The Masters Athlete

Tricks to Keep Your Aging Patients Moving

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- I have no conflicts of interest to disclose

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Today's Lecture

- Demographics
- Preparing for Exercise in the Masters Athlete
- Orthopedic Issues for the Masters Athlete
- Treatment Plans for the Masters Athlete in Your Practice

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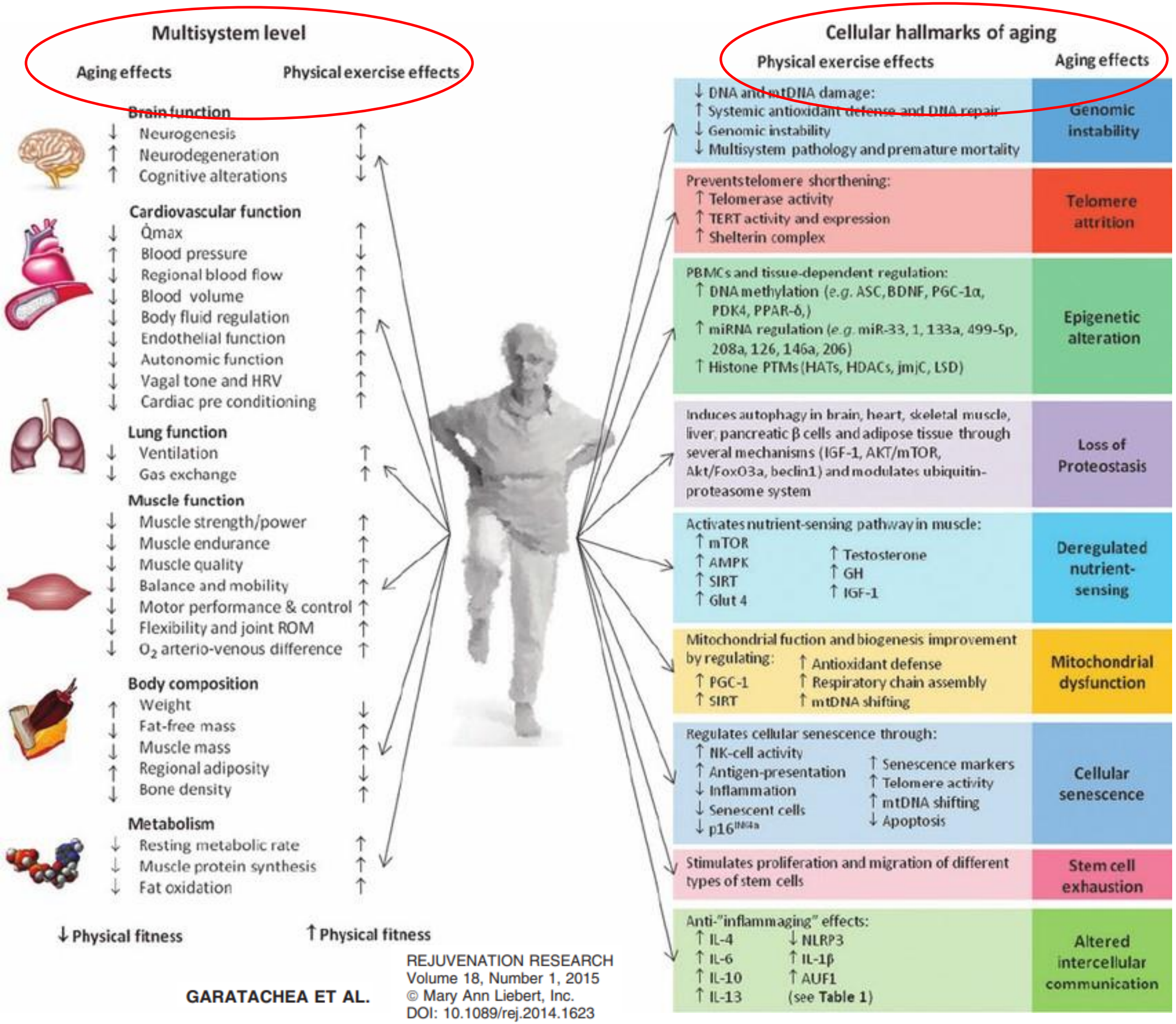

GARATACHEA ET AL.

REJUVENATION RESEARCH
Volume 18, Number 1, 2015

DOI: 10.1089/rej.2014.1623

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Who Is the Masters Athlete?

- A master athlete is an athlete who competes in a particular sport or discipline at a high level of proficiency, usually after the **age of 35!** (What?!)

Sports Health 2015. doi: 10.1177/1941738114548999

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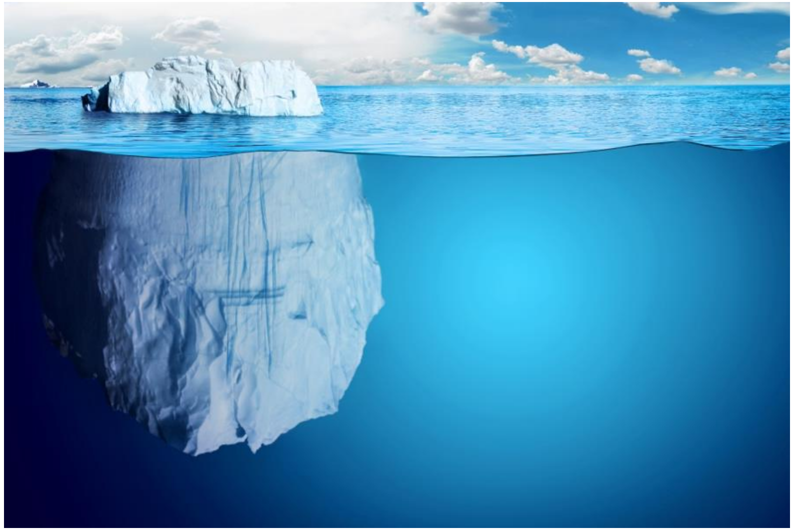
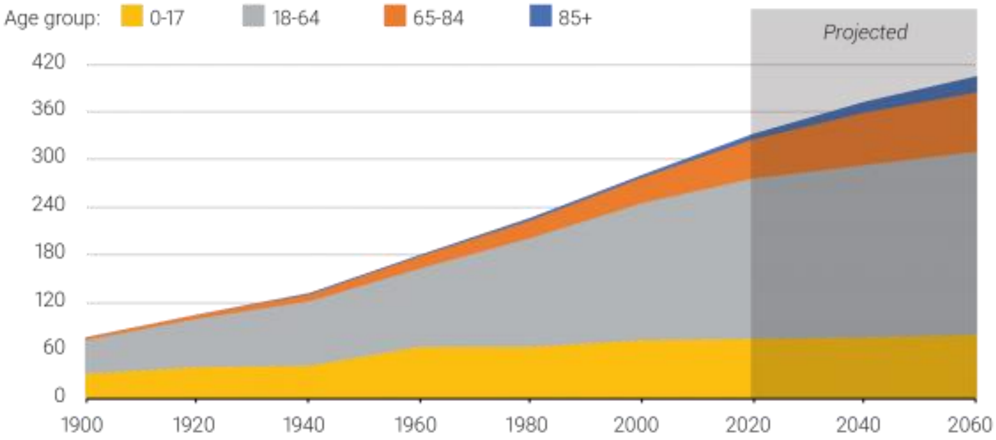
USA Trends

6.9% of the population in 2000 to a projected 19.3% by 2050





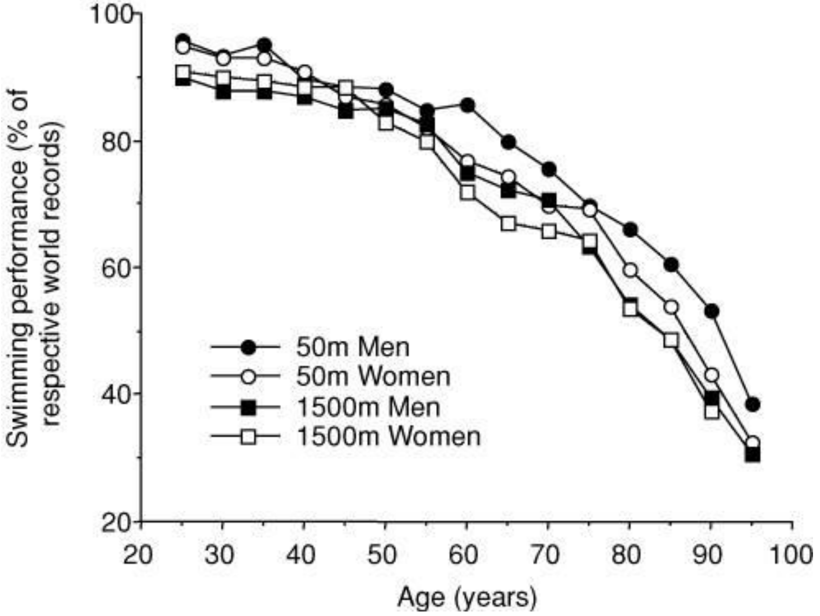
Population Research Bureau, 2022

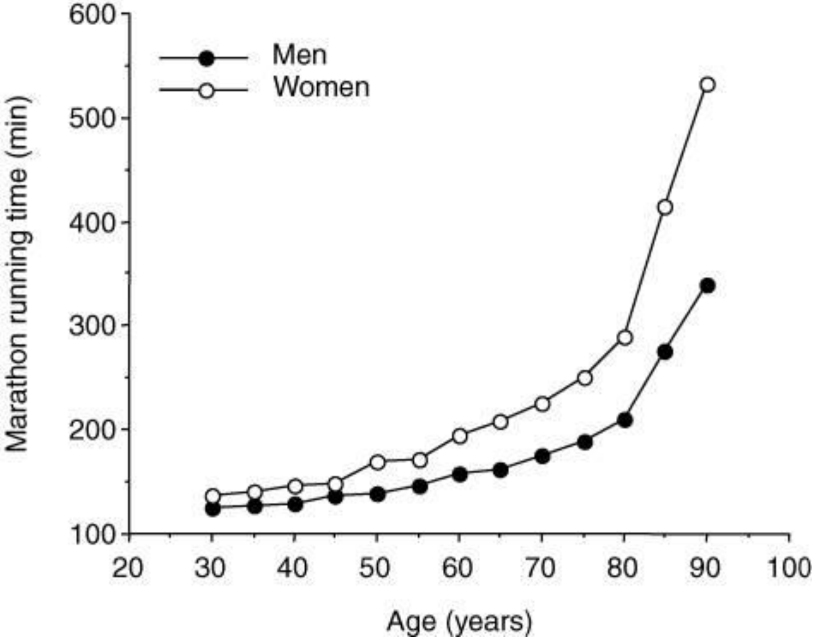
Sports With Masters Divisions

- National Senior Games > 10,000
- Cross Fit
- Ball/Racquet sports
- Running/Triathlon
- Spartan
- Strongman
- Boxing
- Body Building

