

# Clinical Exercise Update: Six Important Findings Regarding Physical Activity Recommendations for Individuals in All Age Groups

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# Webinar Objective

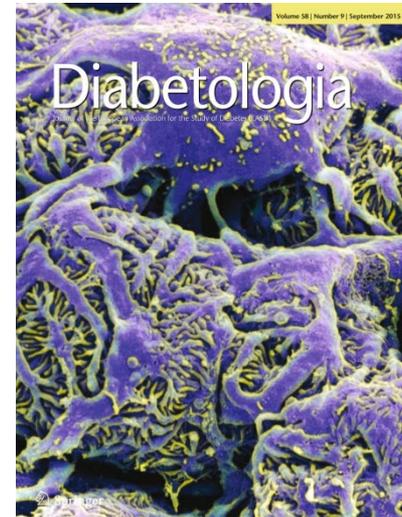
To review and practically apply recent exercise clinical trial research in a variety of settings.

# Six Key Trends in Applied Clinical Exercise Science

- Fitness vs. metabolic health benefits
- Sitting time and all-cause mortality
- Single vs multiple sets of resistance exercise
- Evidence-based yoga benefits
- Intensive vs moderate exercise in obesity
- Diverse forms of physical activity may be as beneficial as “planned workouts”

# 1. Significant improvements in metabolic fitness can accrue without significant increases in physical fitness, e.g., aerobic capacity.

*Pandy et.al. 2015; Vollard 2009; Buchter LR et.al. Med. Sci. Sports Exerc., Vol. 40, No. 7, pp. 1263–1270, 2008. Després JP et.al. 1994 Jul;236(1):7-22.*

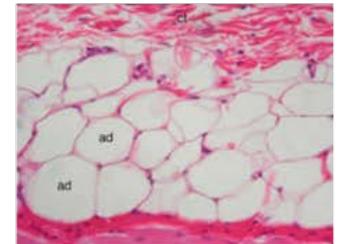
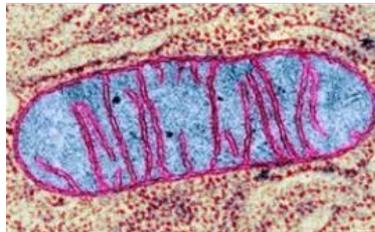
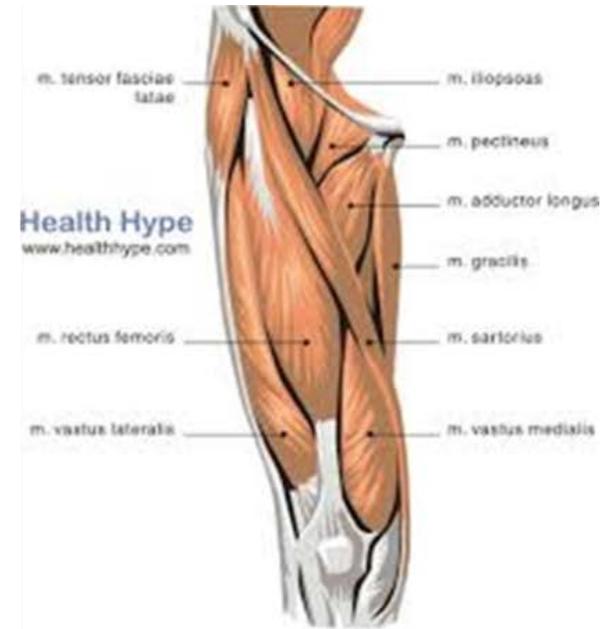


# Metabolic Fitness

Primarily involves the metabolic capacity of the muscle

## PERIPHERAL ADAPTATIONS (muscle)

Muscle mitochondria  
Insulin sensitization in muscle  
Fuel storage and mobilization  
Arterial endothelial function  
PPar activation



# Metabolic Effects of Exercise Training Among Fitness-Nonresponsive Patients With T2D: The HART-D Study

Ambarish Pandey, Church T et.al. Diabetes Care 2015;38:1494 UTSW

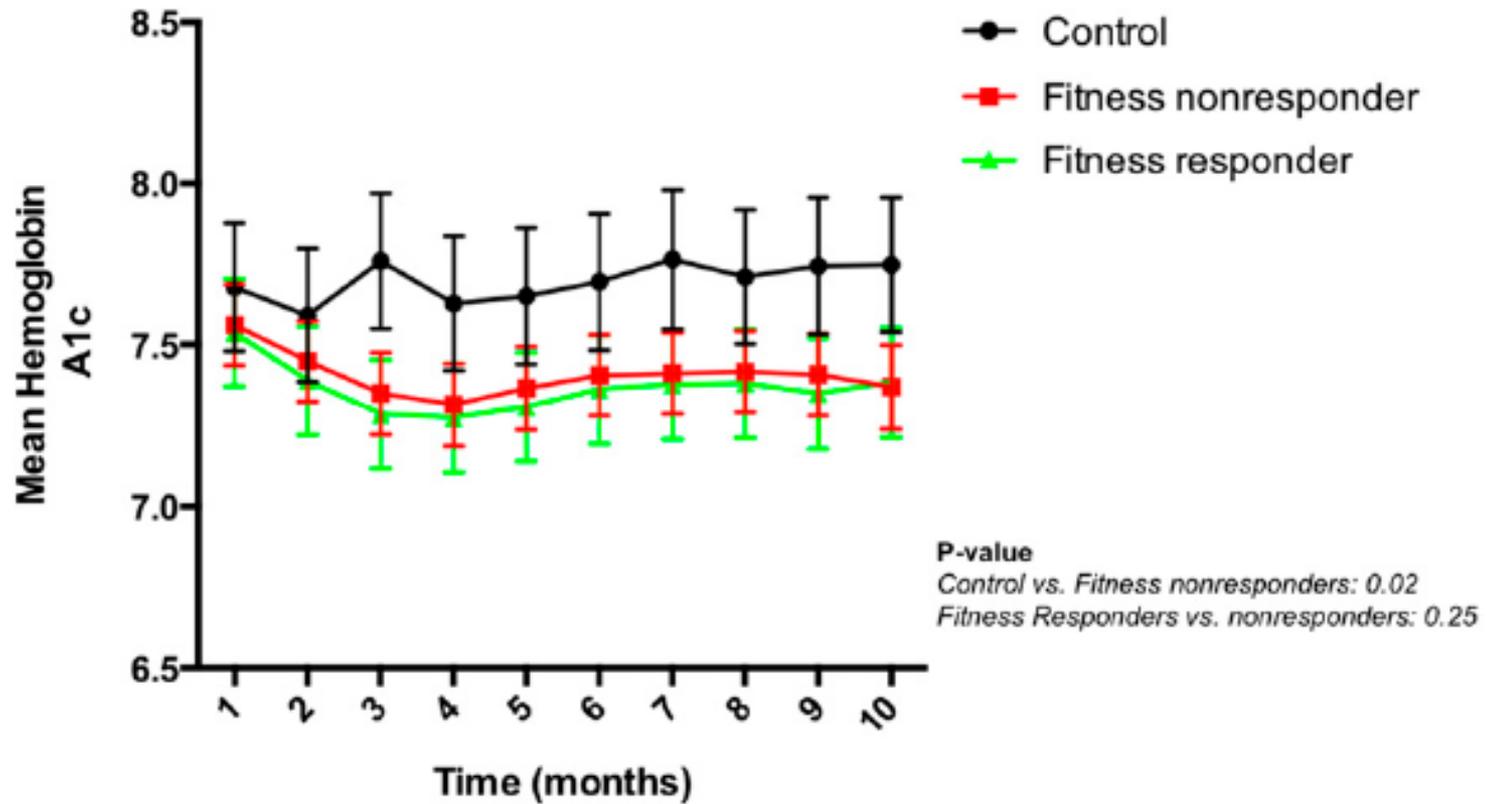
202 participants (mean age 57.1 years, 63% women) - Randomized to a control group or one of three supervised ET groups (AE,RT, Comb) for 9 months.

