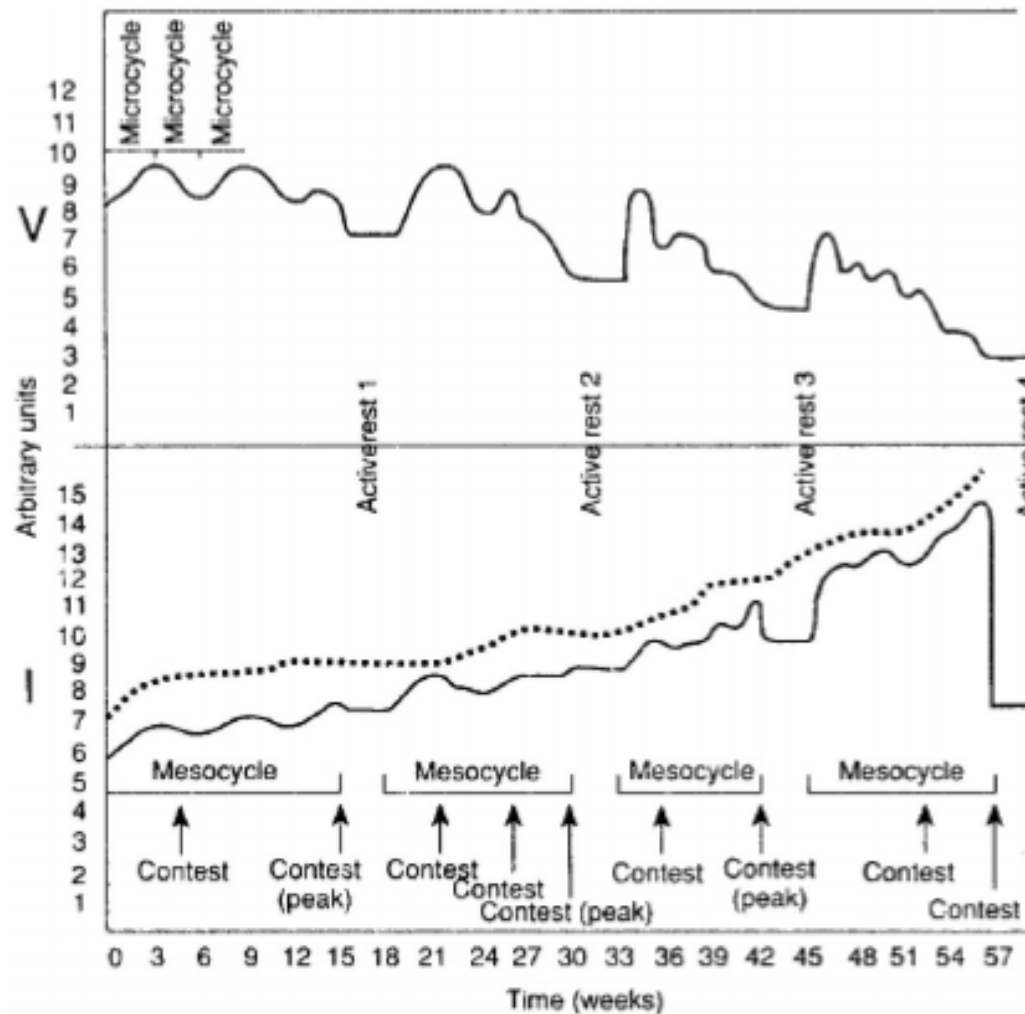Colorado Springs, Colorado

Linear periodization

Periodização generalizada

T- Técnica; I –Intensidade; V – Volume. (Plisk and Stone, 2003)

Periodização generalizada

T- Técnica; I –Intensidade; V – Volume. (Plisk and Stone, 2003)

PHASE: Objective Variable	GENERAL PREPARATION: Strength-Endurance	SPECIAL PREPARATION: Basic Strength	COMPETITION: Strength & Power	PEAKING/ACTIVE REST: Peaking/ Maintenance
Intensity	low to moderate	high	high	very high to low
Volume	high	moderate to high	low	very low
Repetitions	8-20	4-6	2-3	1-3
Sets*	3-5	3-5	3-5	1-3
Sessions/Day	1-3	1-3	1-2	1
Days/Week	3-4	3-5	3-6	1-5
Intensity cycle[†]	2-3/1	2-4/1	2-3/1	—