https://doi.org/10.1136/bmjsem-2018-000370 BJSM 2019

Aging and Elite-Level Sports Performance





doi: 10.1113/jphysiol.2007.141879

Overall Improvement in Athletic Performance

Comparison of 1896 Olympic winning times in running events and current Masters records that surpass those winning times (from ESPN and World Masters Records)

Running events	1896 Olympic winning time (from the first Olympic games in Athens)	Current age-group records that surpass 1896 Olympic times and age at which these records were achieved
100 m (s)	12.0	11.7 (61 years)
200 m (s)	22.2	22.1 (46 years)
400 m (s)	54.2	53.9 (63 years)
800 m (min:s)	2:11.0	2:10.4 (60 years)
1500 m (min:s)	4:33:2	4:27:7 (60 years)
Marathon (h:min:s)	2:58:50	2:54:5 (73 years)

doi: 10.1113/jphysiol.2007.141879

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Preparing the Masters Athlete for Sport

Recommendations for Preparticipation Screening and the Assessment of Cardiovascular Disease in Masters Athletes

An Advisory for Healthcare Professionals From the Working Groups of the World Heart Federation, the International Federation of Sports Medicine, and the American Heart Association Committee on Exercise, Cardiac Rehabilitation, and Prevention

Barry J. Maron, Claudio Gil S. Araújo, Paul D. Thompson, Gerald F. Fletcher, Antonio Bayés de Luna, Jerome L. Fleg, Antonio Pelliccia, Gary J. Balady, Francesco Furlanello, Steven P. Van Camp, Roberto Elosua, Bernard R. Chaitman and Terry L. Bazzarre

- Risk for sudden cardiac death in the range of **1:15,000 joggers** per year or **1:50,000** participants in marathons, with a marked predominance of **deaths in men**
- Young high school and college-aged athletes has been calculated to be ≈1:200 000 to 1:300 000 per academic year
- ECG for athletes > 45
- ECG + Exercise Testing with symptoms or - Men > 45 and Women > 55 with: hypercholesterolemia, dyslipidemia (total cholesterol >200 mg/dL; elevated low-density lipoprotein [LDL] cholesterol [>130 mg/dL]; systemic hypertension (systolic blood pressure >140 mm Hg or diastolic pressure >90 mm Hg); current or recent cigarette smoking; diabetes mellitus (fasting plasma glucose ≥126 mg/dL or treatment with insulin or oral hypoglycemics); history of myocardial infarction or sudden cardiac death in a first-degree relative <60 years old

doi.org/10.1161/01.CIR.103.2.327 Circulation. 2001

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Cardiovascular Risk Assessment in the Older Athlete

- In adult athletes ≥35 years old, CAD is the primary cause of major adverse cardiovascular events.
- A CAC scan quantifies the burden of calcified atherosclerotic plaque and provides important prognostic value.
- A comprehensive risk assessment for CVD in older athletes includes a review of conventional risk markers, physical examination, 12-lead ECG, and CAC score.
- 10-year risk of ASCVD should be estimated for adult athletes using a validated risk calculator such as the ACC/AHA, Astro-CHARM, or MESA calculators.
- CAC scoring or risk-enhancing factors such as hsCRP and Lp(a) may be used to reclassify or revise the risk assessment.
- Studies of endurance athletes not only demonstrate higher prevalence of CAC compared with nonathletes but also suggest coronary plaque composition in athletes is more stable and may not confer the same risk.
- Lifestyle interventions are recommended to optimize cardiovascular health.
- Blood pressure should be optimally controlled to reduce CVD risk.
- Statin therapy is recommended if 10-year risk of ASCVD is ≥10% and considered if risk is ≥7.5%.
- Low-dose aspirin 75-100 mg daily can be considered for athletes with high ASCVD risk and low bleeding risk.
- Stress testing is recommended for athletes with symptoms concerning for ischemic heart disease.
- Stress testing may be considered for asymptomatic athletes with high ASCVD risk (eg, markedly elevated CAC score ≥400).
- Echocardiography or cardiac MRI is recommended for athletes with physical examination or ECG abnormalities concerning for valvular heart disease or cardiomyopathy.

doi: 10.1016/j.jacc.2015.08.035 2016

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Preparing for Competition: Masters Athlete Screening Study

- 5-year prospective screening study (Canada)
- Checking for CVD and MACE (major adverse cardiac events)
- 798 athletes, all sports, screened annually
- Anthropometrics, blood pressure, resting electrocardiogram, modified American Heart Association 14-element recommendations, cardiovascular event questionnaire, physical examination
- Abnormal screen according to the European Association of Cardiovascular Prevention and Canadian Cardiology Society Guidelines underwent further evaluations

https://doi.org/10.1093/eurheartj/ehab724.27060 2021

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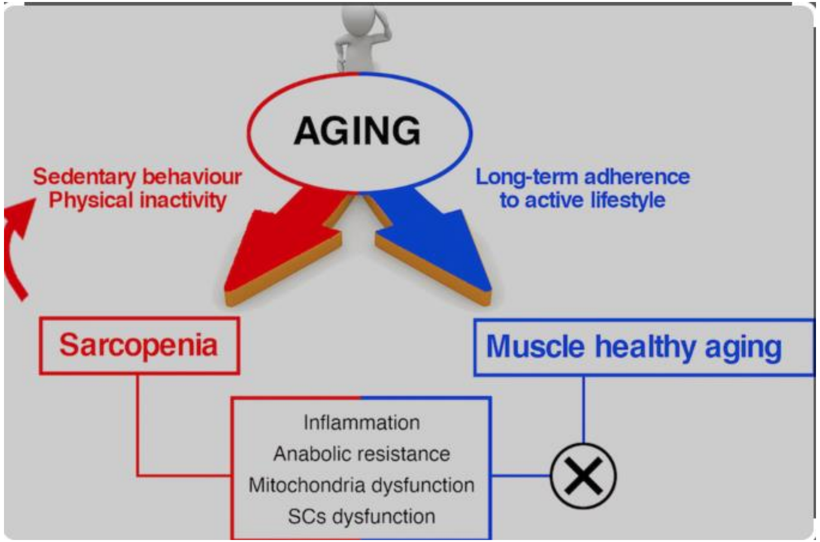
Preparing for Competition: Masters Athlete Screening Study

- 798 masters athletes (62.7% male, 54.6±9.5 years) were screened; 91 (11.4%) of the cohort were found to have CVD. CAD was the most common diagnosis (69.2%)
- During the following four years, there were an additional 89 CVD diagnoses with an incidence rate of 3.58/100, 4.14/100, 3.74/100, 1.19/100, for years two to five, respectively.
- A total of 10 MACE occurred (two cardiovascular deaths, five myocardial infarctions and three cerebrovascular accidents). All events occurred in male athletes (63.6±12.5 years).
- **Yearly cardiovascular screening of masters athletes identified ~3 new diagnoses per 100 athletes per year. Ten MACE occurred despite yearly screening and high CV fitness of masters athletes.**

https://doi.org/10.1093/eurheartj/ehab724.27060 2021

MSK Screening for Masters Athletes

- Skeletal muscle is 40% of body mass
- Sarcopenia has both functional and metabolic implications
- Resistance training increases muscle mass, strength, and fiber hypertrophy
- Mitochondrial density and maximal oxygen uptake increases with endurance training



doi: 10.3390/nu12092869 2020

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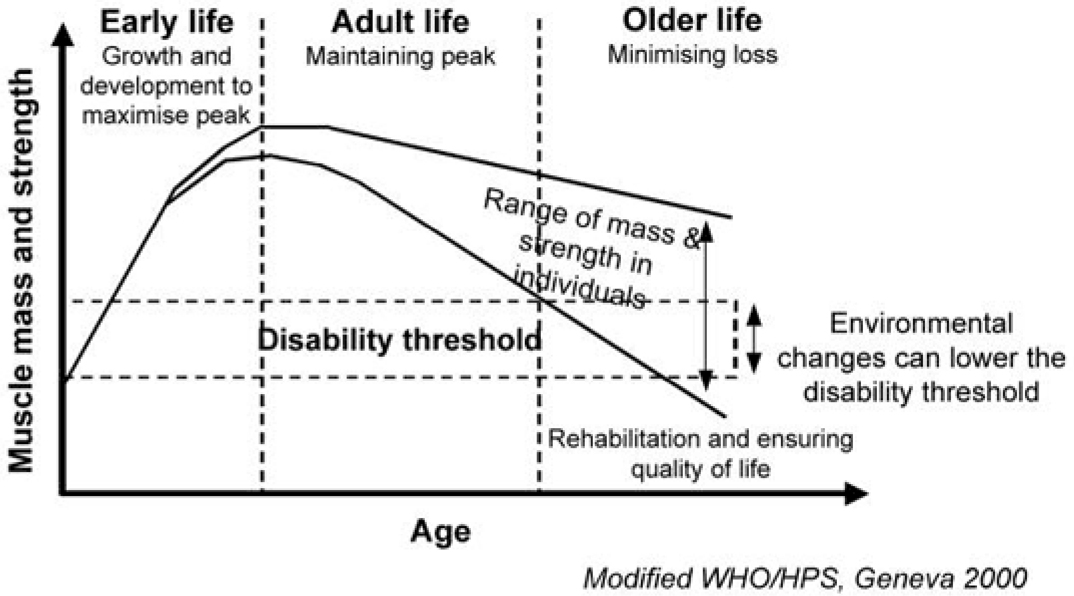
Age-related Sarcopenia