ExRx: 9 months, 3–5 days/week at an intensity of 50–80%

**RESULTS:** Both fitness responders and nonresponders (respectively) had significant improvements in hemoglobin A1c and measures of adiposity ( $\Delta$ HbA1c, waist circumference, & body fat. No significant differences were observed in the degree of change of these metabolic parameters between fitness responders and nonresponders.

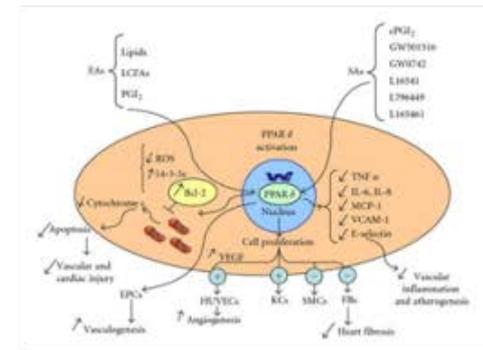
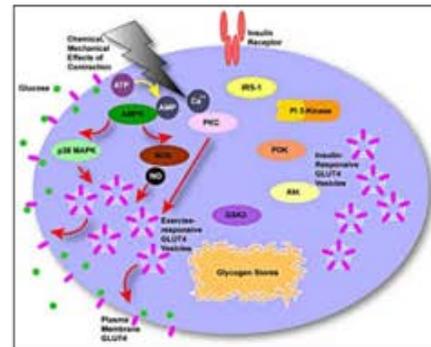
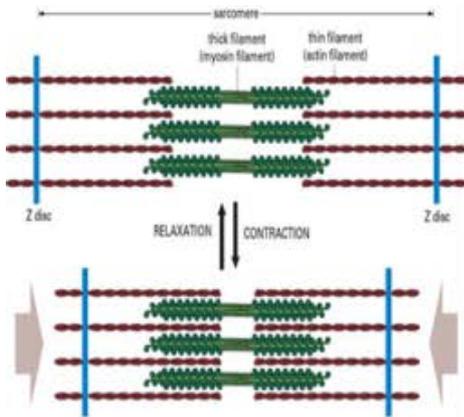
**ExTr is associated with significant improvements in metabolic parameters irrespective of improvement in cardiorespiratory fitness (i.e., aerobic capacity)**

# Monthly Mean HbA1c Levels Across the Study Groups



Pandey 2015

The UT Southwestern data analysis found that hemoglobin A1c, waist circumference, and percentage of body fat all improved in the groups that exercised, regardless of whether the participants improved their cardiorespiratory fitness (i.e., aerobic capacity).



Pandey 2015

# Low-intensity endurance exercise training, plasma lipoproteins and the risk of coronary heart disease:

## **Metabolic Fitness** concept

Després JP, Lamarche B J Intern Med. 1994 Jul;236(1):7-22.

- It is proposed that prolonged endurance exercise of low intensity (approximately 50% VO<sub>2</sub>max), performed on an almost daily basis, seems to significantly improve metabolic variables.
- Indeed, emphasis should not be placed on aiming at increasing VO<sub>2</sub>max through high-intensity exercise, but rather on producing a substantial increase in daily energy expenditure that will eventually lead to weight loss and related improvements in carbohydrate and lipid metabolism.
- Therefore, from a practical standpoint, although a 1 h daily walk may not have marked effects on cardiorespiratory fitness, it probably represents an exercise prescription that is likely to substantially improve 'metabolic fitness', thereby reducing the risk of CHD.

# Intensity and Duration as Physiological Response to Stimulus

## Intensity-driven

above lactate threshold,  
>65-80%  $\dot{V}O_2$  max



*Increased physiologic capacities & anatomic dimensions:  **$\dot{V}O_2$  max**, SV and Q max, EDV, max ex performance, “**CV fitness**”*



## Duration-driven

low-moderate level  
activity, 30-60 %  $\dot{V}O_2$  max



*Increased metabolic adaptations, insulin sensitivity, fat mobilization - oxidation, fibrinolysis,*