Periodização generalizada (aplicação básica) (Plisk and Stone, 2003; SCJ)
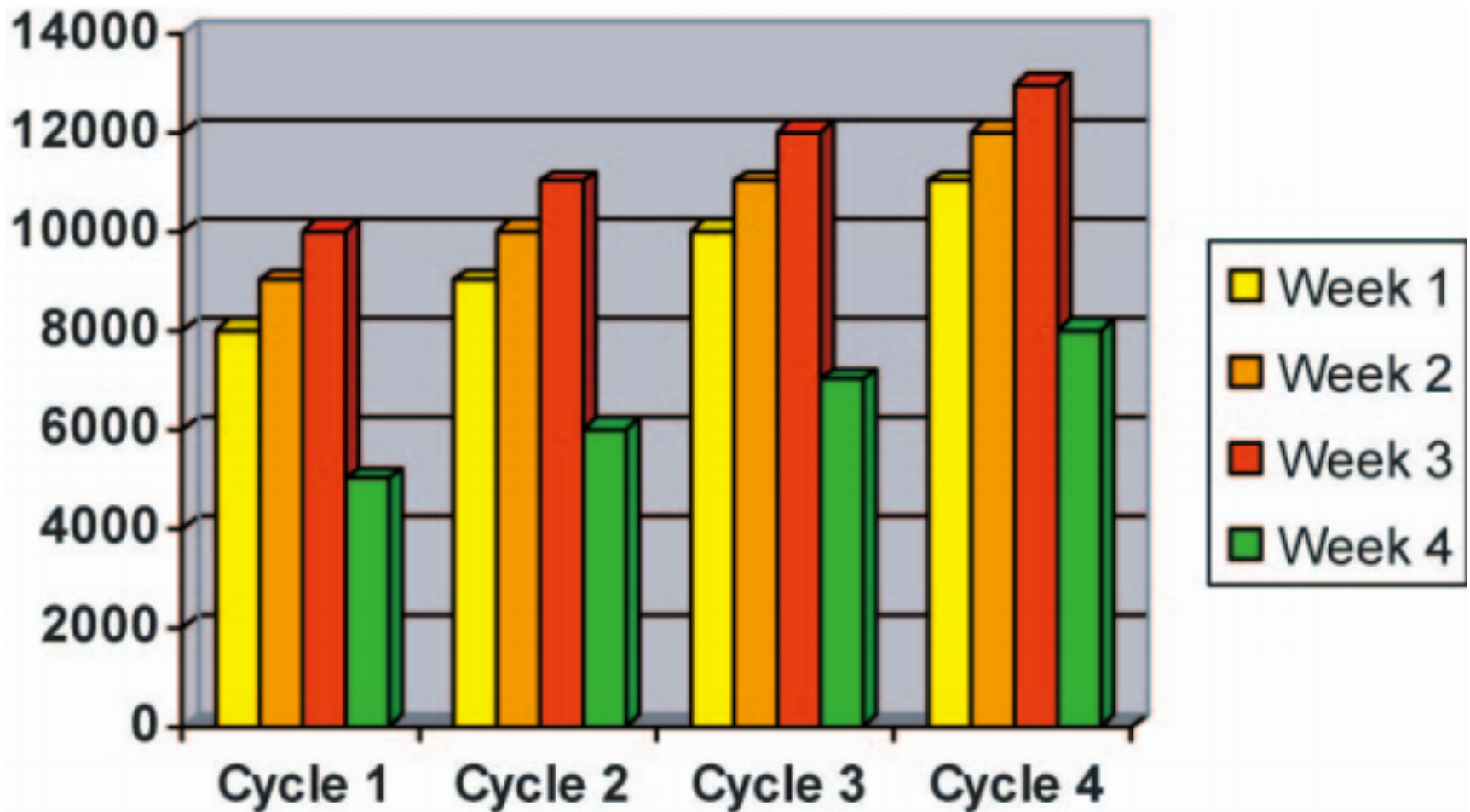
Somatória de microciclos / aumento de vol. e ou intensidade (Plisk and Stone, 2003; SCJ)

Pergunta...

Como mensurar uma sessão de treino?

Comparison of Linear and Reverse Linear Periodization Effects on Maximal Strength and Body Composition

Jonato Prestes,[1] Cristiane De Lima,[2] Anelena B. Frollini,[2] Felipe F. Donatto,[2] and Marcelo Conte[3]

[1]Physiological Sciences Department, Exercise Physiology Laboratory, Federal University of São Carlos, São Paulo, Brazil; [2]Health Sciences Department, Physical Education Post-Graduation Program, Methodist University of Piracicaba, Piracicaba, São Paulo, Brazil; and [3]Superior School of Physical Education, Jundiaí, São Paulo, Brazil