- The average human will lose 40% of their muscle mass between the ages of 30-60.
- After 60, sarcopenia progresses at 40% loss/decade



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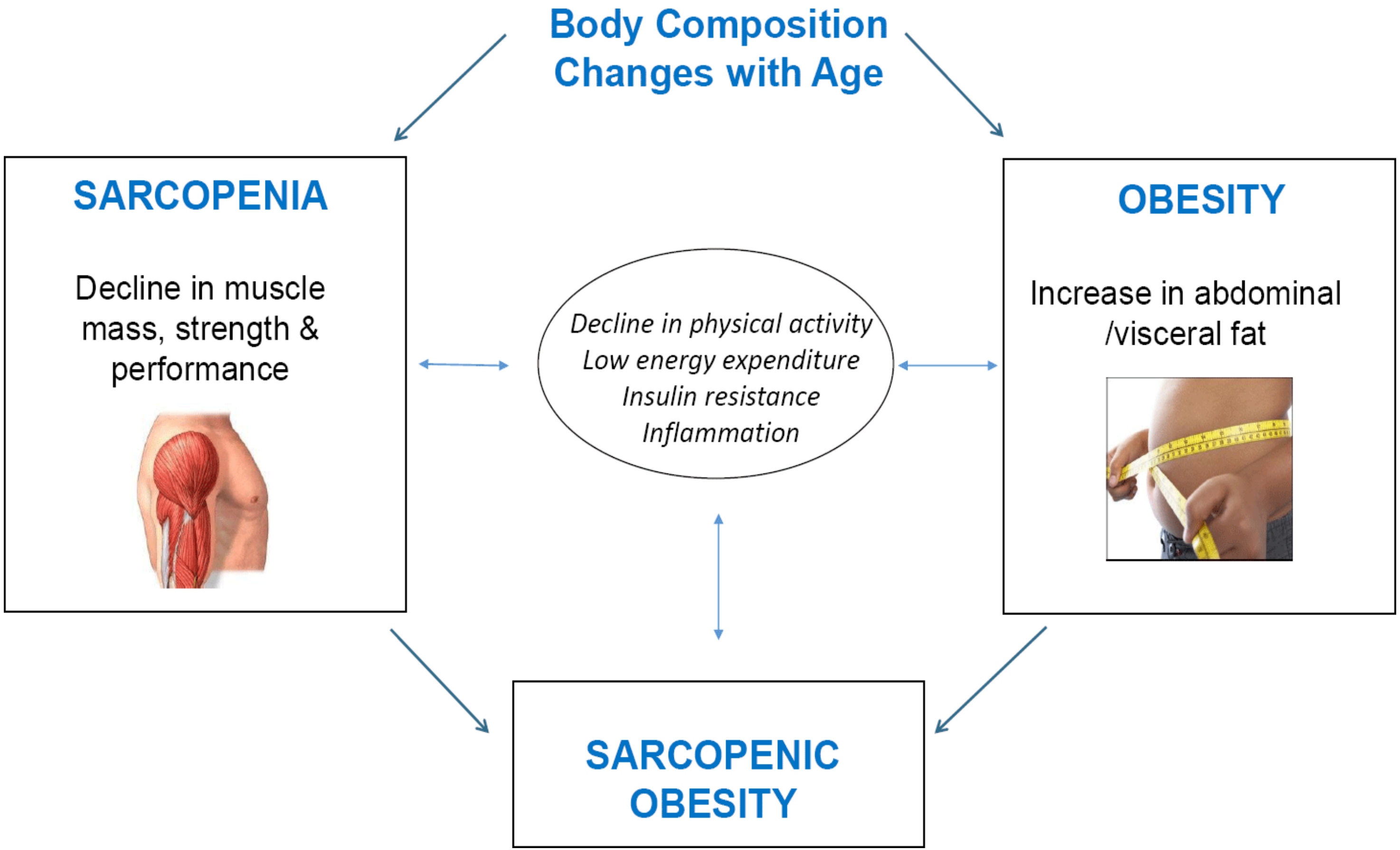

eBioMedicine 2019 49381-388DOI: (10.1016/j.ebiom.2019.10.034)

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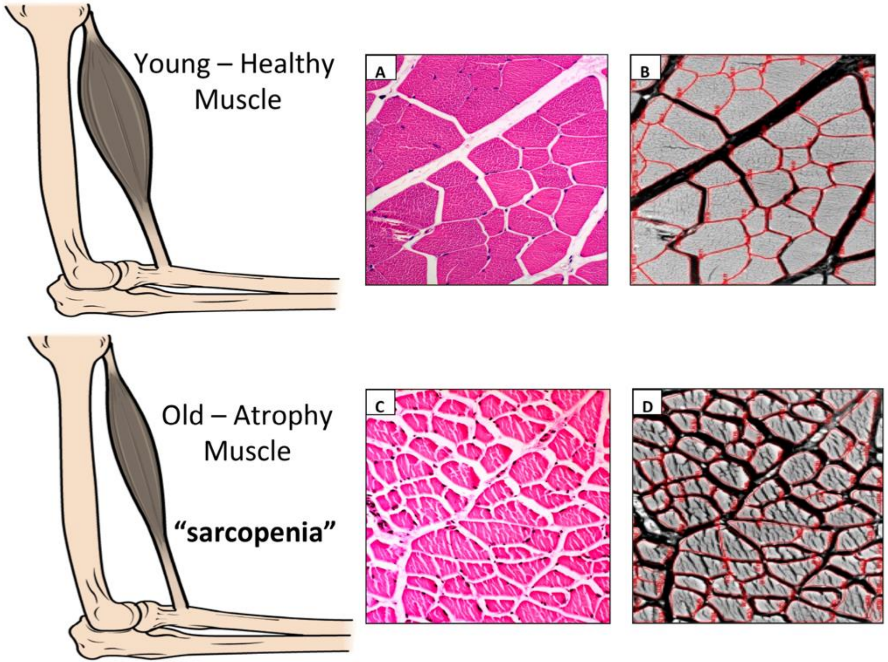
Age-Related Sarcopenia



doi.org/10.3390/jfmk2040040 2019

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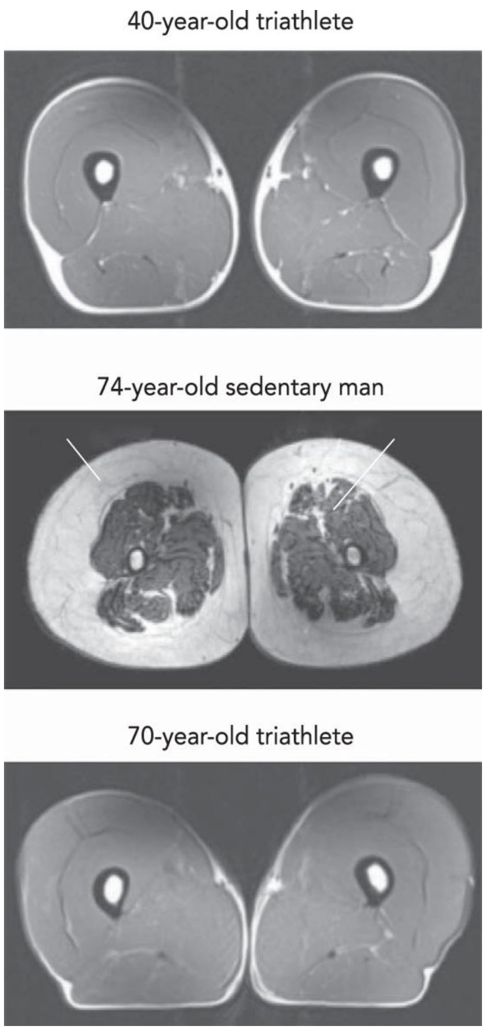

DOI: (10.1152/physiol.00029.2016)

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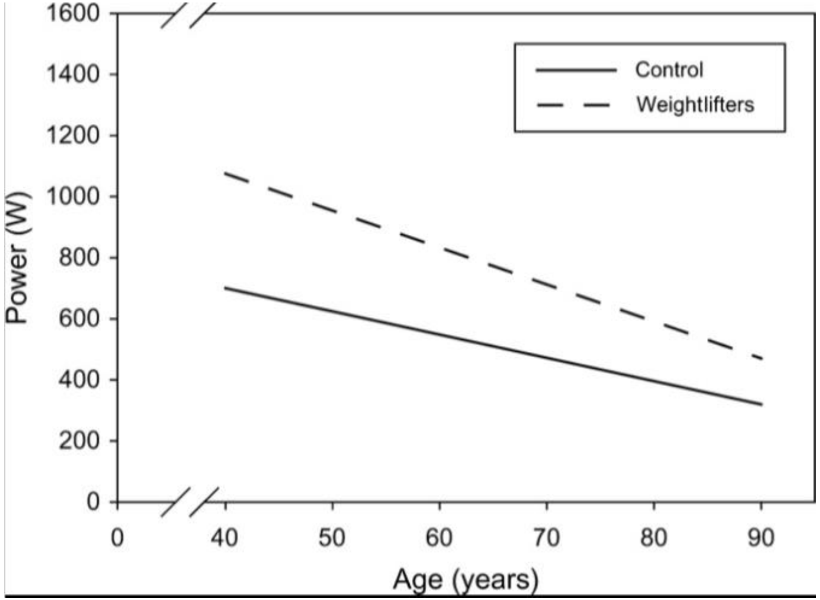
Strength Loss with Aging