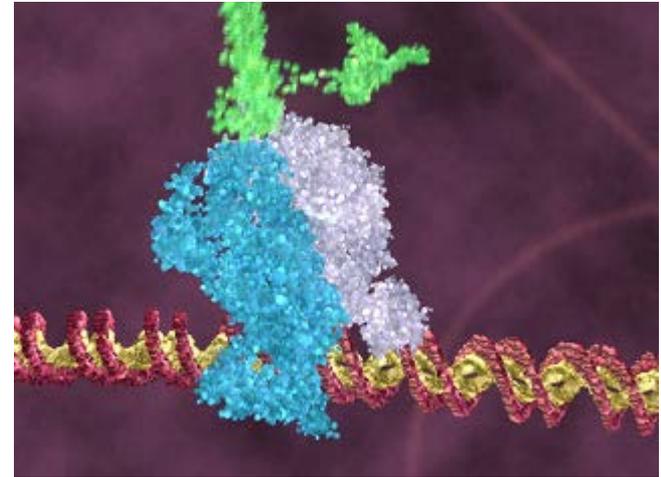
# Long Slow Distance



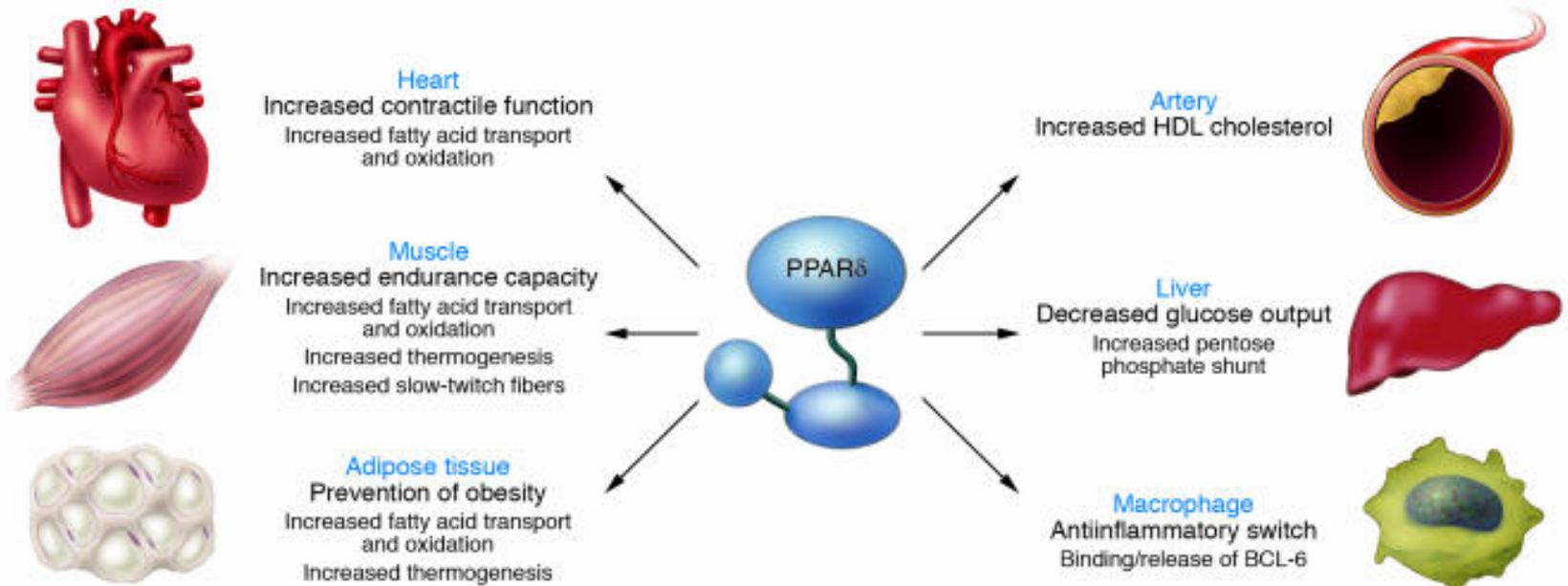
# PPARs

## (Peroxisome Proliferator-Activated Receptors)

PPARs are nuclear hormone receptors and transcription factors that bind DNA and regulate gene expression



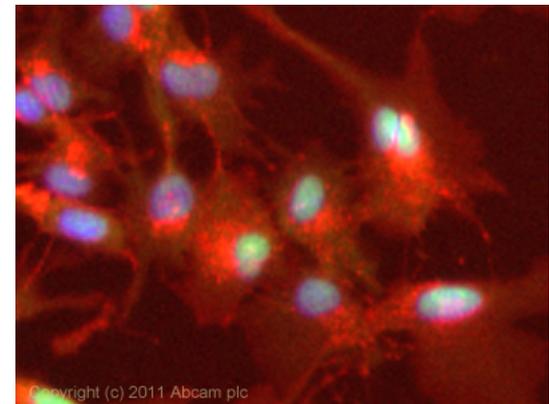
# PPAR Delta



Greene and co-workers at Texas A&M University have shown that expression of PPAR $\alpha$  and AMPK $\alpha$  was observed only in the exercised/trained condition in overweight and obese men and women.

Our data also suggest the importance of **PPAR $\delta$**  in mediating oxidative adaptation to aerobic exercise and the ability of overweight and obese adults to respond and adapt to exercise stimuli in a manner consistent with enhanced metabolic function through upregulation of target genes.

Greene N AmJPhysio 2012;303:E212



# Eben Hopson Middle School North Slope School district



# Accusplit AE1120-XBX Eagle Activity Pedometer

Example children's programs:

- 7-day recall
- Most counts in 4 minutes
- 1-hour step-count guess
- Super-six station



“Every step you take, I’ll be watching you.”  
-*Sting*

**Daily Rx:**

6,000      3-5 years

10,000      Adults

12,000      6-19 years

Colley R Med Sci Spts Ex 2012;44977

# Youth Stepcount Activity Log

## Youth Stepcount Activity Log

Name:

Instructions:

- Wear the pedometer tightly on your waist (beltline) and directly over your right leg.
- Reset your pedometer to ZERO after each day
- Record your total stepcount for two full SCHOOL DAYS (e.g., 7 a.m. to bedtime)
- Record your total stepcount for two full WEEKEND DAYS (e.g., 7 a.m. to bedtime)

\*If you play sports include the pedometer stepcount during that sport (when the pedometer can be worn with your athletic gear)