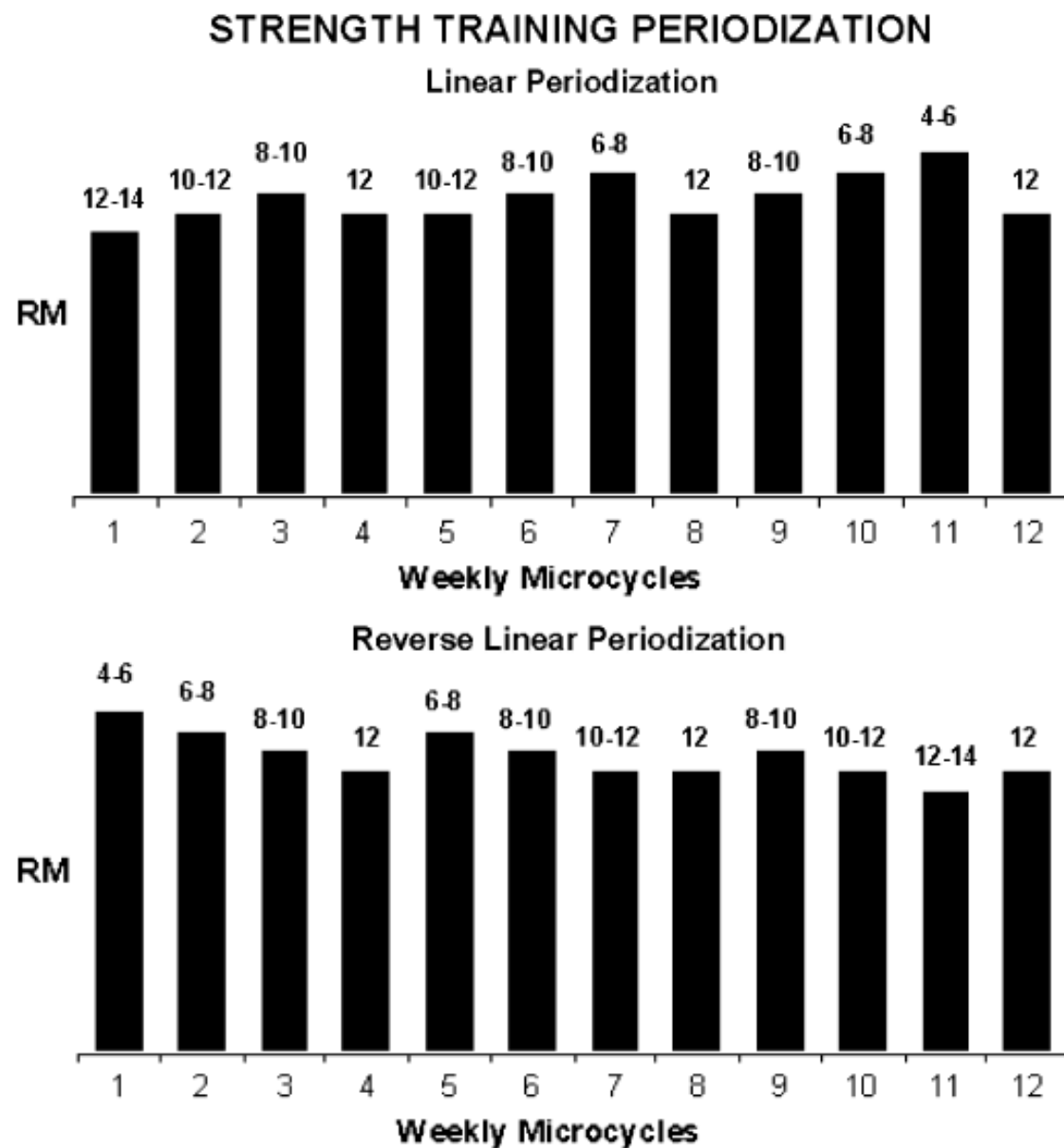**Amostra Mulheres treinadas há + 6 meses.**

Dois grupos: Linear P.

Reverse LP

Figure 1. Load distributions represented by maximal repetitions (RM) in each weekly microcycle of linear and reverse linear periodization strength trainings.

STRENGTH TRAINING PROGRAM

Performed exercises	
Training A	Training B
1. Bench press	1. Back squat
2. Inclined chest fly	2. Leg extension
3. Dumbbell shoulder press	3. Leg curl
4. Lateral raise	4. Glute kickbacks
5. Standing arm curl	5. Hip abduction
6. Biceps preacher curl	6. Hip adduction
7. Triceps extension	7. Standing calf raise
8. Close-grip bench press	8. Lat pull-down
	9. Seated row

Series X Repetitions	Rest interval
3 X 12 - 14 repetitions	45s
3 X 10 - 12 repetitions	1min
3 X 8 - 10 repetitions	1min and 20s
3 X 6 - 8 repetitions	1min and 40s
3 X 4 - 6 repetitions	2min

Figure 2. Exercises divided into A and B training, number of series, repetitions, and rest intervals performed for each microcycle training in linear and reverse linear periodizations.
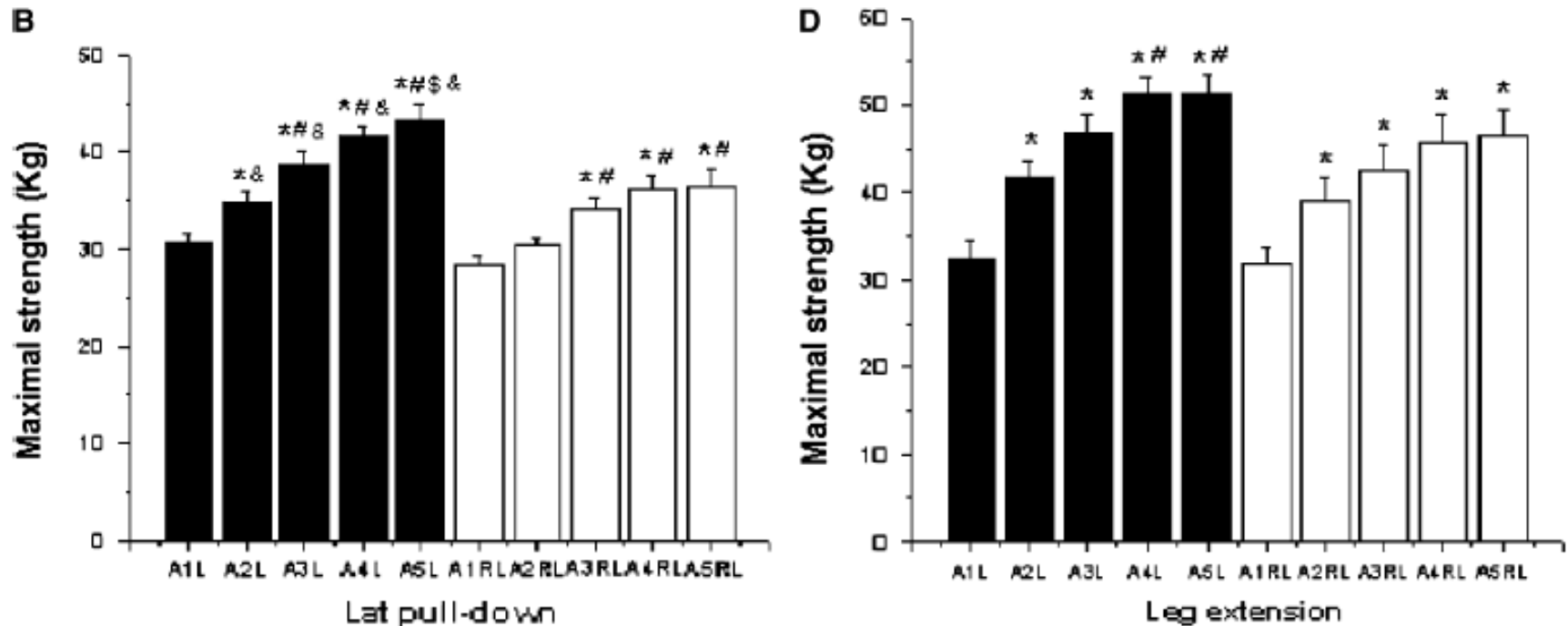
TABLE 2. Anthropometric variables during 12 weeks of strength training.

