

canfitpro 2019

Periodization: The Golden Formula of Training Stress and Recovery

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1

Periodization

Method for structuring training programs into periods or phases using programmed variation of training loads and rest periods in a cyclic fashion to elicit improvements in fitness and performance. It involves manipulating or systematically changing training variables at regular intervals of time.

Idea originated in the 1920s in response to the year-long training practices of athletes.

2

- Improvements in fitness occur during the *recovery* period between workouts, not during the workouts themselves.
- The human body is great at adapting to stress *as long as that stress is applied in small doses*. When the stress is too severe, or not enough recovery has preceded the new stress, injury can result.
- Positive physiological adaptations to training occur when there is a correctly-timed alternation between stress and recovery. When your client finishes a workout, he/she is weaker, not stronger. How much weaker depends on the severity of the training stress. The faster and more complete your clients' recovery, the more they will get out of their training.

3

- The most effective adaptations occur when you are recovered from previous training & best prepared to tolerate a subsequent overload.
- The greater the training stimulus, the longer the time needed for recovery and adaptation to the stimulus.
- While much of training is a science, with specific biochemical & physiological changes occurring through the use of specific workouts, manipulating stress & recovery in organized & systematic training program to achieve greatest adaptation possible is an art. As such, it needs to be practiced & fine-tuned like other forms of art.

4

Recovery During Training

- Give clients chance to adapt & habituate to each level of training before increasing level. Every few weeks, back off volume by about a third for one recovery week before increasing training load. Train clients in cycles, using final week of cycle as recovery week to absorb the training, make the necessary adaptations, & recover so they can handle upcoming training load.
- Make clients' training polarized – work out easy on easy days so they can truly recover & hard on hard days to provide stress. When designed this way, with both stress & recovery given equal attention & diligence, it is an elegant system that works.

5

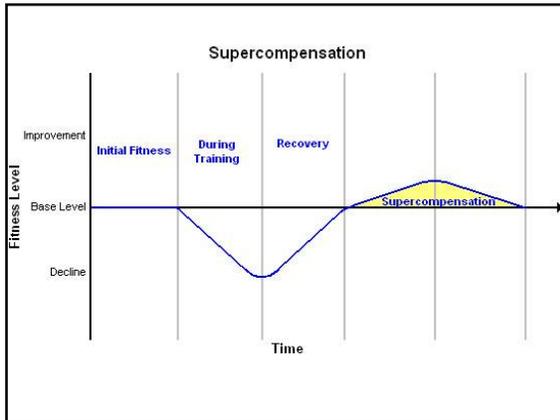
Post-Workout Recovery

- Factors affecting recovery:
 - age (younger people recover faster between workouts)
 - training intensity (higher intensity workouts require more recovery)
 - nutrition
 - environment
 - stress
 - level of cardiovascular fitness (high level of cardiovascular fitness speeds recovery)

What about estrogen, Jason?

- Estrogen protects muscle tissue, inhibits inflammation, & plays significant role in stimulating muscle repair & regeneration following strenuous exercise. Although exact mechanisms by which estrogen influences skeletal muscle damage, inflammation, & repair are not totally clear, estrogen may exert its protective effects by acting as antioxidant, by stabilizing muscles' membranes, & by governing regulation of genes.

6



7

Research Findings

Periodized vs. non-periodized strength training programs

- **Kraemer et al. (2000):**
 - female collegiate tennis players; 2-3 x week for 9 months
 - significantly greater increases in bench press, shoulder press, & leg press 1-RMs, tennis serve velocity, & lean body mass
 - significantly greater decrease in % body fat
- **Willoughby (1993):**
 - weight trained college-aged males; 3 x week for 16 weeks
 - significantly greater increases in bench press & squat 1-RMs
- **O'Bryant et al. (1988):**
 - untrained college-aged males; 3 x week for 11 weeks
 - significantly greater increases in squat 1-RM & maximal cycling power
- **Stowers et al. (1983):**
 - untrained college-aged males; 3 x week for 7 weeks
 - significantly greater increases in squat 1-RM, vertical jump, & lean body mass