Return this log to your health care provider

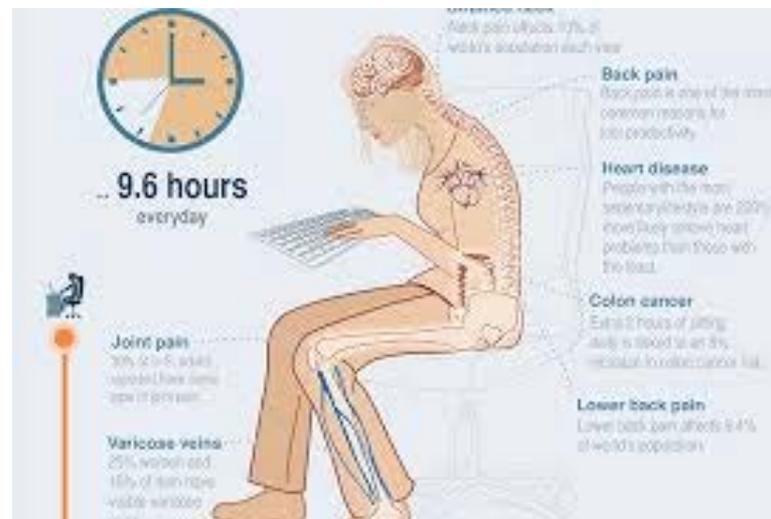
Total # of Steps

Total # of Steps	
School day Date:	
School day Date:	
Weekend day Date:	
Weekend day Date:	
Comments:	

# All Non-exhaustive Physical Activity is Good

- As little as 20-30 minutes 3 times a week of low-moderate level exercise is beneficial in helping reduce cardiovascular disease and diabetes through metabolic pathways that are not entirely related to aerobic capacity.

## 2. Prolonged sitting/sedentary time is associated with increased mortality and increased incidence of insulin resistance and type 2 diabetes



*Matthews et.al. 2015; Pavey 2015; Armstrong Katrien Wijndaele Diabetologia (2014) 57:305–312; Carr 2013; Cooper 2012; Genevieve Healy, Diabetes Care, Feb. 2011; Wilmot EG et.al., et.al. Diabetologia. 2013 Apr;56(4):942-3.; Gibbs, et.al. Diabetes Care, July 8, 2015; Sardinha et.al. Diabetes Care 31:569–575, 2008*

# Mortality Benefits for Replacing Sitting Time with Different Physical Activities

Med. Sci. Sports Exerc., Vol. 47, No. 9, pp. 1833–1840, 2015

154,614 older adults (59–82 yr) in the National Institutes of Health-AARP Diet and Health Study

- Among less active adults, **replacement of 1 hr/day of sitting with an equal amount of either exercise or nonexercise activity was associated with lower (30-40%) mortality.**
- Inactive adults may get substantial mortality benefits from reducing couch time by 1 hr/day in favor of engaging in purposeful exercise or a broad range of activities of everyday living, such as lawn and garden activities, daily walking apart from exercise, and household chores

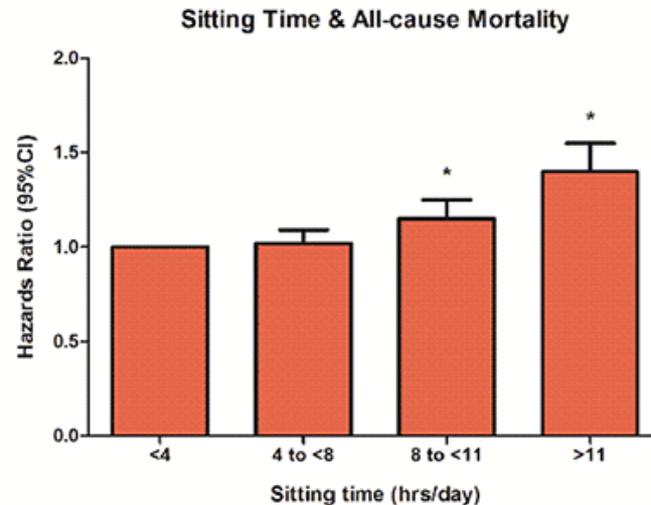
# Sitting Time and All-Cause Mortality Risk

## Sitting Time and All-Cause Mortality Risk in 222,497 Australian Adults



Hidde P van Der Ploeg, Tien Chey, Rosemary J Korda, Emily Banks, Adrian Bauman  
*Arch Intern Med.* 2012; 172 (6) : 494-500

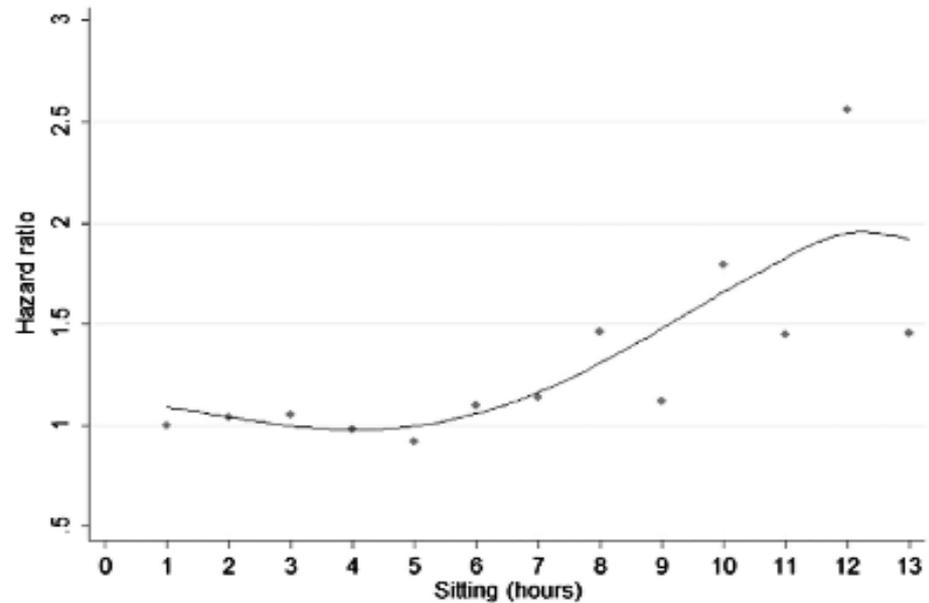
Adjusted for:  
age, sex, education,  
marital status,  
urban/rural residence,  
**physical activity,**  
**BMI, smoking**



# Sitting-time and 9-year all-cause mortality in older women

Toby G Pavey et.al. Br J Sports Med 2015;49:95-99 Brisbane Australia

- Prolonged sitting-time was positively associated with all-cause mortality. Women who reported sitting for more than 8 h/day and did not meet PA guidelines had an increased risk of dying within the next 9 years.
- 6656 participants in the **Australian Longitudinal Study on Women's Health** who were followed for up to 9 years



**Figure 1** Unadjusted HRs for all-cause mortality and continuous sitting-time (nb. hours 13–16 are combined as 13 due to small participant numbers; N=6656).