- Loss of muscle fibers occurs with aging beyond 50 (Falkner, 2009)
- Repetitive strength training encourages muscle hypertrophy at any age (Pearson, 2022)
- Type II muscle fiber loss > Type I with aging (Khadeserian, 1998)



DOI: 10.1097/JSM.0b013e3181845f1c, 1998

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Muscle Fiber Types

	Type I fibers	Type II a fibers	Type II x fibers	Type II b fibers
Contraction time	Slow	Moderately Fast	Fast	Very fast
Size of motor neuron	Small	Medium	Large	Very large
Resistance to fatigue	High	Fairly high	Intermediate	Low
Activity Used for	Aerobic	Long-term anaerobic	Short-term anaerobic	Short-term anaerobic
Maximum duration of use	Hours	<30 minutes	<5 minutes	<1 minute
Power produced	Low	Medium	High	Very high
Mitochondrial density	High	High	Medium	Low
Capillary density	High	Intermediate	Low	Low
Oxidative capacity	High	High	Intermediate	Low
Glycolytic capacity	Low	High	High	High
Major storage fuel	Triglycerides	Creatine phosphate, glycogen	Creatine phosphate, glycogen	Creatine phosphate, glycogen
Myosin heavy chain, human genes	MYH7	MYH2	MYH1	MYH4

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Common MSK Issues in the Masters Athlete

- Muscle/Tendon
  - Tendonitis
  - Tendonosis
  - Partial Tear
  - Rupture
- Ligament
- Bone
  - Osteoarthritis
  - Bone Insufficiency

Principles for Assessment of MSK Injury in Masters Athlete

- Evaluate locally, think globally
- Make sure you aren't creating a bigger problem (rest=rust)
- Beware MRI findings
- Consider cause and prevention strategies

Don't Miss the Forrest for the Trees

What is Your Goal and Role in Primary Care?

Physical Activity Guidelines 2023

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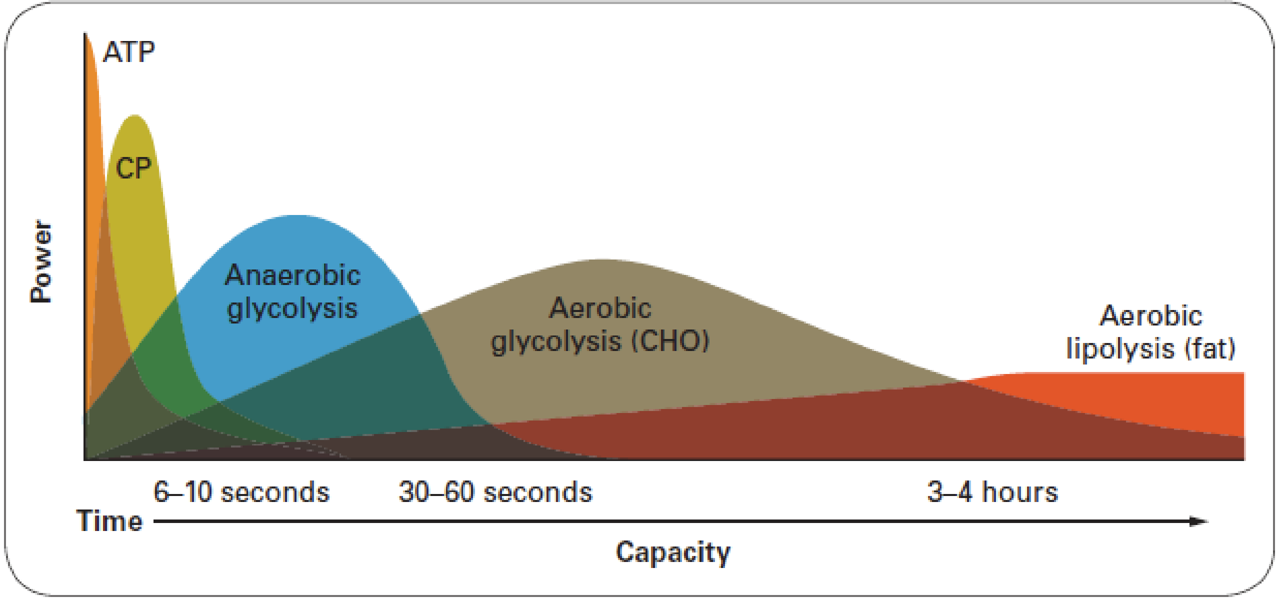
Fitness Resources

- Cardio (2-3x/week)
- Strength (2-3x/week)
- Balance (2-3x/week)
    - In-Person
    - Virtual

What About Exercise Intensity?

Energy Systems



Your Prescription for Health
ExeRcise is Medicine®

Name: ______________________________ Date: _______________

❑ Aerobic Activity

Type: Walk Run Swim Bike Other_______________

Frequency (days/week): 2 3 4 5 6 7

Intensity: Light (A Casual Walk) Moderate (A Brisk Walk) Vigorous (Jogging or Running)

Time (minutes/day): 10 20 30 60 60 or more

Steps/day: 2,500 5,000 7,500 10,000 10,000 or more

❑ Strength Training

- Muscle strengthening should be done at least two days per week
- Exercise should be done to strengthen all major muscle groups: legs, hips, back, chest, abdomen, shoulder, arms
- For each exercise, 8-12 repetitions should be completed
- Examples: push-ups, pull-ups, sit-ups, and lunges

Physician Signature: _________________________

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Physiologic Capacity and Aging

Oxygen consumption and its determinants at maximal exercise in endurance exercise-trained men

	Young men (28 years)	Older men (60 years)	Age-related change (%)
Oxygen consumption (ml kg^{-1} min^{-1})	68.2	49.4	28
Cardiac output (l min^{-1})	27.0	21.7	20
Stroke volume (ml $beat^{-1}$)	147	132	10
Heart rate (beats min^{-1})	184	165	10
a–v O_2 difference (ml $(100\ ml)^{-1}$)	16.7	15.2	8

The data were compiled from four studies in which values for all of the variables were reported in groups of young and older groups (Grimby *et al.* 1966; Hagberg *et al.* 1985; Rivera *et al.* 1989; Ogawa *et al.* 1992).

doi: 10.1113/jphysiol.2007.141879

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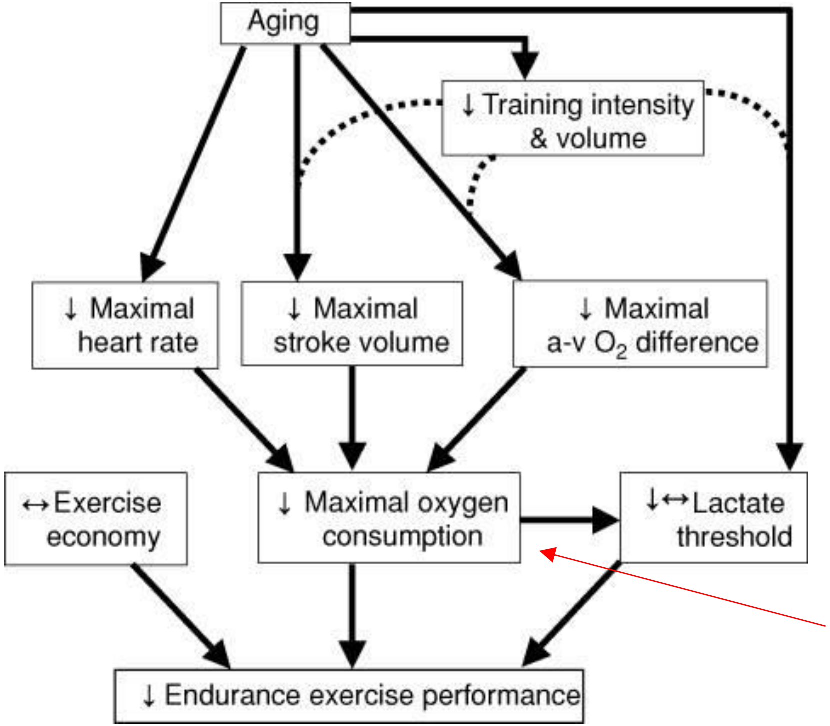
Aging and Physiologic Capacity

Exercise economy: the steady-state oxygen consumption while exercising at a specific submaximal exercise intensity below the lactate threshold



The ability to sustain a high fraction of one's maximal oxygen consumption during submaximal exercise

Maximal oxygen consumption, the upper limit of energy production

doi: 10.1113/jphysiol.2007.141879

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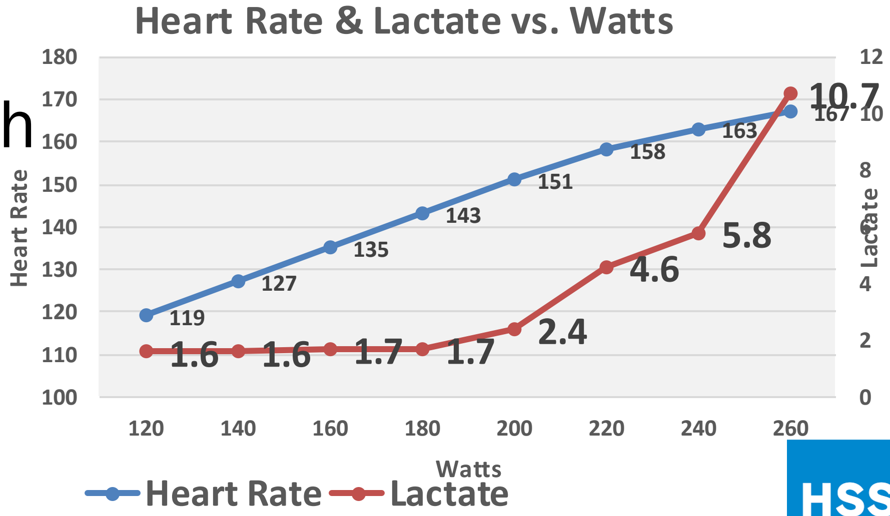
Lactate Threshold