8

Research Findings

- **Stone et al. (1981):**
 - college-aged males; 3 x week for 6 weeks
 - significantly greater increase in squat 1-RM
 - significantly greater decrease in % body fat
- **Baker et al. (1994):**
 - weight-trained males; 3 x week for 12 weeks
 - similar improvements in bench press & squat 1-RMs, vertical jump, & lean body mass
- **Herrick & Stone (1996):**
 - untrained college-aged females; 2 x week for 15 weeks
 - similar improvements in bench press & squat 1-RMs
- **Prestes et al. (2009):**
 - compared linear periodization (LP; 12-14 RM to 4-6 RM) to reverse linear periodization (RLP; 4-6 RM to 12-14 RM)
 - women w/at least 6 months weight training experience; 3 x week for 12 weeks
 - only LP group increased fat-free mass & decreased fat mass
 - both types of training significantly increased strength (bench press, lat pull-down, arm curl, & leg extension), however LP group increased strength significantly more did than RLP group

9

Research Conclusions

- Periodized programs are better than non-periodized programs, especially in the long-term & especially when the person is already trained.
- Increases in strength with periodized programs are partly due to decreases in training volume.
- To increase muscular strength, undulating or linear periodization may be most effective, while reverse linear periodization may be most effective to increase muscular endurance.

10

Points to Consider...

- Studies have only compared training interventions with no variation to those with degrees of variation.
- Demonstrating that training programs with variation over short time period have more benefit than those with no variation does not necessarily support periodization; it only supports the benefit of variation, but offers no insight into how that variation is best scheduled and organized.
- There is a large inter-individual response to training, both in magnitude of response & time frame for developing and retaining training effects; thus, there cannot be one periodization model.

11

Types of Training Loads

- **Stimulating Loads**
 - increase fitness
 - increase training volume, intensity, or volume of intensity
- **Maintenance Loads**
 - maintain fitness
 - maintain one component while improve another component
- **Recovery Loads**
 - used before increase in training volume or intensity

12

Cycles of Training

Macrocycles (3-4 months)

- describe the overall phase/season of training

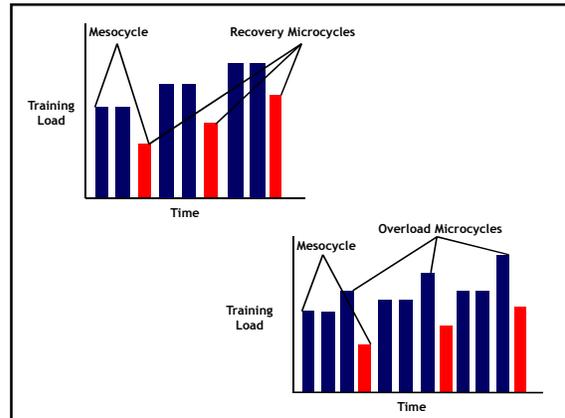
Mesocycles (3-6 weeks)

- include 1 or 2 purposes/training emphases
- use stimulating loads for primary purpose
- use maintenance loads for secondary purpose

Microcycles (1 week)

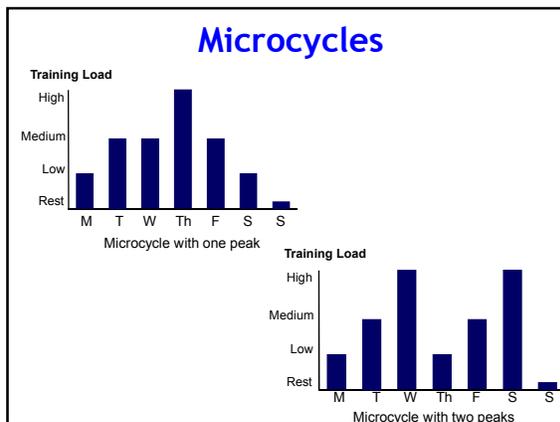
- include individual workouts to match training purpose(s)