# Replacing sitting time with standing or stepping: associations with cardio-metabolic risk biomarkers

Genevieve Healy et.al. Eur. Heart J. July 2015

**Methods:** A subsample of participants from the 2011/12 Australian Diabetes, Obesity, and Lifestyle Study wore the posture-based activPAL3 monitor [36–80 years (58y); 57% women; n = 698 with data].

**Sitting-to-standing** reallocations were only significantly ( $P < 0.05$ ) associated with approximately 2% lower fasting plasma glucose, 11% lower triglycerides, 6% lower total/HDL-cholesterol ratio, and 0.06 mmol/L higher HDL-cholesterol per 2 h/day.

**Sitting-to-stepping** reallocations were only significantly associated with approximately 11% lower BMI, 7.5 cm lower waist circumference, 11% lower 2-h plasma glucose, 14% lower triglycerides, and higher HDL-cholesterol per 2 h/ day, while

Sitting-reduction strategies targeting increased standing, stepping, or both, may benefit cardio-metabolic health. Standing is a simple alternative to sitting, and requires further examination in prospective and intervention studies.

# BMJ Open Multicomponent Intervention to Reduce Daily Sedentary Time: A Randomised Controlled Trial

Lucad J Carr, Kristina Karvinen, Mallory Peavler, Rebecca Smith, Kayla Cangelosi

BMJ Open 2013;3: e003261. doi:10.1136/bmjopen-2013-003261 Uofl

Compared to controls, the intervention group reduced daily sedentary time (mean change (95%CI): -58.7 min/day

**Table 5** Quartile and median Likert scale responses (1=not at all helpful; 2=a little helpful; 3=moderately helpful; 4=quite helpful; 5=extremely helpful) on the helpfulness of individual intervention components for reducing sedentary time (N=23)

Please rate how helpful each of the following intervention components was in reducing your daily sedentary time	Likert scale		
	Q1	Median	Q3
Pedal machine biofeedback display (minutes pedalled, calories burned, etc)	4	5	5
Wearing the pedometer	4	5	5
Self-monitoring daily steps and pedal time on the website	4	5	5
Email reminders to log physical activity on website	4	4	5
Access to pedal exercise machine at work	4	4	5
'Walk Across America' group challenge on website	3	3	5
Social networking features on website (profile, newsfeed, messaging)	3	3	4
Environmental features (Walkscore, information on facilities)	3	3	4

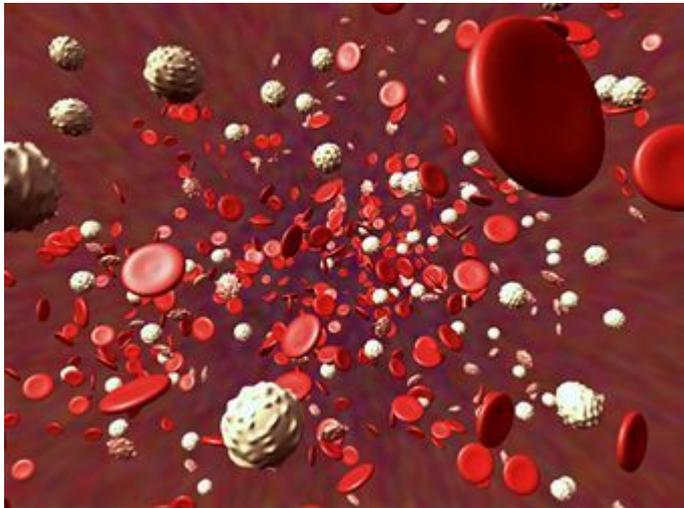
Each added hour spent sitting was associated with a 14% increase in coronary artery calcium (CAC) score, independent of traditional risk factors, including physical activity, in a study of middle-aged subjects without cardiovascular disease

Dallas Heart Study N=2031

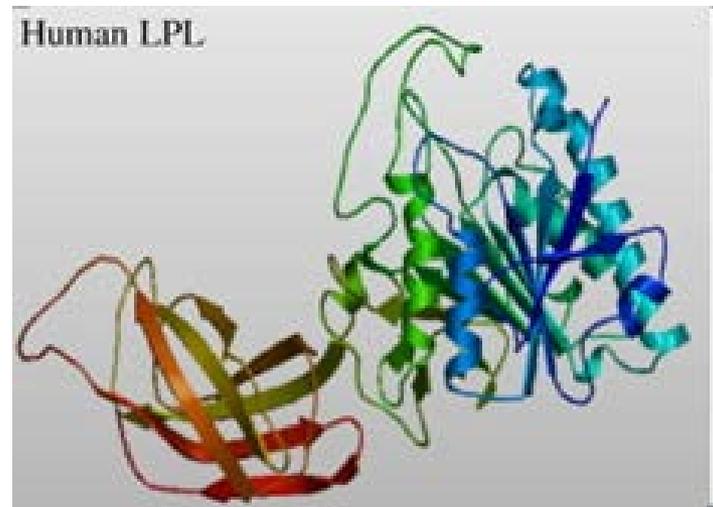
Kulinski et.al. ACC sessions San Diego 3/11/15

# The Physiology of Inactivity i.e., Prolonged Sitting

**Increased platelet “stickiness”**



**Decreased lipoprotein lipase activity**



# Workplace EE

5 min/hr X 7 hrs

35 min @ 3-4 kcal/min

2000-2500 steps

**100 – 140 kcal**  
**(insulin sensitization –**  
**e.g., ~10-15 mg**  
**metformin)**



3. The preponderance of evidence suggests that performing multiple sets (e.g. 2-3) of resistance training exercises confers measurable muscle hypertrophic and/or strength gains advantage over single sets of exercises.

In other words, if overall muscular strength is your goal 2-3 sets of 8-12 exercise repetitions for the major muscle groups may be all that is necessary.