AV	Groups	A1	A2	A3	A4	A5
FM	LP	13.46 ± 0.62	11.91 ± 0.90	11.83 ± 1.01	11.07 ± 0.93*	11.13 ± 0.95
	RLP	14.39 ± 1.03	13.80 ± 0.97	13.32 ± 0.96	12.79 ± 0.93	12.34 ± 0.65
FFM	LP	43.37 ± 1.03	46.03 ± 0.85†	45.68 ± 0.75†	46.44 ± 0.95*†	46.72 ± 0.96*†
	RLP	41.39 ± 1.33	41.93 ± 1.30	42.34 ± 1.24	42.92 ± 1.23	42.68 ± 1.12
BF%	LP	23.05 ± 0.80	20.58 ± 1.15	20.38 ± 1.25	19.23 ± 1.25*	19.09 ± 1.23*
	RLP	25.06 ± 1.61	24.02 ± 1.59	23.25 ± 1.56	22.31 ± 1.38	22.76 ± 1.47

AV = anthropometric variables; FM = fat mass (kg); FFM = fat-free mass (kg); BF% = body fat percentage (%); LP = linear periodization ($n = 10$); RLP = reverse linear periodization ($n = 10$). A1 = baseline evaluation; A2 = evaluation after 4 weeks of training; A3 = evaluation after 8 weeks of training; A4 = evaluation after 12 weeks of training; A5 = evaluation after 1 week of detraining. *Significant statistical difference in relation to A1; †significant statistical difference between the periodizations in the same week of evaluation. The values were expressed by mean ± standard error of the mean ($p \leq 0.05$).

Figure 3. Maximal strength levels for bench press, lat pull-down, arm curl, and leg extension exercises. Black squares refer to the linear periodization group ($n = 10$), and white squares refer to the reverse linear periodization group ($n = 10$). A1 = baseline evaluation; A2 = evaluation after 4 weeks of training; A3 = evaluation after 8 weeks of training; A4 = evaluation after 12 weeks of training; A5 = evaluation after 1 week of detraining. * Statistically significant difference in comparison with A1; # statistically significant difference in comparison with A2; $ statistically significant difference in comparison with A3; & statistically significant difference between the periodizations in the same week of evaluation. The values are expressed as mean $\pm$ SEM ($p \leq 0.05$).

Figure 3. Maximal strength levels for bench press, lat pull-down, arm curl, and leg extension exercises. Black squares refer to the linear periodization group ($n =$ 10), and white squares refer to the reverse linear periodization group ($n = 10$). A1 = baseline evaluation; A2 = evaluation after 4 weeks of training; A3 = evaluation after 8 weeks of training; A4 = evaluation after 12 weeks of training; A5 = evaluation after 1 week of detraining. * Statistically significant difference in comparison with A1; # statistically significant difference in comparison with A2; $ statistically significant difference in comparison with A3; & statistically significant difference between the periodizations in the same week of evaluation. The values are expressed as mean $\pm$ *SEM* ($p \leq 0.05$).

Aplicações práticas

- A periodização linear (4 – 14RM) diminuiu a gordura e aumentou a massa muscular;

- Os dois grupos aumentaram a força;

- Em uma semana de destreinamento não houve perdas;

Periodização ondulatória (não linear):

- Conceito mais atual;

- Manutenção das capacidades por longos períodos;

- Variação do volume e intensidade durante o treinam.;

    Utiliza-se diferentes zonas de treinamento;

> - **Muito pesado – 1 a 3 RM**
> - **Pesado   – 4 a 6 RM**
> - **Moderado   – 8 a 10 RM**
> - **Leve   – 12 a 15 RM**

Kraemer and Hakkinen (2002), Strength training for sport

Periodização ondulatória (não linear):

• Utiliza-se as zonas de treinamento;

• Em cada sessão;

• Semanalmente;

• A cada duas semanas;

• Muito popular p/força e potência para longos períodos;

• Planejar uma restauração adequada, após 12 semanas.

