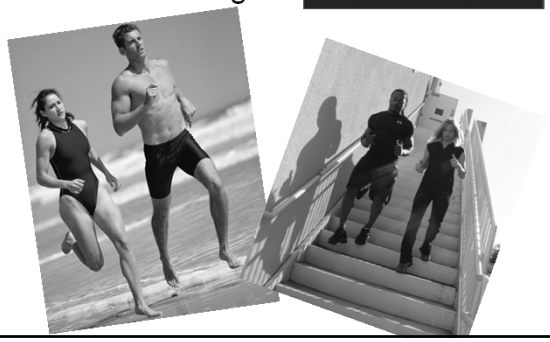
High Intensity Interval Training

EXERCISE ETC. INC.



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Why You MUST Use Intervals

- Interval Training increases total WORK performed at higher intensity resulting in:
  - Faster improvement in VO2 Max
  - Greater adaptation of Type II Muscle Fibers
  - Increased Lactate & Ventilatory Thresholds
  - Increased Weight Loss

Intervals Increase Weight Loss By:

- Increases Total Calorie Expenditure During the Workout
- Increases Fat Utilization both During and After Exercise
- Increases Excess Post-Exercise Oxygen Consumption (E.P.O.C.) – The Afterburn

What is EPOC?

Excess **P**ost-exercise **O**xygen **C**onsumption

- O_2 Consumption Necessary to Return to the Pre-Exercise Physiological Resting State
  - Replacing oxygen stores
  - Phosphagen (ATP-PC) resynthesis,
  - Lactate removal
  - The increased ventilation, blood circulation and body temperature above pre-exercise levels

Enhancing EPOC

- Studies show that EPOC is dependent on both the intensity and duration of exercise
- Current research indicates that >75% VO2 AND > 30 minutes duration is required for significant EPOC

Expend More Calories at REST

- Studies have shown increases of additional 10-160 kcals over the course of 24 hours
- What about compound effects?
  - Daily Workouts
  - Twice Daily Training
- May not be practical for less experienced or motivated client

Burn More Belly Fat!

- Increases Total Calorie Expenditure During the Workout
- Increases Fat Utilization both During and After Exercise (i.e. EPOC)
- Yes! H.I.I.T. found to reduce visceral and subcutaneous Ab Fat

Mythconceptions

- "Working out at low intensity burns more fat."
- If I work out a high level of intensity I'll burn off my muscle mass."

Caloric Burn: Sitting on Your ____

- 200 lb person
- Sitting = 68 calories burned per hour,
- ***100% of those calories are fat calories***
- If burning a maximal percentage of "fat calories" were the goal, this would be the perfect workout.

EPOC and Fat Annihilation:

132 lb (60 kg) person, 30 min of cardio

Intensity (% of VO2)	Total cals burned	Fat cals burned & % fat cals	Main substrate	EPOC 24 hrs	Fat cals & Tot cals
50% Walk, 3.5mph	126	~106 (84%)	Fat	0	106 / 126
70% Jog, 5 mph	228	~152 (66%)	Fat	0	152 / 228
80% Run, 6 mph	273	~89 (32%)	Glycogen	160	249 / 443
90% (20 sec) / 70% (40 sec) 9 mph / 5mph	298	~105	ATP / Glycogen & fat	200 ±	305 / 498

Will High Intensity Intervals REALLY Make Me Lose Muscle Mass?

- Proper rest, proper hydration & proper nutrition are the key
- Without all 3 of these components, cortisol levels may rise, resulting in increased belly fat, decreased muscularity

Before & After HIIT?

DESIGNING INTERVAL PROGRAMS Overcoming Training Thresholds

- Lactate Threshold
  - The intensity at which an abrupt increase in blood lactate occurs
    - 80-90% HRR in trained individuals
    - 50-60% HRR in untrained individuals
- Ventilatory Threshold
  - Where ventilation deviates from the linear increase
  - Breathing becomes labored
- Psychological Threshold