13

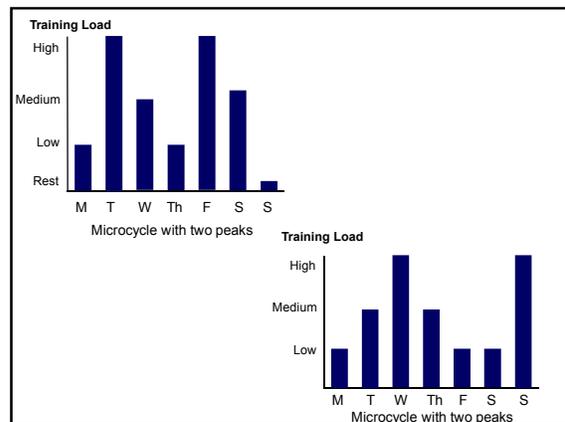


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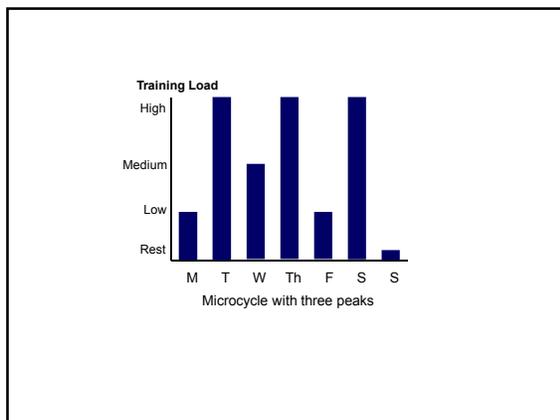
Microcycles



15



16



17

Building a Periodized Program

- Step 1: Establish client's goals
- Step 2: Identify how to train client to reach goals
- Step 3: List physiological/fitness variables (VO₂max, lactate threshold, muscular hypertrophy, strength, etc.)
- Step 4: Ask yourself:
 - Theme of each cycle? (Weight loss? Cardiovascular endurance? Muscular endurance/toner?)
 - How do I order training stimuli?
- Step 5: Determine periods of emphasis or maintenance of each variable
- Step 6: Choose length & objective of each mesocycle & microcycle
- Step 7: Design individual workouts to match objective(s) of each microcycle

18

How do we periodize strength?

Linear Periodization:

Weeks 1 & 2: Hypertrophy

- high volume/low to moderate intensity
- 3-6 sets of 10-15 reps @ 75-80% 1-RM w/2 min rest

Week 3: Recovery

- 2 sets of 10-15 reps @ 75-80% 1-RM w/2 min rest

Weeks 4 & 5: Strength

- low to moderate volume/high intensity
- 3-5 sets of 4-6 reps @ ≥ 85-90% 1-RM w/3-5 min rest

Week 6: Recovery

- 2 sets of 4-6 reps @ ≥ 85-90% 1-RM w/3-5 min rest

Weeks 7 & 8: Power (force x velocity)

- low volume/very high intensity
- 3-5 sets of 2-3 reps @ ≥ 95% 1-RM w/3-5 min rest (force)
- plyometrics (squat jumps, box jumps, leg hops, leg bounds, etc.) (velocity)

Week 9: Recovery

- 2 sets of 2-3 reps @ ≥ 95% 1-RM w/5 min rest
- back off on # sets/reps of plyometric exercises

19

How do we periodize strength?

Non-Linear Periodization:

	Workout 1	Workout 2	Workout 3
Week 1	2 sets of 4-6 RM w/3:00 rest	3 sets of 8-10 RM w/2:00 rest	4 sets of 12-15 RM w/1:00 rest
Week 2	3 sets of 8-10 RM w/2:00 rest	4 sets of 12-15 RM w/1:00 rest	2 sets of 4-6 RM w/3:00 rest
Week 3	4 sets of 12-15 RM w/1:00 rest	2 sets of 4-6 RM w/3:00 rest	3 sets of 8-10 RM w/2:00 rest
Week 4 (Recovery)	2 sets of 8-10 RM w/2:00 rest	1 set of 4-6 RM w/3:00 rest	2-3 sets of 12-15 RM w/1:00 rest
Week 5	2 sets of 4-6 RM w/3:00 rest	4 sets of 12-15 RM w/1:00 rest	3 sets of 8-10 RM w/2:00 rest
Week 6	3 sets of 8-10 RM w/2:00 rest	2 sets of 4-6 RM w/3:00 rest	4 sets of 12-15 RM w/1:00 rest
Week 7	4 sets of 12-15 RM w/1:00 rest	3 sets of 8-10 RM w/2:00 rest	2 sets of 4-6 RM w/3:00 rest
Week 8 (Recovery)	1 set of 4-6 RM w/3:00 rest	2-3 sets of 12-15 RM w/1:00 rest	2 sets of 8-10 RM w/2:00 rest

20

How do we periodize cardio?

Type of Training	Example of Workout	Heart Rate (% max)	Pace	Time of Year	Purposes
Aerobic Capacity (Endurance)	Easy running, cycling, etc.: 30-90 min	70-75%	1 to 1.5 min/km slower than 5K race pace	Base phase/preseason & during entire training year as recovery days between harder workouts	<ul style="list-style-type: none"> Increase mitochondrial & capillary density Increase aerobic enzyme activity Increase blood volume Improve running economy
Lactate Threshold	• 20-minute tempo run @ LT pace • 4 x 1,600m (5-8 min) @ LT pace w/1 min rest	80-90%	12-15 sec/km slower than 5K race pace or 6-9 sec/km slower than 10K race pace	Late base phase/early competitive phase	<ul style="list-style-type: none"> Improve lactate threshold Elevate intensity of running at which person begins to fatigue
Aerobic Power (VO ₂ max)	Long intervals (3-5 min) w/1:1 work:rest ratio	95-100%	2,400m to 3,000m race pace	Early to mid-competitive phase	<ul style="list-style-type: none"> Increase VO₂max Increase stroke volume & cardiac output
Anaerobic Glycolysis	Short intervals (45-90 sec) w/1:2 work:rest ratio	N/A	1,600m race pace or slightly faster	Mid- to late-competitive phase	<ul style="list-style-type: none"> Increase anaerobic endurance Increase muscles' ability to tolerate and buffer muscle acidosis
ATP-CP (Phosphagen) System	Very short intervals (5-15 sec) w/2-5 min rest	N/A	Close to top speed	Mid- to late-competitive phase	<ul style="list-style-type: none"> Increase muscle power production Recruit fast-twitch motor units

21

Mesocycle #1: Primary - Cardiovascular Endurance/Muscular Strength Secondary - Aerobic Power (VO₂max)

Week 1: 222 minutes
Week 2: 222 minutes
Week 3: 272 minutes
Week 4: 184 minutes

Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Cardio: 30 min. ST: 3 x 4-6 reps @ 85% 1RM w/3:00 rest	VO ₂ max Intervals - 10:00 warm-up - 4 x 3:00 @ 95-100% max HR w/2:00 recovery - 10:00 warm-down	Cardio: 30 min. ST: 3 x 4-6 reps @ 85% 1RM w/3:00 rest	Cardio: 40 min.	Cardio: 30 min. ST: 3 x 4-6 reps @ 85% 1RM w/3:00 rest	Rest	Cardio: 60 min.
Cardio: 30 min. ST: 3 x 4-6 reps @ 85% 1RM w/3:00 rest	VO ₂ max Intervals - 10:00 warm-up - 4 x 3:00 @ 95-100% max HR w/2:00 recovery - 10:00 warm-down	Cardio: 30 min. ST: 3 x 4-6 reps @ 85% 1RM w/3:00 rest	Cardio: 40 min.	Cardio: 30 min. ST: 3 x 4-6 reps @ 85% 1RM w/3:00 rest	Rest	Cardio: 60 min.
Cardio: 40 min. ST: 2 x 4-6 reps @ 85% 1RM w/3:00 rest	VO ₂ max Intervals - 10:00 warm-up - 5 x 3:00 @ 95-100% max HR w/2:00 recovery - 10:00 warm-down	Cardio: 40 min. ST: 2 x 4-6 reps @ 85% 1RM w/3:00 rest	Cardio: 50 min.	Cardio: 40 min. ST: 2 x 4-6 reps @ 85% 1RM w/3:00 rest	Rest	Cardio: 70 min.
Cardio: 27 min. ST: 3 x 4-6 reps @ 85% 1RM w/3:00 rest	VO ₂ max Intervals - 10:00 warm-up - 3 x 3:00 @ 95-100% max HR w/2:00 recovery - 5:00 warm-down	Cardio: 27 min. ST: 3 x 4-6 reps @ 85% 1RM w/3:00 rest	Cardio: 33 min.	Cardio: 27 min. ST: 3 x 4-6 reps @ 85% 1RM w/3:00 rest	Rest	Cardio: 46 min.