Kraemer and Hakkinen (2002), Strength training for sport

Nonlinear periodization

Nonlinear periodization - weeky
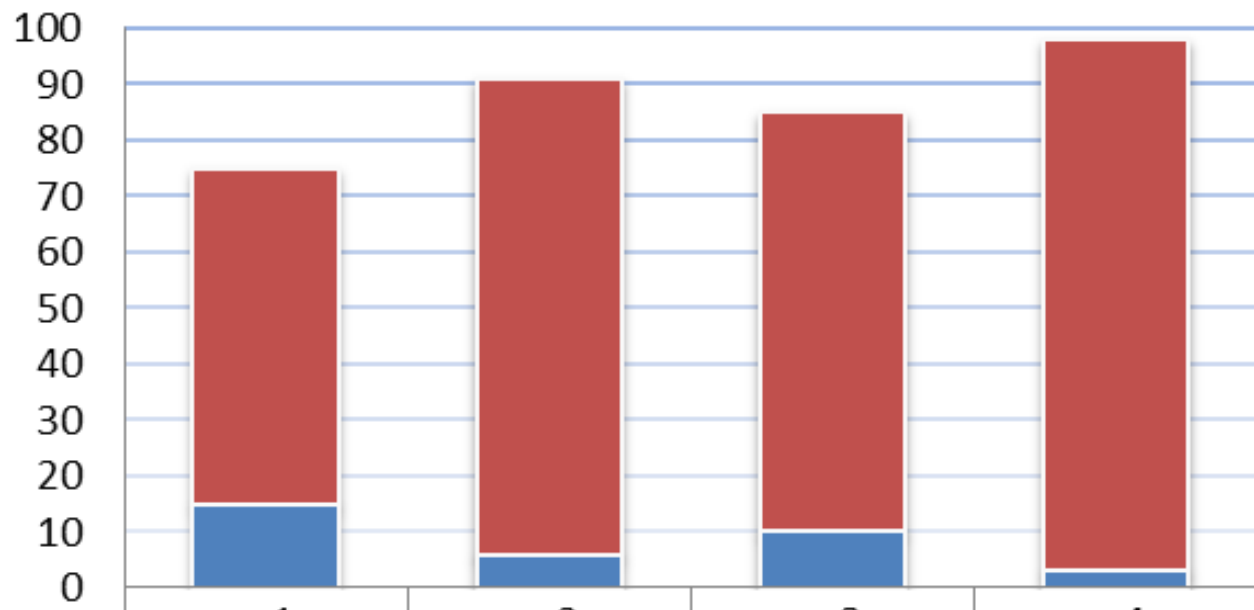
	w1	w2	w3	w4
■ Intensity (%1RM)	60	85	75	95
■ Reps Max.(RM)	15	6	10	3

Example

Nonlinear periodization
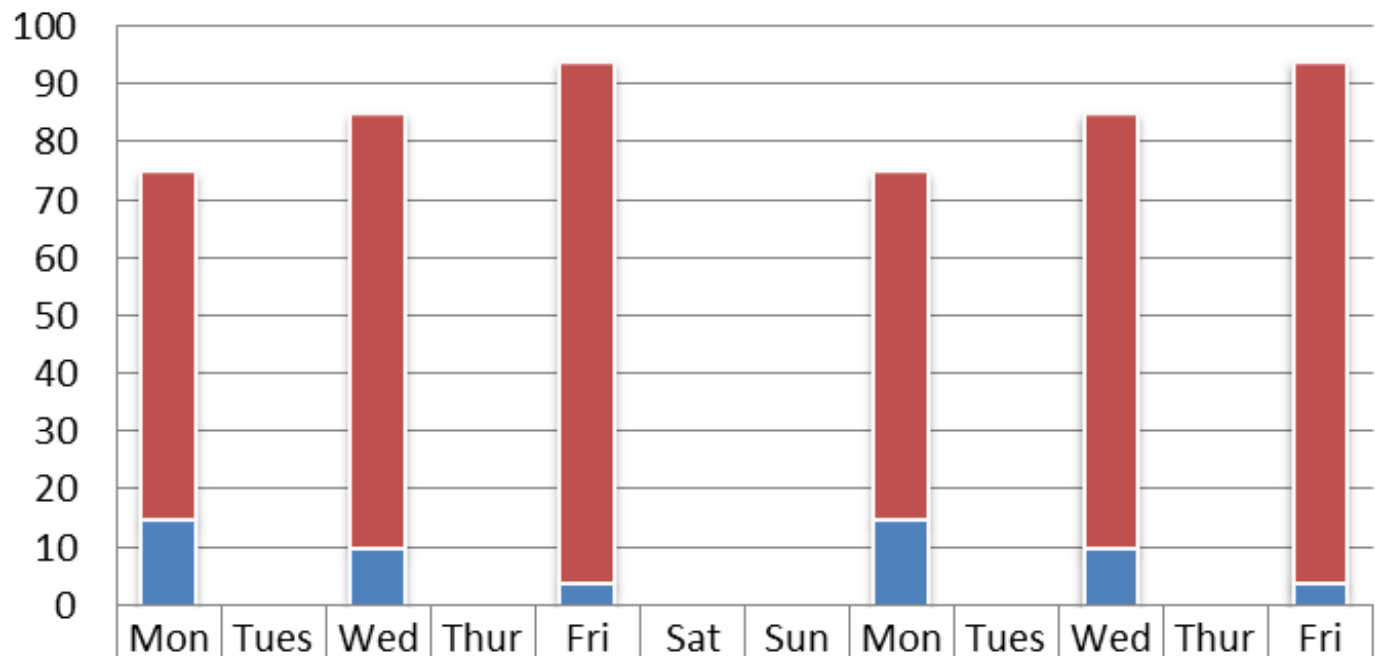
Example

A Comparison of Linear and Daily Undulating Periodized Programs With Equated Volume and Intensity for Local Muscular Endurance