- The point during exercise of increasing intensity at which lactate levels begin to rise disproportionately
- Occurs at 50% of VO_2Max in untrained people
- Can be increased to 85-90% with training
- <u>**Maximum sustainable workload**</u>



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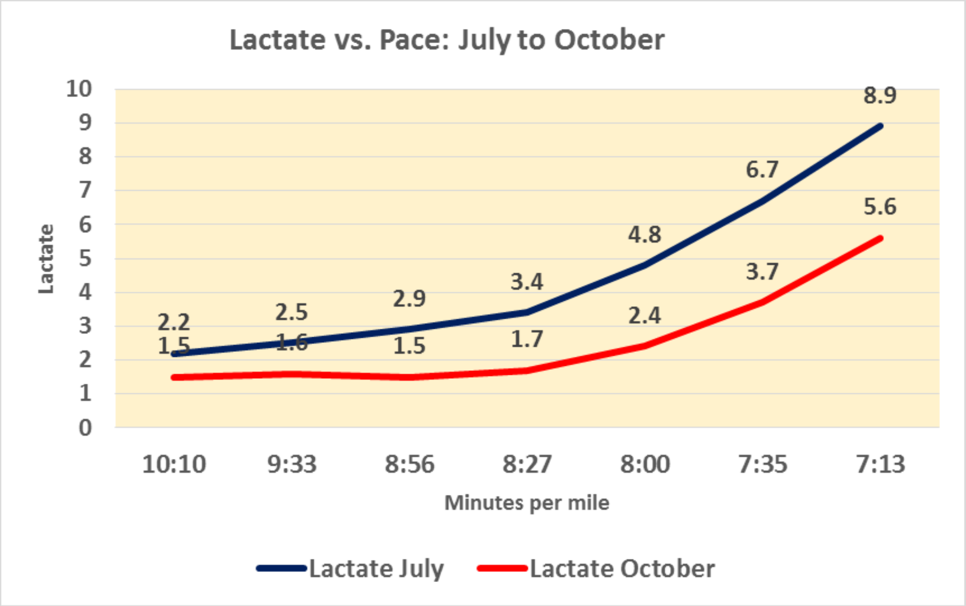
Raising Lactate Threshold

- Accumulate volume at maximal steady state as well as high intensity intervals
- **Push it up**
  - Tempo workouts
  - “comfortably hard”
- **Pull it up**
  - High intensity Intervals



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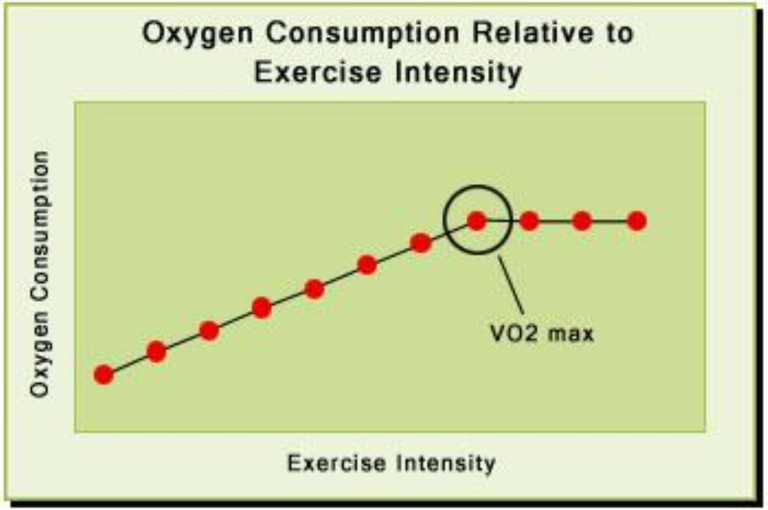
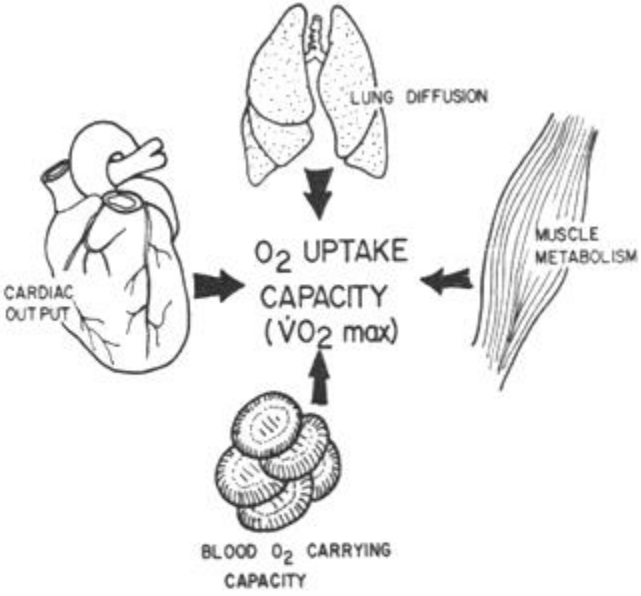
Maximum VO_2

- VO_2 Max = *the maximum amount of oxygen able to be used during exhaustive exercise*





$$VO_2 = CO \times (a\text{-}vO_2)$$

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Maximum VO_2 Values

- 30-39 year old, average
  - Male = 42ml/kg/min
  - Female= 37 ml/kg/min
- 40-49 year old, average
  - Male = 40ml/kg/min
  - Female = 34ml/kg/min
- 50-59 year old, average
  - Male = 37ml/kg/min
  - Female = 31ml/kg/min
- 70-79 year old, average
  - Male = 31 ml/kg/min
  - Female = 28 ml/kg/min
- Heart Transplant candidates
  - ≤14ml/kg/min

Elite endurance athletes
60-80ml/kg/min

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What is HIIT?

0	Rest
1	Really Easy
2	Easy
3	Moderate
4	Sort of Hard
5	Hard
6	
7	Really Hard
8	
9	Really, Really, Hard

HIIT = 90-95% of Peak Heart Rate for short bursts of activity (5-60 seconds) [*ACSM – 2019*]

- Peak Heart Rate – 220 – age
- *or*
- 211 – 0.64 x Age

Example: (211 – (.64 x 50)) = 179

Max HR = 179 x.9 = 161

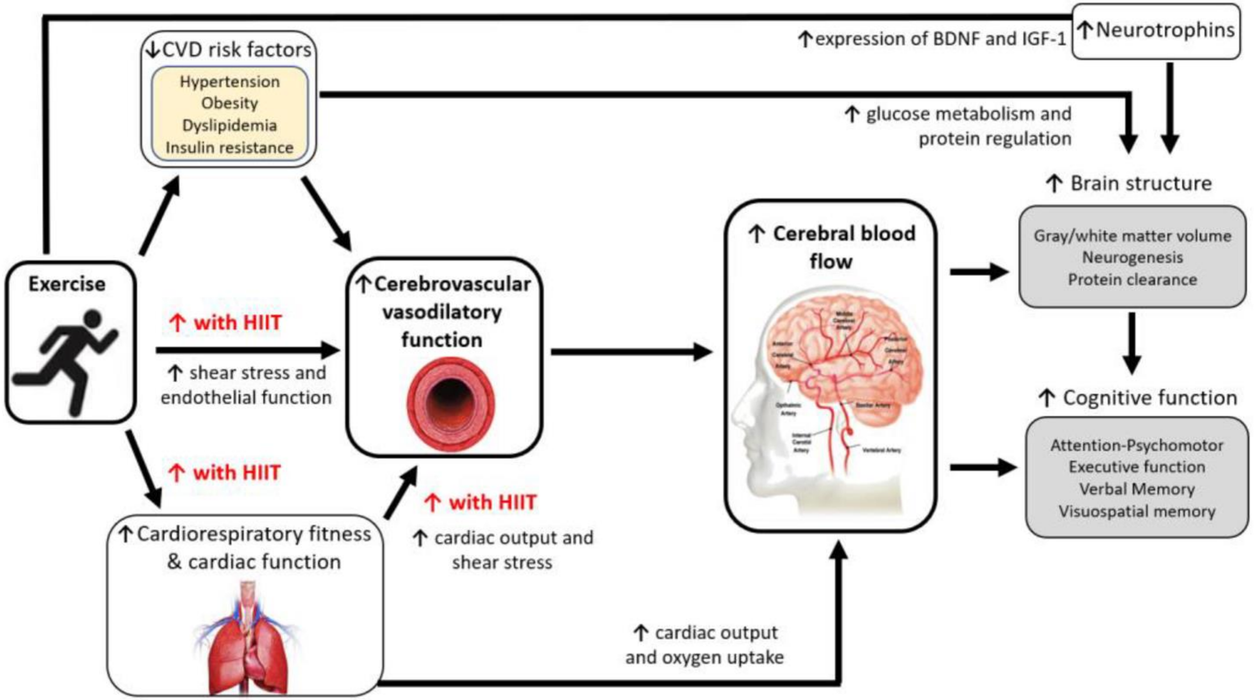
Who can HIIT It?