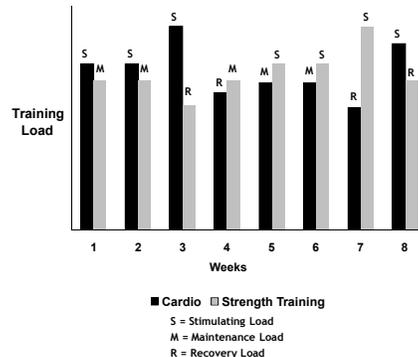
22

Mesocycle #2: Primary - Cardiovascular Endurance/Muscular Strength Secondary - Aerobic Power (VO₂max)

Week 5: 197 minutes
Week 6: 197 minutes
Week 7: 164 minutes
Week 8: 250 minutes

Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Cardio: 25 min. ST: 3 x 4-6 reps @ 90% 1RM w/3:00 rest	VO ₂ max Intervals - 10:00 warm-up - 4 x 3:00 @ 95-100% max HR w/2:00 recovery - 10:00 warm-down	Cardio: 25 min. ST: 3 x 4-6 reps @ 90% 1RM w/3:00 rest	Cardio: 35 min.	Cardio: 25 min. ST: 3 x 4-6 reps @ 90% 1RM w/3:00 rest	Rest	Cardio: 55 min.
Cardio: 25 min. ST: 3 x 4-6 reps @ 90% 1RM w/3:00 rest	VO ₂ max Intervals - 10:00 warm-up - 4 x 3:00 @ 95-100% max HR w/2:00 recovery - 10:00 warm-down	Cardio: 25 min. ST: 3 x 4-6 reps @ 90% 1RM w/3:00 rest	Cardio: 35 min.	Cardio: 25 min. ST: 3 x 4-6 reps @ 90% 1RM w/3:00 rest	Rest	Cardio: 55 min.
Cardio: 20 min. ST: 3 x 2-3 reps @ 95% 1RM w/3:00 rest	VO ₂ max Intervals - 10:00 warm-up - 3 x 3:00 @ 95-100% max HR w/2:00 recovery - 5:00 warm-down	Cardio: 20 min. ST: 3 x 2-3 reps @ 95% 1RM w/3:00 rest	Cardio: 30 min.	Cardio: 20 min. ST: 3 x 2-3 reps @ 95% 1RM w/3:00 rest	Rest	Cardio: 50 min.
Cardio: 35 min. ST: 2 x 4-6 reps @ 90% 1RM w/3:00 rest	VO ₂ max Intervals - 10:00 warm-up - 5 x 3:00 @ 95-100% max HR w/2:00 recovery - 10:00 warm-down	Cardio: 35 min. ST: 2 x 4-6 reps @ 90% 1RM w/3:00 rest	Cardio: 45 min.	Cardio: 35 min. ST: 2 x 4-6 reps @ 90% 1RM w/3:00 rest	Rest	Cardio: 65 min.

23



24

Some Final Points...

Training emphases & sequencing should be guided by:

- Client's strengths & weaknesses
 - spend more time on aspects of fitness that attend to client's strengths
- Amount of recovery needed

25

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26

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27