Krieger, JW. *J Strength Cond Res* 24(4): 1150–1159, 2010;  
Radaelli R et.al. , *Age (Dordr)*.2014;36(6): *ACSM guidelines*,  
2014; Kelly SB *J Strength Con Res*. 2007 Nov;21(4):1003-6;  
*Carpinelli R & Otto R. Sports Medicine, 26:73-84, 1998.*

# Forms of Applied Muscular Strength

- Maximum muscular strength
- Strength endurance (muscular endurance)
- Static strength (eg. joint stability)
- Functional strength

# Key Benefits of RT

- Increased bone mineral content
- Functional strength and endurance
- Insulin sensitization
- Metabolic and body composition

# Maximum Strength Gains

SXR	%↑ 1RM
1X2	20.0
1X6	25.5
1X10	21.6
2X2	17.3
2X6	22.9
2X10	25.1
3X2	23.5
<b>3X6</b>	<b>29.6*</b>
3X10	23.0

Berger, 1962

9 groups of males,  
N=20; 3X/week for 12  
weeks

These data support the use of multiple-set programs for trained individuals and single-set programs for untrained individuals during the initial short training period.

Journal of Strength and Conditioning Research, 2004, 18(1), 35–47  
 © 2004 National Strength & Conditioning Association

## QUANTITATIVE ANALYSIS OF SINGLE- vs. MULTIPLE-SET PROGRAMS IN RESISTANCE TRAINING

BRIAN L. WOLFE<sup>1</sup>, LINDA M. LEMURA<sup>2</sup>, AND PHILLIP J. COLE<sup>1</sup>

<sup>1</sup>Exercise Physiology Laboratory, Bloomsburg University of Pennsylvania, Bloomsburg, Pennsylvania 17815;

<sup>2</sup>Department of Biology, Le Moyne College, Syracuse, New York 13214.

TABLE 4. Coded characteristics of the studies: research design, significance of the studies, and journal impact factors.\*

Study	Study design	Significance between single and multiple sets	Journal quality impact factor
Abe et al. (2000) (1)	RCT	NI	0.983
Berger (1982) (6)	NI	SD	1.125
Borst et al. (2001) (7)	CT	SD	2.110
Coleman (1977) (12)	NI	NS	0.592
Craig and Kang (1994) (13)	NI	NI	0.609
De Hoyos et al. (1988) (14) (abstract)	NI	NS	2.110
De Hoyos et al. (1997) (15) (abstract)	NI	NS	2.110
Gotshalk et al. (1997) (21)	RAN	NI	1.533
Hass et al. (1998) (22)	RAN	NS	2.110
Hass et al. (2000) (23)	RCT	NS	2.110
Harley et al. (1995) (25)	CT	NI	1.625
Jacobson (1986) (26)	RCT	NS	NI
Kuffler et al. (1992) (28)	NI	NI	2.110
Kraemer (1997) (29) (experiment 2)	RAN	SD	0.609
Kraemer (1997) (29) (experiment 3)	RAN	SD	0.609
Kraemer (1997) (29) (experiment 4)	RAN	SD	0.609
Kraemer et al. (2000) (30)	RCT	SD	2.110
Kraemer et al. (1997) (31)	NI	SD	0.609
Marr et al. (2001) (34)	RCT	SD	2.110
McGee et al. (1992) (35)	NI	SD	NI
Messier and Dill (1985) (36)	CT	NS	1.125
Miller et al. (1994) (37)	NI	NI	2.275
Mulligan et al. (1996) (39)	RAN	NI	0.609
Nieklas et al. (1995) (40)	CT	NI	1.025
Ostrowski et al. (1997) (41)	RCT	NS	NI
Pollock et al. (1994) (abstract) (42)	NI	NI	2.110
Reid et al. (1987) (43)	RAN	NI	0.943
Ryan et al. (1993) (45)	NI	NI	2.275
Ryan et al. (1994) (46)	CT	NI	2.275
Saiborn et al. (2000) (48)	RAN	SD	0.609
Schlumberger et al. (2001) (49)	RCT	SD	0.609
Silverstein et al. (1982) (51)	RAN	NS	NI
Starkey et al. (1996) (52)	RCT	NS	2.110
Starkey et al. (1994) (53) (abstract)	CT	NS	2.110
Stowers et al. (1983) (57)	RAN	SD	NI
Terhizan and Hartley (1985) (58) (abstract)	RCT	NS	2.110
Terrell et al. (1994) (59)	CT	NI	2.275
Vincent et al. (1998) (60) (abstract)	RAN	NI	2.110
Wescott (1986) (61)	NI	NS	NI
Wescott et al. (1989) (62)	NI	NS	NI
Wells et al. (2001) (63) (abstract)	RCT	NS	2.110

# Effects of single vs. multiple-set short-term strength training in elderly women.

Radaelli R et.al. , Age (Dordr).2014;36(6): Sao Paulo

Thus, the purpose of this study was to compare the effects of a short-term strength training program with single or multiple sets in elderly women.  
N=27, 60-74 yrs

Maximal dynamic (1-RM) and isometric strength, muscle activation, muscle thickness (MT), and muscle quality (MQ = 1-RM and MT quadriceps quotient) of the **knee extensors** were assessed.

1 or 3 sets 2X/wk for 6 weeks.

Significant increases in all MT: **vastus lateralis, rectus femoris, vastus medialis, and vastus intermedius**), with no differences between SS or MS groups.

**These results suggest that during the initial stages of strength training, single- and multiple-set training demonstrate similar capacity for increasing dynamic strength, MT, and MQ of the knee extensors in elderly women.**