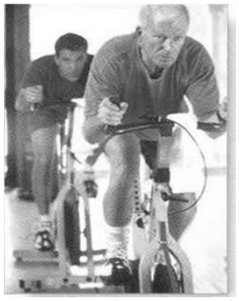
DESIGNING INTERVAL PROGRAMS

- Training Variables
  - Work
  - Rest/Recovery
  - Cycles/Repetitions
  - Sets

WORK

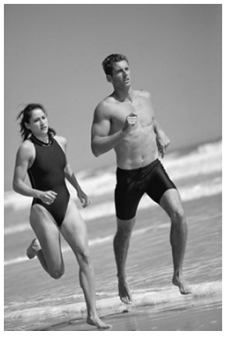
- Exercise performed at a higher intensity
- Time & Intensity factors
  - Client's goals, motivation, fitness level, health, and energy system you want to challenge (sport-specific)
- The higher the intensity the shorter the work interval

REST/RECOVERY



- Lower intensity
- The higher the work intensity, the longer the rest
- Active
- Passive

DON'T MAKE THIS MISTAKE!



- Some instructors and participants may be accustomed to or mistakenly desire continuously high work intensities
- Incomplete or inadequate rest limits the peak intensity of the subsequent intervals

REPETITIONS (Cycles)

- Refers to a complete work/rest interval
- Similar to a repetition in weight training
- Can be repeated 1-20 times

SETS

- The number of times a series of cycles will be performed in a given exercise session
- A longer rest period is given between sets

Programming Intervals Based on Energy Demands

- Phosphagen System
- Glycogen System
- Aerobic System

Phosphagen System Challenge

Substrate	Stored ATP/CP
Duration	< 30 sec.
Intensity	95% - 100% Max
Examples	100 meter sprint; power lifting
Sample Ratio	1:3 (30 sec work, 90 sec rest)

Glycogen/Lactic Acid System Challenge

Substrate	Glucose, glycogen
Duration	30 sec. –3 min.
Intensity	85% - 95% Max
Examples	400-800 meter run
Sample Ratio	1:2 (60 sec work, 120 sec rest) (120 sec work, 240 sec rest)

Aerobic System Challenge

Substrate	Fatty acids, glucose, glycogen
Duration	> 3 min.
Intensity	< 85% Max
Examples	Treadmill jog, 5 mph
Sample Ratio	1:1 (5 min work; 5 min rest)

Sample HIIT Ratios
Classic work:rest ratios = 1:1, 1:2 or 1:3

System	Work	Rest/Type	Reps	Sets
ATP/PC (Strength & Power)	0-30 sec	0-90 sec Passive	8-10	4-5
Glycogen	30-60 sec	90-180 sec Active/Passive	5	3-4
(Speed)	60-120 sec	120-360 sec Active	5	2-3
Aerobic (endurance)	2-3 min 3-5 min	2-6 min/Active 1 ½ -5 min. Active/Passive	4-6 3-6	1-2 1

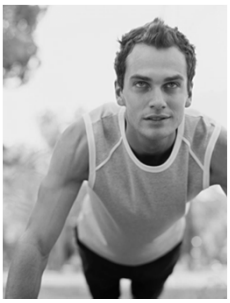
Program Considerations

- Keep it Simple!
- Allow 48 hours rest between HIIT sessions
- Modify as necessary to account for environmental factors:
  - Heat and humidity
  - altitude
  - pollen count

Basic Interval Progression

Week #	Work* **(*Duration or reps or intensity)**	Recovery
1-2	60 sec	60 sec
3-4	45 sec **(workload increases)**	60 sec
5-6	30 sec **(workload increases)**	90 sec
7-8	30 sec **(workload unchanged)**	60 sec
9-10	30 sec **(workload unchanged)**	30 sec
11-12	30 sec **(workload unchanged)**	15 sec

High Intensity Interval Progressions



- Progressively Reduce the Rest Interval
- Progressively Increase Intensity
- String together sets of short-burst intervals
  - Do the MOST intense circuit 1st!

Beginner Interval Program
35 year old woman, RHR = 75

- On the treadmill….

-5 min.Warm-up
(40% HHR = 119 BPM)
-5 min jog
(70% HHR = 152 BPM)
-5 min. walk
(50% HRR = 130 BPM)
-Repeat 3x's
-5 min. cool-down

Sample Treadmill Program

week	*work*	*rest*	*cycles*
1-2	3 mph; 1 min	2.5 mph; 3 min	10
3-4	3 mph; 90 sec	2.5 mph; 2 ½ min	10
5-6	3 mph; 2 min	2.5 mph; 2 min	10
7-8	3.0 mph; 2 ½ min	2.5 mph; 90 sec	10
9-10	3 mph; 3 min	2.5 mph; 1 min	10
11-12	3 mph; 3 ½ min	2.5 mph; 30 sec	10

Intermediate Interval Program
35 year old woman, RHR = 60

- On the treadmill….