MATTHEW R. RHEA, WAYNE T. PHILLIPS, LEE N. BURKETT, WILLIAM J. STONE, STEPHEN D. BALL, BRENT A. ALVAR, AND AARON B. THOMAS

Exercise and Wellness Research Laboratory, Department of Exercise Science and Physical Education, Arizona State University, Tempe, Arizona 85212.

Table 1. Subject characteristics: group means $\pm$ SD.*

Group	LP	DUP	RLP
N	20 (10m, 10w)	20 (10m, 10w)	20 (10m, 10w)
Age (y)	21 $\pm$ 2.4	21 $\pm$ 1.9	22 $\pm$ 1.6
Weight (kg)	64 $\pm$ 13.4	66.8 $\pm$ 23.2	68.6 $\pm$ 20.1

* m = men; w = women; LP = linear periodization; DUP = daily undulating periodization; RLP = reverse linear periodization.

Três grupos:
- Linear P.;
- Reverse P.;
- Daily Ondulating P.;

Exerc. Ext. de joelhos

Duas sessões/sem.

2' intervalo - séries

Table 2. Training programs cycle repeated throughout the 15 wk.*

LP group	
Week 1–5	3 × 25 RM
Week 6–10	3 × 20 RM
Week 11–15	3 × 15 RM
RLP group	
Week 1–5	3 × 15 RM
Week 6–10	3 × 20 RM
Week 11–15	3 × 25 RM
DUP group	
Workout 1	3 × 25 RM
Workout 2	3 × 20 RM
Workout 3	3 × 15 RM
Workout 4	3 × 25 RM
Workout 5	3 × 20 RM
Workout 6	3 × 15 RM

* LP = linear periodization; DUP = daily undulating periodization; RLP = reverse linear periodization; RM = repetition maximum.

Resultados:

Força (1RM):

• DUP - ↑ 9,8%;

• LP - ↑ 9,1%;

• RLP - ↑ 5,6 %;

Resistência muscular:

• DUP - ↑ 54,5 %;

• LP - ↑ 55,9%;

• RLP - ↑ 72,8 %;

Todos os grupos dim. a circunferência da coxa

Aplicações práticas

- Para aqueles que desejam aumentar a resistência muscular, utilizar a Periodização linear reversa.

RT in health and fitness program

- Increase strength and power;

- Increase muscle mass;

- Improves cardiovascular function;

- Promotes better glycemic control;

- Prevents osteoporosis;

- Promotes weight loss and maintenance;

- Improves dynamic stability and preserves functional capacity;

- Prevents injuries;

- Promote psychological well-being.

Ratamess et al. (2009) Progression Models in Resistance Training or Healthy. MSSE

Periodization resistance training for older adults

SHORT-TERM EFFECTS OF TWO RESISTANCE TRAINING PERIODIZATION MODELS (Linear Vs Undulating) ON STRENGTH AND POWER OF THE LOWER-BODY IN A GROUP OF ELDERLY MEN

A. JIMENEZ,[1] AND J. D. E. PAZ[2]

[1]Centre for Sports Sciences & Human Performance, School of Science, University of Greenwich, Chatham Maritime, United Kingdom; and [2]Biomedical sciences, University of Leon, Leon, Spain

- The scientific literature reveals that most of studies with RT periodizations utilized young males;
- It is necessary to investigate varying aspects of periodized training models in other populations:

Jimenez and Paz (2011), JSCR

SHORT-TERM EFFECTS OF TWO RESISTANCE TRAINING PERIODIZATION MODELS (Linear Vs Undulating) ON STRENGTH AND POWER OF THE LOWER-BODY IN A GROUP OF ELDERLY MEN

- Subjects: 58 physically active elderly men (68,8 ± 3,1 years);

- 6 sessions of technique familiarization to exercises and testing protocols;

- Divided in 3 study groups: linear periodization (LPG), undulating periodization (UPG) and control group (CG);

- Training program: 12 weeks, 3 sessions/week (36 sessions)

Jimenez and Paz (2011), JSCR

SHORT-TERM EFFECTS OF TWO RESISTANCE TRAINING PERIODIZATION MODELS (Linear Vs Undulating) ON STRENGTH AND POWER OF THE LOWER-BODY IN A GROUP OF ELDERLY MEN

- Both periodization models were effective to improve strength and power values among elderly people, especially the functional capacity in the daily life.