# Single vs. multiple sets of resistance exercise for muscle hypertrophy: a meta-analysis.

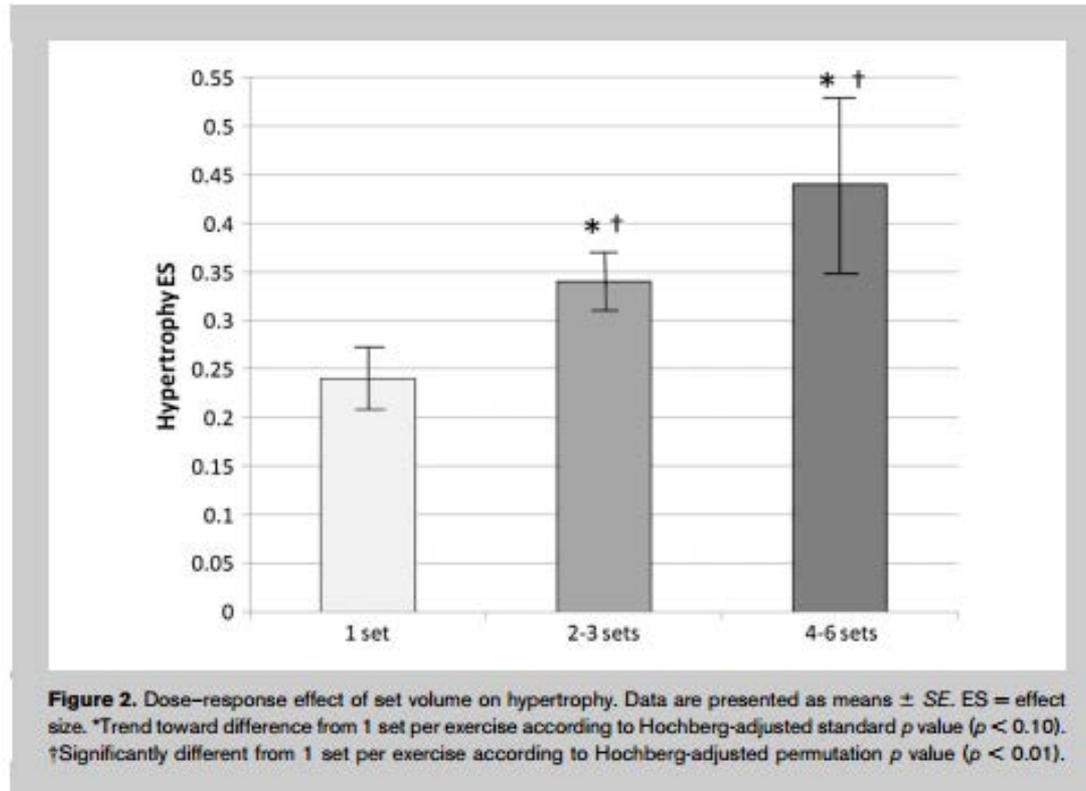
Krieger, JW. J Strength Cond Res 2010;24(4): 1150–1159. CO Springs

The purpose of this study was to use multilevel meta-regression to compare the effects of single and multiple sets per exercise on muscle hypertrophy. **The analysis comprised 55 effect sizes (ESs), nested within 19 treatment groups and 8 studies.**

Multiple sets were associated with a larger ES than a single set (difference = 0.10  $\pm$  0.04; confidence interval (p = 0.016). In a dose–response model, there was a trend for 2–3 sets per exercise to be associated with a greater ES than 1 set (p = 0.09).

**In conclusion, multiple sets are associated with 40% greater hypertrophy-related ESs than 1 set, in both trained and untrained subjects.**

# Single versus multiple sets of resistance exercise: A meta-regression



Krieger JW. 2009

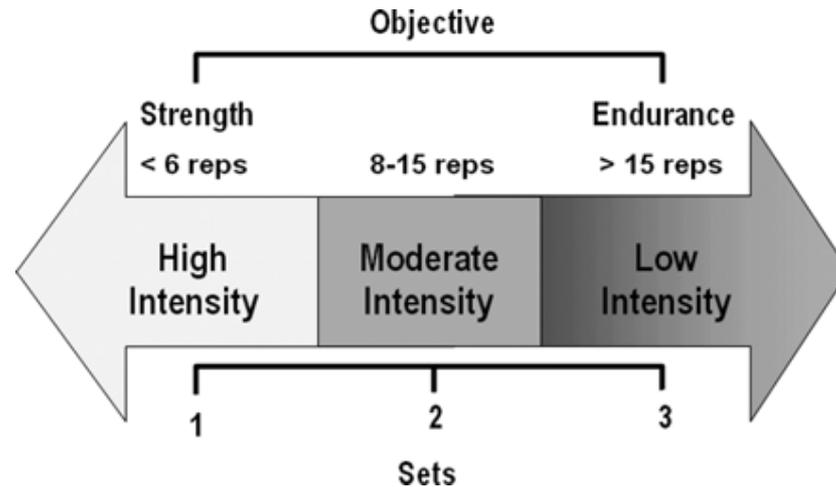
# Resistance Exercise Evidence-Based Recommendations

**TABLE 7.6 Resistance Exercise Evidence-Based Recommendations**

FITT-VP	Evidence-Based Recommendation
<i>Frequency</i>	<ul style="list-style-type: none"> <li>Each major muscle group should be trained on 2–3 d · wk<sup>-1</sup>.</li> </ul>
<i>Intensity</i>	<ul style="list-style-type: none"> <li>60%–70% 1-RM (moderate-to-vigorous intensity) for novice to intermediate exercisers to improve strength</li> <li>≥80% 1-RM (vigorous-to-very vigorous intensity) for experienced strength trainers to improve strength</li> <li>40%–50% RM (very light-to-light intensity) for older individuals beginning exercise to improve strength</li> <li>40%–50% 1-RM (very light-to-light intensity) may be beneficial for improving strength in sedentary individuals beginning a resistance training program</li> <li>&lt;50% 1-RM (light-to-moderate intensity) to improve muscular endurance</li> <li>20%–50% 1-RM in older adults to improve power</li> </ul>
<i>Time</i>	<ul style="list-style-type: none"> <li>No specific duration of training has been identified for effectiveness.</li> </ul>
<i>Type</i>	<ul style="list-style-type: none"> <li>Resistance exercises involving each major muscle group are recommended.</li> <li>Multijoint exercises affecting more than one muscle group and targeting agonist and antagonist muscle groups are recommended for all adults.</li> <li>Single joint exercises targeting major muscle groups may also be included in a resistance training program, typically after performing multijoint exercise(s) for that particular muscle group.</li> <li>A variety of exercise equipment and/or body weight can be used to perform these exercises.</li> </ul>
<i>Repetitions</i>	<ul style="list-style-type: none"> <li>8–12 repetitions is recommended to improve strength and power in most adults.</li> <li>10–15 repetitions is effective in improving strength in middle-aged and older individuals starting exercise.</li> <li>15–20 repetitions are recommended to improve muscular endurance.</li> </ul>
<i>Sets</i>	<ul style="list-style-type: none"> <li>2–4 sets are recommended for most adults to improve strength and power.</li> <li>A single set of resistance exercise can be effective especially among older and novice exercisers.</li> <li>≤2 sets are effective in improving muscular endurance.</li> </ul>
<i>Pattern</i>	<ul style="list-style-type: none"> <li>Rest intervals of 2–3 min between each set of repetitions are effective.</li> <li>A rest of ≥48 h between sessions for any single muscle group is recommended.</li> </ul>
<i>Progression</i>	<ul style="list-style-type: none"> <li>A gradual progression of greater resistance, and/or more repetitions per set, and/or increasing frequency is recommended.</li> </ul>

1-RM, one repetition maximum.  
Adapted from [20].