  -5 min. Warm-up
  (50% HRR = 122 BPM)
  -2 min run
  (80% HRR = 160 BPM)
  -4 min. jog
  (70% HRR = 148 BPM)
  -Repeat 3x's
  -5 min. cool-down

Treadmill Intervals

- Incline Training
- Recovery
  - Comfortable Speed 3 min.; 0 % grade
- Work Interval
  - Same Speed
  - 2% grade for 1 minute
  - 4% grade for 1 minute
  - 6% grade for 1 minute

- Speed Training
- Recovery
  - Comfortable Speed 3 min.; 0 % grade
- Work Interval
  - Same Grade
  - ↑ speed 1/2 mph 1 min
  - ↑ speed 1/2 mph 1 min
  - ↑ speed 1/2 mph 1 min

Advanced Interval Program
35 year old woman, RHR = 45

- On the treadmill….

  -5 min. Warm-up
  (50% HRR = 115 BPM)
  -20 sec run
  (95% HRR = 178 BPM)
  -40 sec. jog
  (75% HRR = 150 BPM)
  -Repeat 10 x's
  -5 min. cool-down

Group Fitness Intervals

- Adding Intensity
  - Increase movement speed
  - Add traveling moves
  - Increase ROM, use longer levers
  - Add propulsions

GROUP FITNESS: AEROBIC INTERVAL

Type	Intensity % HRR	Time
Work: High/low or Step	> 75% RPE 14 – 16	3 – 4 minutes
Rest: Low impact Low level step	60 – 70 % RPE 12 - 13	3 – 4 minutes

GROUP FITNESS: ANAEROBIC INTERVALs

Type	Intensity % HRR	Time
Work: Power step or Hi impact aerobics	> 85% RPE 15 - 18	30 – 90 sec.
Rest: Low intensity step Low impact	70 – 75% RPE 12 - 14	90 seconds - 3 minute

GROUP TRAINING CIRCUIT

Station 1 Lateral Hops Over Step	**Station 2** Push Ups	**Station 3** Resisted Squats
Station 4 Leg Raises	**Station 5** Rope Jumping	**Station 6** Inverted Pull-Ups or Alternating DB Rows
Station 7 Mountain Climbers	**Station 8** Tubing Triceps Pressdown	**Station 9** Bridge Marching

- Instructor determines time spent and rest between stations
- After 1 complete Circuit, rest 3-5 minutes
- Repeat 1 to 2 times

Non-traditional Group Fitness Intervals

- Squat thrusts
- Jumping jacks
- Walking lunges
- Burpees
- Squat w/ OH Press
- Rope jumping
- Farmer's walk
- Push-ups
- Squat jumps
- Mountain climbers

High Intensity Interval Variations

1. Pyramids
2. Ladders
3. Mixed Interval Circuit
4. Partner Intervals
5. Building Block Intervals
6. Tabata Intervals

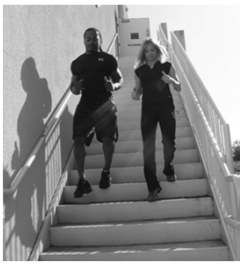
1) Designing Pyramid Intervals

- Ascending Pyramid
  - Increase Repetitions, Duration, or Load with each Consecutive Set
- Descending Pyramid
  - Decrease Repetitions, Duration or Load with each Consecutive Set
- Adjust Rest Intervals Accordingly

Ascending Pyramid

- Run 1 flight of stairs; Rest 30 sec
  - 5 Push-Ups; Rest 30 s
- Run 2 flight of stairs; Rest 60 sec
  - 10 Push-Ups; Rest 60 sec
- Run 3 flight of stairs; Rest 90 sec
  - 15 Push-Ups; Rest 90 sec

Descending Pyramids



- Skating Lunges 60 s, Rest 10 sec
  - 15 Chair Dips; Rest 10 sec
- Skating Lunges 40 sec; Rest 20 sec
  - 12 Chair Dips; Rest 20 sec
- Skating Lunges 20 sec; Rest 30 sec
  - 9 Chair Dips; Rest 3 min