- "**The results encourage researchers and exercise professionals to include both periodization models in the design and development of resistance training programs for elderly population.**"

Jimenez and Paz (2011), JSCR

Early plateaus of power and torque gains during high- and low-speed resistance training of older women

Joseph F. Signorile,[1,2,3] Michelle P. Carmel,[2] Shenghan Lai,[2,4] and Bernard A. Roos[1,2,3,5]

[1]Department of Exercise and Sport Sciences, University of Miami, Coral Gables; [2]Stein Gerontological Institute, Miami; [3]Geriatric Research, Education, and Clinical Center, Veterans Affairs Medical Center, Miami, Florida; [4]Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland; and [5]Departments of Medicine and Neurology, University of Miami School of Medicine, Miami, Florida

- RT can be an effective short term intervention to counteract the strength and power losses from sarcopenia;

- Training periods longer than 6 months report decreased gains after 2-3 months;

Signorile et al. J Appl Physiol 98: 1213–1220, 2005;

Methods

- Subjects – 17 healthy women (living indepedently), ages 61-75 years;

- 2 groups: Power (PWR, n=9) and Strength (STR, n=8);

- Training, isokinetic equipament (Biodex), **3 sessions/week** for **12 weeks**; All efforts during isokinetic training are at perceived maximum;

- **PWR group** – 10 reps at 4,73 rad/sec;

- **STR group** – 6 reps at 1,05 rad/sec;

- Total work was equated;

- Obs: Low-speed isokinetic training provides higher resistance and a greater strength stimulus, whereas high-speed training has greater impact on movement speed and power.

Signorile et al. J Appl Physiol 98: 1213–1220, 2005;

Table 2. *Training schedule across all training weeks*

Week	Group	Day	Sets	Repetitions
1	PWR	1	1	6
	STR		1	4
1	PWR	2	2	6
	STR		2	4
1	PWR	3	1	8
	STR		1	5
2	PWR	1	2	8
	STR		2	5
2	PWR	2	1	10
	STR		1	6
2	PWR	3	2	10
	STR		2	6
3–11	PWR	1	3	10
	STR		3	6
3–11	PWR	2	3	10
	STR		3	6
3–11	PWR	3	3	10
	STR		3	6
12	PWR	1	2	10
	STR		2	6
12	PWR	2	2	10
	STR		2	6
12	PWR	3	No training	
	STR		Recovery day before testing	

Signorile et al. J Appl Physiol 98: 1213–1220, 2005;

Results

Results of repeated-measures analysis of group **Average Power**, **Peak Torque**, and **Total Work** values **across the training period**

	Group		P value
	PWR	STR	
AP, W	108.94±6.30*	59.35±6.68	<0.0001
PT, kg·m	48.23±4.98	92.75±5.29*	<0.0001
TW, kJ	541.17±39.41	625.28±41.80	NS

Values are means ± SD. AP, average power; PT, peak torque; TW, total work; NS, not significant. *Significant difference between conditions

Signorile et al. J Appl Physiol 98: 1213–1220, 2005;

Results **STR group**

- The gains in PT (at 3–4 wk) in the training. Right and left knee average PT (A and B, respectively).

Signorile et al. J Appl Physiol 98: 1213–1220, 2005;
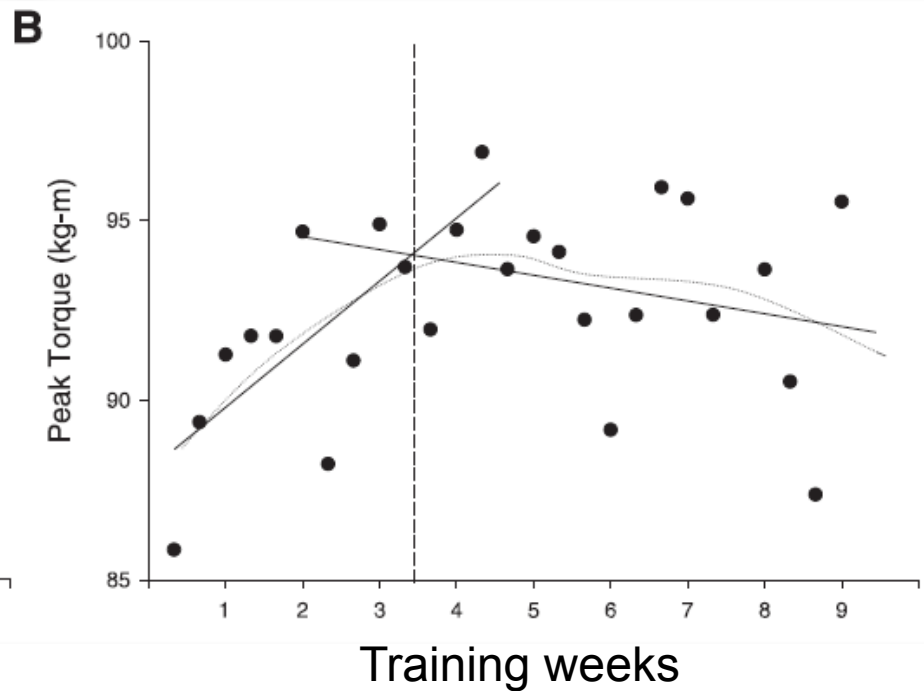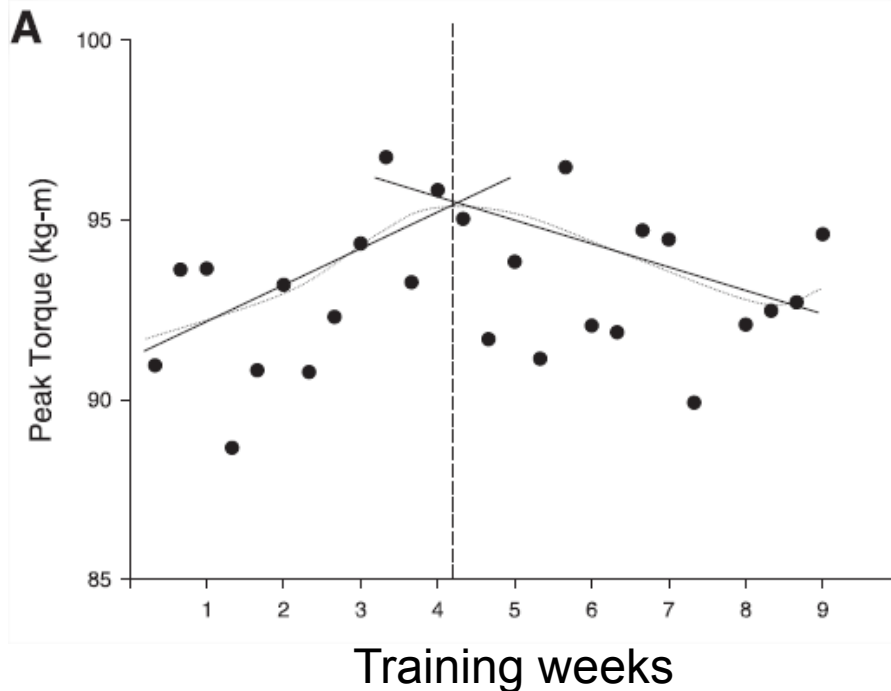
Results **PWR group**