- All ages
- All shapes and sizes
- All athletes have different physical and metabolic limitations
- Can evolve over time

HIIT in Older Adults

- HIIT increases VO2 max in subjects > 65 y/o (Marriot 2021)
- HIIT maintains cardiopulmonary fitness in subjects 45-65 (Alzar 2022)
- HIIT maintains functional movement in subjects > 65 (Stern 2023)
- HIIT more effective than moderate intensity exercise in adults > 65 (Marriot 2021)

Multi-System Benefits of Exercise Intensity



doi.org/10.3390/ijerph192416926 2022

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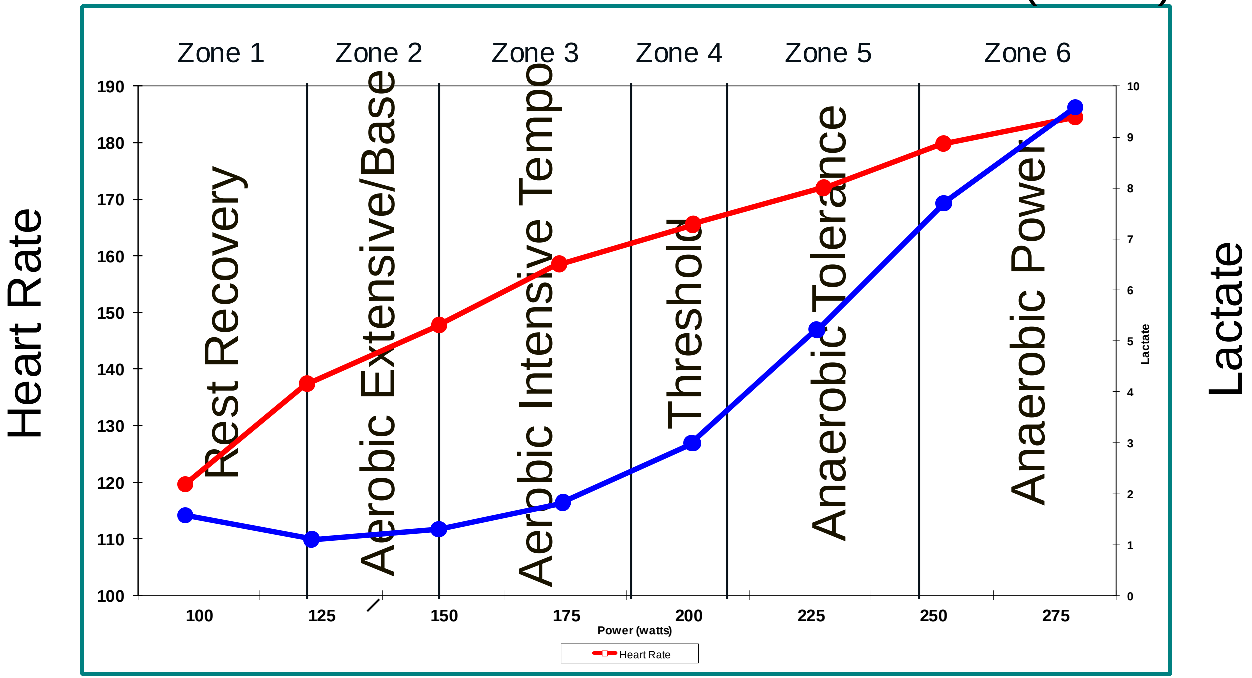
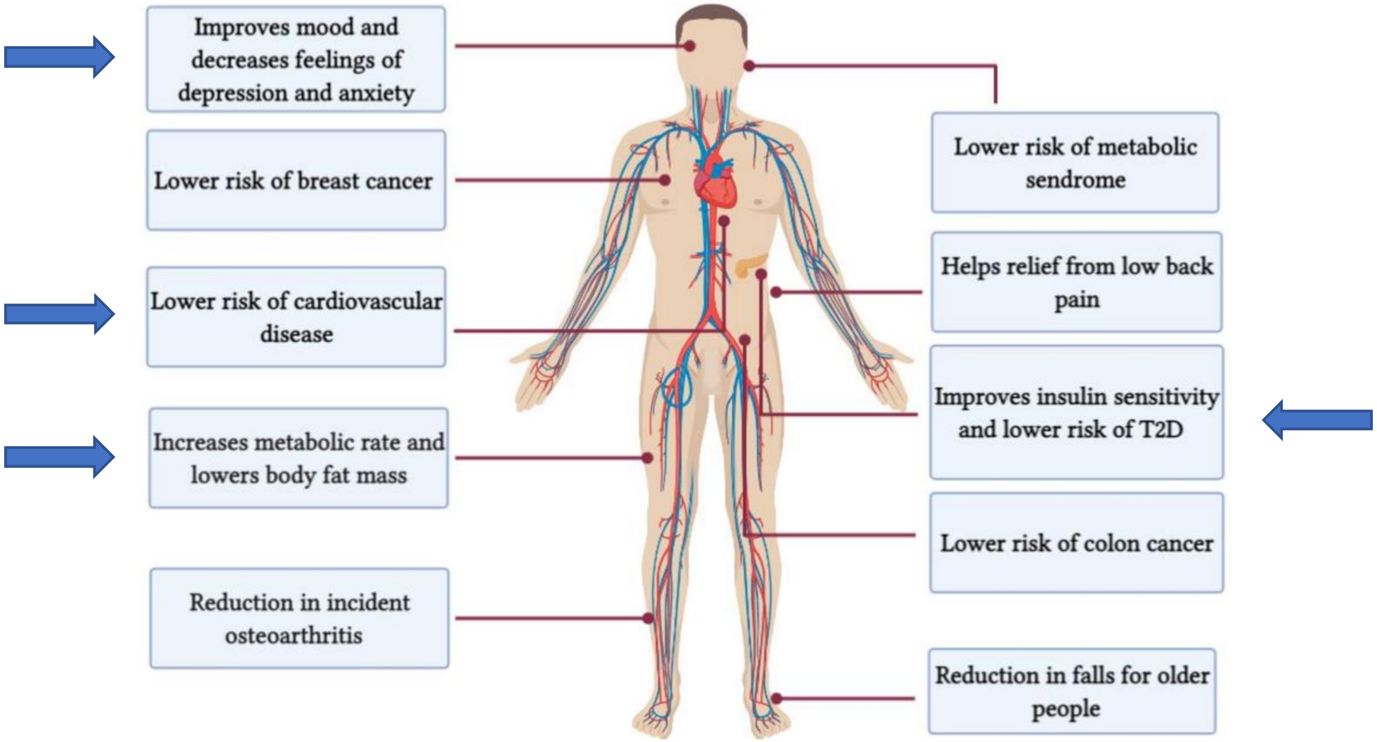
Heart Rate & Lactate vs. Power (Watts)



Courtesy of Polly DeMille, RN, CSCS

Medical Benefits of HIIT



Evidence-Based Effects of High-Intensity Interval Training on Exercise Capacity and Health: A Review with Historical Perspective.
Int. J. Environ. Res. Public Health **2021**

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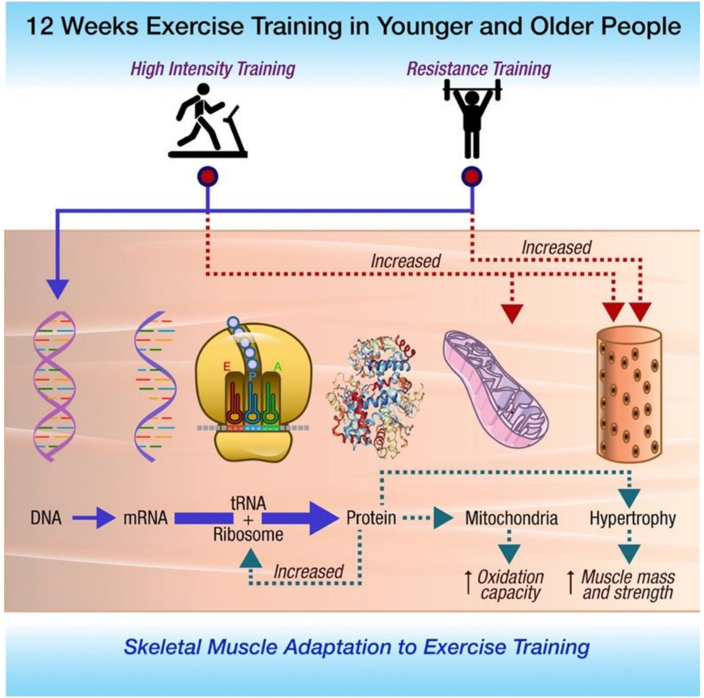
Cellular Response to Intensity Training

- 12 week study
- 36 men and 36 women
- Young = 18-30
- Old = 65-80
- Group 1 - High Intensity Biking
- Group 2- Strength Training
- Group 3 – Strength + Interval Training
- Muscle biopsies pre/post – (assessed lean muscle mass + insulin sensitivity)



doi.org/10.1016/j.cmet.2017.02.009 2019

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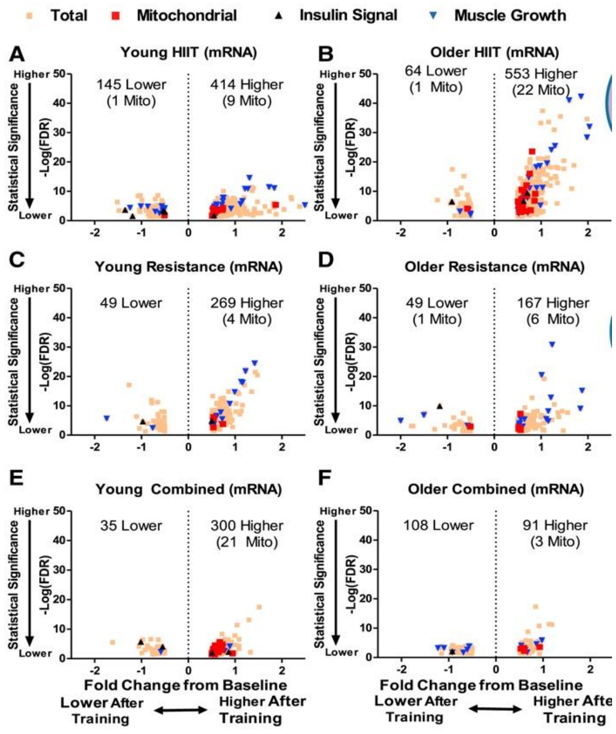
Cellular Benefits of HIIT



- HIIT and combined training improved aerobic capacity and skeletal muscle mitochondrial respiration
- High-intensity interval training improved age-related decline in muscle mitochondria
- HIIT reversed many age-related differences in of mitochondrial proteins in concert with increased mitochondrial protein synthesis

Robinson M et al. Enhanced Protein Translation Underlies Improved Metabolic and Physical Adaptations to Different Exercise Training Modes in Young and Old Humans. *Cell* 2018

Friends

Different Intensities → Different Adaptations

Light → Moderate → Vigorous → Maximal





"Manipulation of different exercise training variables promotes specific & diverse mitochondrial adaptations"

Granata C, Jamnick NA, Bishop DJ. Training-Induced Changes in Mitochondrial Content and Respiratory Function in Human Skeletal Muscle. Sports Med. 2018 Aug;48(8):1809-1828. doi: 10.1007/s40279-018-0936-y. PMID: 29934848.