2) Ascending/Descending Ladders

- Jump Rope in seconds
  - 30 – 50 – 70 – 50 – 30
- Abdominal Crunches in repetitions
  - 20 – 25 – 30 – 25 - 20
- Stair Climbing (up & down 1 flight)
  - 1 – 2 – 3 – 2 - 1

3) Mixed Interval Circuit for PTs

Set	Exercise	Work	Rest
1	Push-Ups	30 sec	15 sec
2	KB Squats	60 sec	30 sec
3	Jump Rope	90 sec	45 sec
4	Cycling	2 min	60 sec
5	Run / Jog	3 min	90 sec

Rest is Active (i.e. jog/walk or other activity during rest interval)

3) Mixed Interval Circuit for GFIs

Set	Exercise	Work	Rest
1	Push-Ups on step	30 sec	15 sec
2	Squats from the step	60 sec	30 sec
3	Lunges off the step	90 sec	45 sec
4	Mountain Climbers from step	2 min	60 sec

*Rest is Active (i.e. jog/walk during rest interval)
*Repeat 2 times for 15 minute interval program

4) Partner Intervals

- Partner A Completes an Exercise for Time
  - Shuttle Runs, Squats, Thrusters, Mountain Climbers?

- Partner B Holds Static Position Until Partner A Completes His/Her Set
  - Planks, Bridges, Pillars

Partner Interval Pyramid

- Partner A: 20 Lunges
  - Partner B: High Push-Up ISO
- Partner A: 20 Squats
  - Partner B: Plank
- Partner A: 20 Squat Jumps
  - Partner B: Low Push-Up ISO

5) Building Block Intervals

- Select up to 4 or 5 exercises
- Choose a duration
  - Repetitions or Time
- Add an exercise to each block
- Rest 10-20 sec between exercises
- Rest 1 to 3 minutes between blocks

Example

- Exercise #1, Rest 30 sec
- Exercise #1 & 2, Rest 45 sec
- Exercise #1, 2, & 3, Rest 60 sec
- Exercise #1, 2, 3, & 4, Rest 90 sec

Building Block Intervals: Sample

Set	Squat Thrusts	Jumping Rope	Mountain Climbers	Walking Lunges
1	30 secs	•**Rest 10 seconds between sets**		
2	25 secs	30 secs	•**Rest 1-3 minutes between blocks**	
3	20 secs	25 secs	30 secs	
4	15 secs	20 secs	25 secs	30 secs
5	10 secs	15 secs	20 secs	25 secs

6) Ultimate Intervals: The 4-Minute ("Tabata") Workout

- **More effective time management**
- **Burn fat more effectively by:**
  - Enhancement of EPOC
  - Improving Hormonal Balance
- **Increase muscle development & bone health**
- **Improve athletic performance by:**
  - Improving VO_2max & Anaerobic Capacity
  - Reducing training volume

The 4-Minute Workout:
Original Tabata Protocol

- Done on Cycle Ergometer
- Control group: 4 days per week, 30 min per session, $\leq$ 75% VO2
- Test group: 3 days per week, 4 minute per session, intensity $\geq$ 85% VO2 and 1 day per week 30 min per session, $\leq$ 75% VO2

Results

- After 6 weeks --
- Control Group
  - Increased VO2 Max by approx 8%
  - No anaerobic increase
- Test Group
  - Increased VO_2max by approx 13%
  - Increased anaerobic capacity by approx 28%

Designing 4-Minute Drills

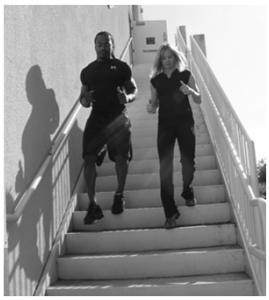
- Choose 1 exercise
  - May utilize body weight
  - May utilize light weight: 25 – 40% 1 RM
- Technique
  - Perform as many perfect, full ROM reps as possible in 20 secs
  - Rest for 10 secs
  - Perform 8 sets, for a total of 4 minutes per drill

Suggested 4-minute Drill: Push-ups

- Do either straight leg or bent knee, but keep form consistent during drill
- Localized tricep fatique is the limiting factor
- Watch form; client may rest in the “up” position

Also Try:

- Stair climbing
- Sprints
- Shuffles
- Mountain climbers
- Squats (light resistance)
- Med ball slams
- Inverted Pull-ups



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