- The gains in power (at 3–4 wk) in the training cycle. Right and left knee average power (A and B, respectively).

Signorile et al. J Appl Physiol 98: 1213–1220, 2005;
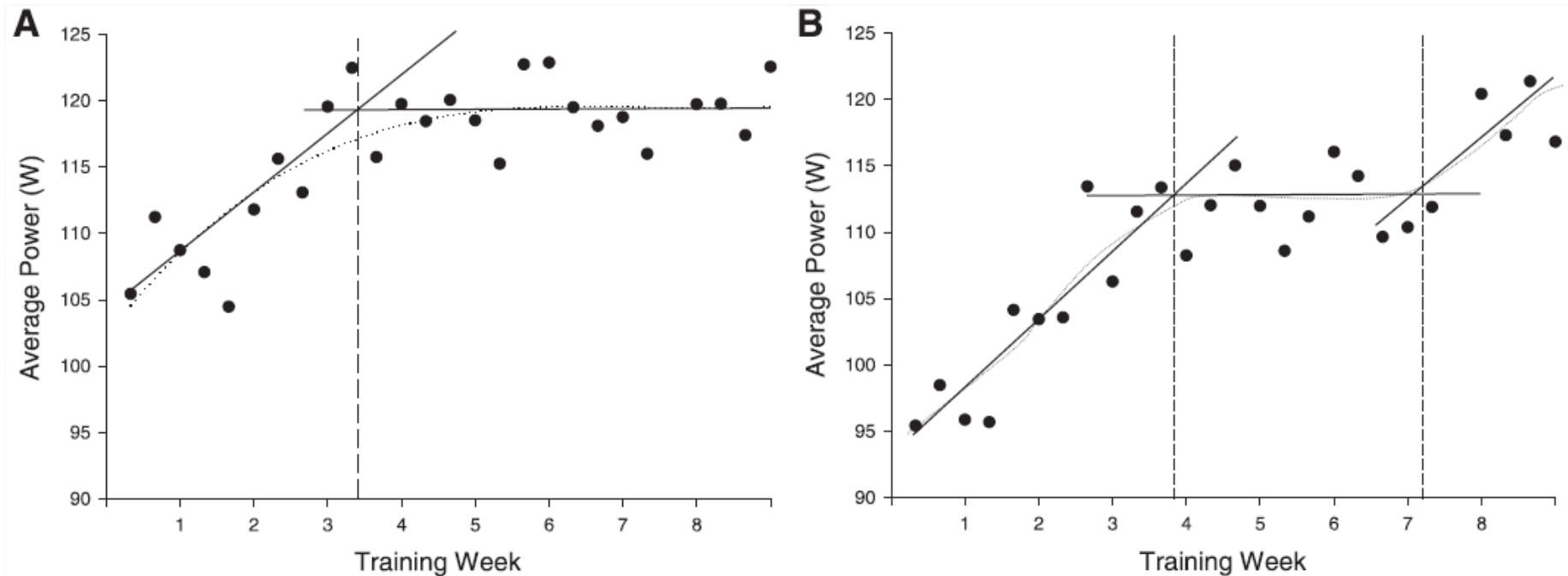
Considerations

- The results of this study also confirm that **<u>power</u>** is more effectively increased using **lower loads** and **higher training speeds**, whereas **<u>strength</u>** is better addressed using **high-load, low-speed** training in older persons.

- By the **fourth week of training**, training **volume should be reduced** during both power and strength cycles so that can be maintained or increased during this tapering period.

Signorile et al. J Appl Physiol 98: 1213–1220, 2005;

Considerações finais:

- Verificar o objetivo do praticante;
- Cuidado com a recuperação nos mesociclos;
- Questão motivacional;
- Aderência ao programa de exercícios.

Muito obrigado.

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