Exercise Summary – The Masters Athlete

- Daily Movement
- Strength 3x/week
- Cardio 3x/week
- Balance 2-3x/week
- Consistency

Compliance

Fitness Compliance: Overview

- **Demographic and Biological Factors** (Men>Women, Thin>Obese)
- **Self-Esteem** (Higher SE, Higher Compliance)
- **Social and Cultural Support, Incentive**
- **Physical Environment**

G et al, Correlates of Adult Participation in Physical Activity, Med Sci

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What Motivates You?

1. External Motivation
2. **Internal Motivation**

What Makes People Fitness Compliant?

Fun

Community

Results

Goals

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Factors Generating Internal Motivation

- Community
- Competency
- Results
- Enjoyment

Coon D. *Gateways to Mind and Behavior*, 2010

Enjoyment During Exercise Mediates Adherence

- 45 random participants, avg age 46 y/o, women>men 6:1
- The fun group – enjoyment focused training:
  - 1) Group>Solo
  - 2) Group decision making>dictating
  - 3) Positive feedback = achievement
  - 4) Intensity regulation
  - 5) Workout announced in advance (transparency)
  - 6) Training diversity (different forms

Jekuac D et al, Psychology, 6, 48-54. 2015

Enjoyment During Exercise Mediates Adherence

- Control Group – goal to improve fitness
- Emphasis on fitness, no social cues
- Parameters:
    1) cardiorespiratory exercise
    2) resistance exercise
    3) flexibility exercise
    4) neuromotor exercise

Jekuac D et al, *Psychology*, 6, 48-54. 2015

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Enjoyment During Exercise Mediates Adherence

Table 1. Means and standard deviations for PACES and exercise frequency.

		M	*SD*	*t*	*df*	*p*
1. Session PACES	IG	68.9	4.8	−0.9	39	0.37
	CG	70.2	4.5			
4. Session PACES	IG	71.1	1.9	6.9	39	<0.01
	CG	66.2	2.6			
8. Session PACES	IG	71.3	1.8	6.7	24.0	<0.01
	CG	65.8	3.0			
Exercise Frequency	IG	7.9	0.3	2.6	17.0	0.02
	CG	7.2	1.3			

Note: *M* = Mean; *SD* = standard deviation; *t* = value of the t-distribution; *df* = degrees of freedom; *p* = probability value; PACES = Physical Activity Enjoyment Scale; IG = intervention group; CG = control group.

Jekuac D et al, *Psychology*, 6, 48-54. 2015

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The Fun Factor

What Makes People Fitness Compliant?

Fun

Community

Results

Goals

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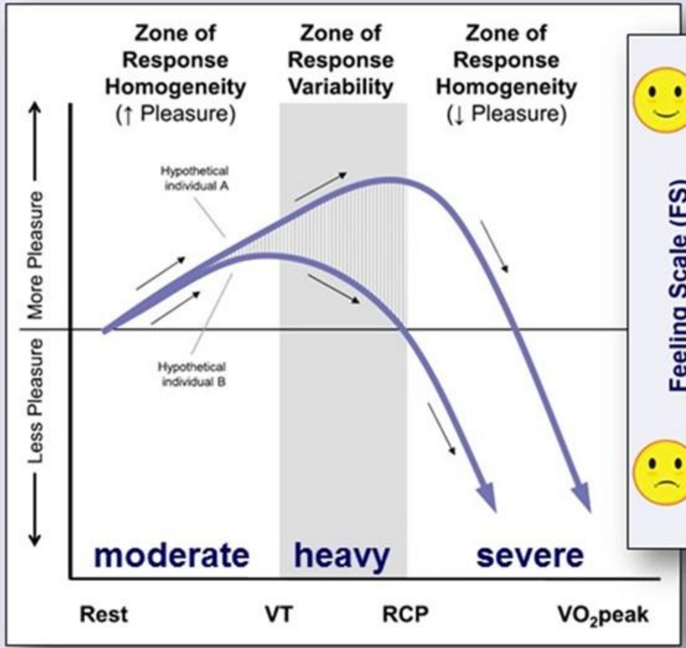
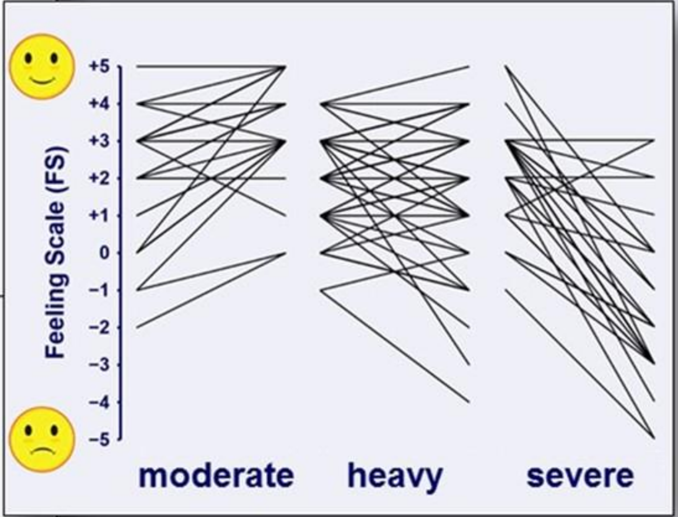
Sports Med 2011; 41 (8): 641-671

The Pleasure and Displeasure People Feel When they Exercise at Different Intensities

Decennial Update and Progress towards a Tripartite Rationale for Exercise Intensity Prescription

Panteleimon Ekkekakis,[1] *Gaynor Parfitt*[2] and *Steven J. Petruzzello*[3]





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The Communal Effect of Exercise Adherance

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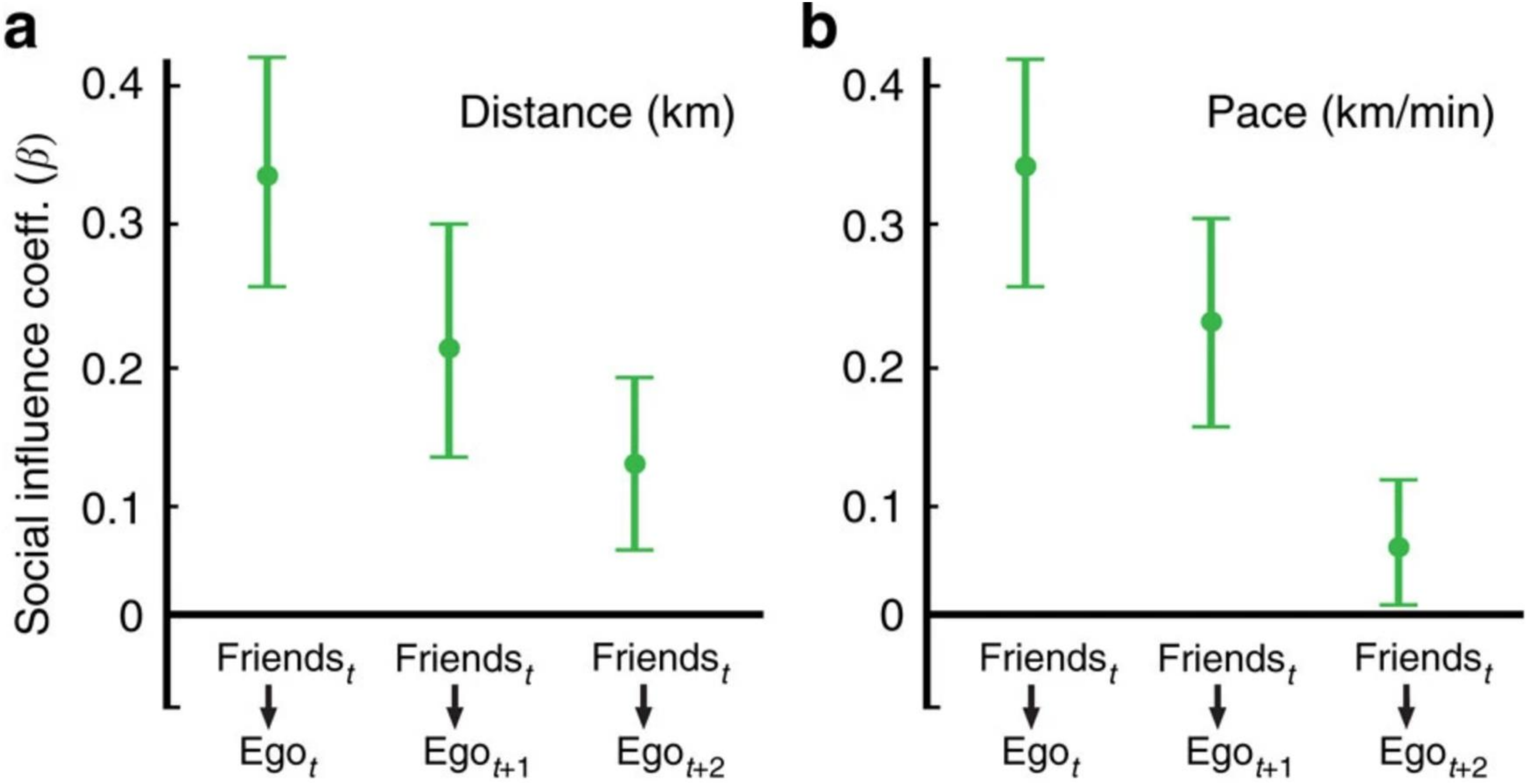

Aral. Nature, 2017

What Makes People Fitness Compliant?

Fun

Community

Results

Goals

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The Optimal Fitness Program

- Cardio
- Strength
- Flexibility/Balance

- *Exercise Snacks*

What Makes People Fitness Compliant?

Fun

Community

Results

Goals

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Goals


CERVEZA
PACIFICO
CLARA
THERE'S SOME HO'S IN THIS HOUSE
THIS IS A
she did it

Clinical Recommendations

SORT: Strength of Recommendation Taxonomy
A: consistent, good-quality patient-oriented evidence
B: inconsistent or limited-quality patient-oriented evidence
C: consensus, disease-oriented evidence, usual practice, expert opinion, or case series

Clinical Recommendation	SORT Evidence Rating
Preparticipation screening for cardiovascular disease should include a standard 12-lead electrocardiogram (ECG) for all masters athletes older than 40 years. ECG exercise testing should be performed for older athletes with 1 or more cardiac risk factors, including diabetes, a family history of myocardial infarction, or dyslipidemia, among others.[17]	B
Adults and masters athletes alike should engage in moderate to vigorous aerobic exercise for 20- to 30-minute sessions 3 to 5 days each week, as well as resistance, flexibility, and balance training.[11]	B
Generally, masters athletes should avoid returning to high-impact sports after total joint arthroplasty but may return to low-impact sports.[14,33] In the setting of hip resurfacing, however, return to high-impact activities may be permissible.[21]	B
Treatment for musculoskeletal injuries in the masters athlete should include rehabilitation and analgesia, such as nonsteroidal anti-inflammatory drugs (NSAIDs), when appropriate.[10,19] NSAIDs should be used with caution given the gastrointestinal and cardiovascular risks.[19]	B

doi: 10.1177/1941738114548999

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Training Hacks for the Masters Athlete

BY Simon Ward

Aging is inevitable, but it doesn't have to be the end of your athletic career. Here are some training adjustments to consider as you age.

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Lift Heavy

Muscle mass starts to decline in the mid- to late thirties. It occurs at a rate of around 3-5% per decade and speeds up once we hit the mid- to late 50s, to about 7-8% per decade. This mainly affects the fast-twitch fibers, which is why an athlete tends to lose power and speed rather than endurance.

Sadly, no amount of swimming, cycling or running will help preserve fast-twitch fibers because endurance activities generally don't provide sufficient load for that type of muscle adaptation. Instead of doubling down on the long slow distance (LSD), Dr. Stacy Sims suggests LHS ("lifting heavy sh**t") as you age to preserve muscle mass. This means exercises like deadlifts, squats, leg presses, and seated or bent-over rows with a heavy (for you) load and a low number of repetitions. Dr. Sims' work (and her excellent book ROAR) focuses on female athletes of all ages, but the concepts apply to men as well.

Many aging athletes feel that lifting in such a way may actually cause them injury, and of course, if you have a poor lifting technique, then that might happen. But if you have good technique, then heavy work in the gym can have a number of wonderful benefits. Maximal strength can improve, and with it, power. Heavy weights can also lead to improved resilience in connective tissues, which will be a big help in the battle to stay injury-free. At the very least, one can slow down that loss of muscle mass—and in some circumstances, you may even gain new muscle.

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Maintain Range of Motion

With age, our joints tighten up, and the range of movement (ROM) around a joint or series of joints can be reduced. This has implications for all three triathlon disciplines, but especially swimming and running. If velocity is measured by limb frequency and length of stroke or stride, a loss of ROM (coupled with that loss of speed/power mentioned earlier) ultimately results in a slowdown.

Decreased mobility also increases your risk of injury. Any athlete should aim to avoid an injury, but it's even more important in your older years, as any lost fitness is harder to regain. To increase your mobility, Dr. Kelly Starrett recommends doing at least 15 minutes of mobility work for every 60 minutes of training each week. For example, if you aim for 10 hours of swimming, cycling, and running, then your minimum would be 2.5 hours.

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Don't Skimp on Intensity

As you age, long, slow distances (even for long-distance triathletes) should become less of a priority, and high-intensity training must occupy the forefront of your mind. Like with heavy lifting, this can seem counterintuitive to older athletes, but trust me, it does work, and if you are healthy and injury-free, then you have absolutely nothing to fear.

To retain or build in regular high-intensity interval workouts, aim to work at an RPE of 9-10 for around 10% of your total weekly duration. Of course, this will depend upon your training history and attention to other recovery factors.

You may want to be cautious about fast running, especially if you have a history of calf or Achilles problems, but on the bike and in the pool, there should be nothing to hold you back. Work at the same percentage above FTP or CSS that a younger athlete might. Quality is the key, so don't be shy about taking a longer recovery interval between repetitions if you feel you need it.

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Listen to Your Body

You have gained some athletic wisdom over the years, so you should use it! Recovery between workouts also requires adjustment with age. Maybe you could have done a track workout and a Vo2 max bike workout in 48 hours in your thirties, but you might need 72 or even 96 hours as you enter your 60s. Mountain bike hall-of-famer and XTERRA athlete Ned Overend once said, “I can still do what I always did, it just takes me longer to get it done.”

The bottom line is that you have to be more compassionate to your body. You’ve been using it hard for 30, 40, or even 50 years, and it has served you well. Now is the time to repay that service with some kindness. Look after those aching joints, tired muscles and well-used heart.

Listen to your body and if you’re ever in doubt about a workout or your health on that day, take it easy, or rest. As an older, wiser athlete you have hopefully learned to control your ego a bit and can be comfortable finding the path for long-term consistency.

At some point, we all must accept that we are no longer going to get faster or more powerful—but avoiding the slowdown as much as possible can be just as exciting a goal! By lifting heavy weights, maintaining intensity, and looking after your mobility and recovery, you’ll be healthy and performing well into your later years.

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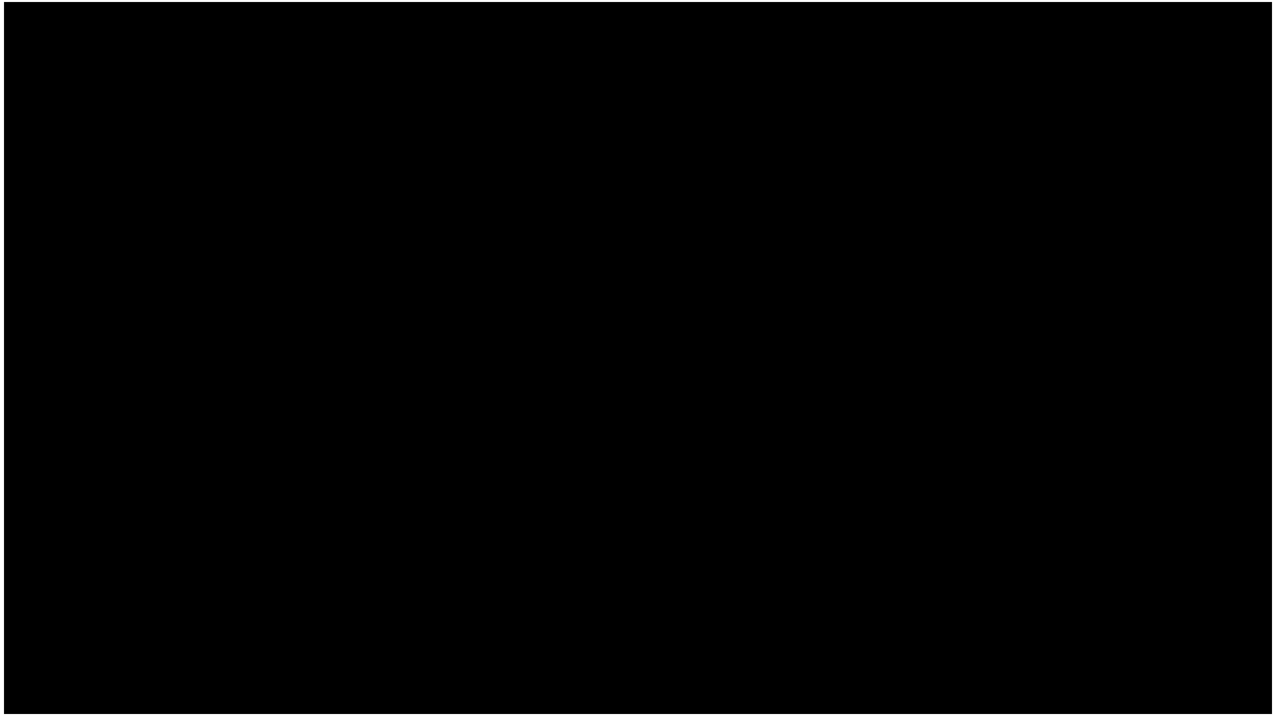

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Thank You

Questions and Discussion

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