# AHA Scientific Statement



Classification of weight training intensity (resistance). A lower repetition range with a heavier weight may better optimize strength and power, whereas a higher repetition range with a lighter weight may better enhance muscular endurance. Using weight loads that permit 8 to 15 repetitions (reps) will generally facilitate improvements in muscular strength and endurance.

Williams AHA 2007

# Effects of intensity and volume on insulin sensitivity during acute bouts of resistance training

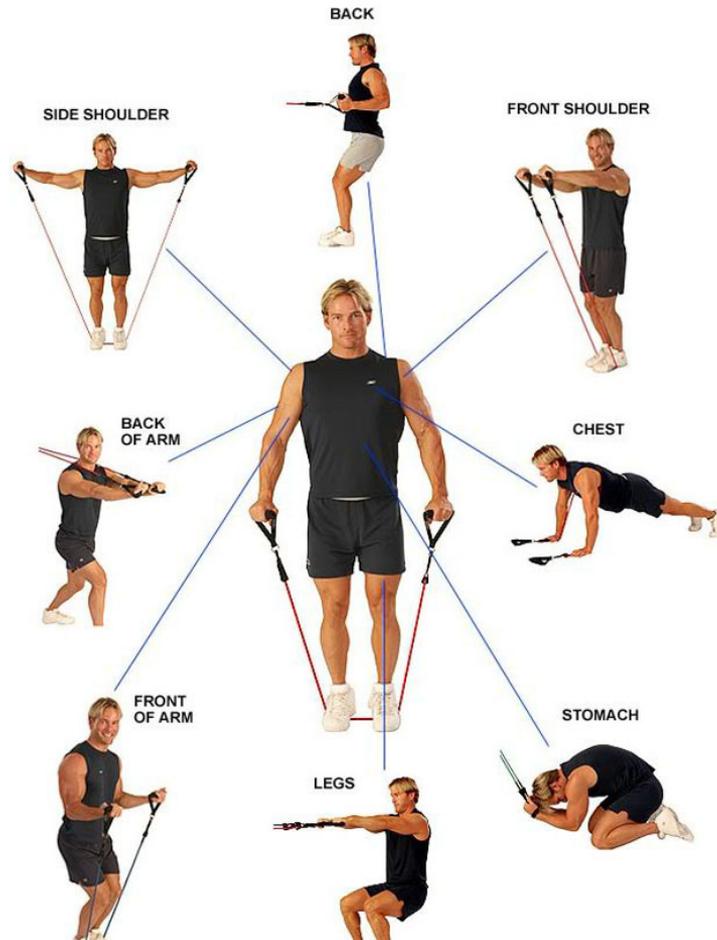
Black LE et.al. J Strength Cond Res.2010 Apr;24(4):1109-16. ASU

- 17 adults with **IFG** completed 4 separate bouts of resistance exercise under **moderate** intensity (65% 1RMax) or **high intensity** (85% 1RM) conditions within the confines of single set and multiple set protocols.
- **High-intensity protocols resulted in greater insulin sensitivity (0.83 multiple set; 0.53 single set) as compared with moderate-intensity protocols. The high-intensity, multiple set bout yielded the greatest effect in both fasting glucose (0.61) and insulin sensitivity (0.83).**

# These Are All Resistance Exercises



# Program Overview

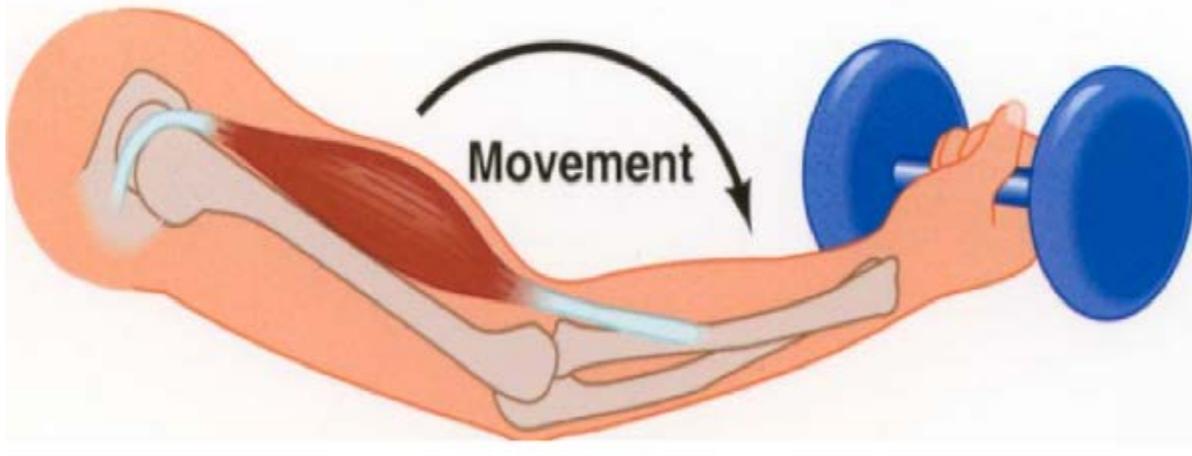


# Yoga



# Types of Contraction

## Eccentric contraction



# Pilates

Concentration  
Centering. ...  
Control. ...  
Breathing. ...  
Precision. ...  
Flow.



# Eccentric muscle contractions – usually very slow and purposeful



# 4. Practical evidence-based Hatha Yoga for those at risk for chronic disease

*Pascoe M. J Psychia. Res. 2015; Ospina M. Agency for Healthcare Research and Quality. Yoga research review. 2007; Desveaux Let.al. Med Care. 2015 Jul;53(7):653-61. LaForge R. Chap 15, Adv Health and Fitness Manual, Am Council on Exercise 2008; LaForge R. Chap 24. Fitness Professional's Handbook, 6th edition, Human Kinetics, 2012.*

# Yoga (cont.)

## **Branches:**

Bhakti

Guru

Hatha

Jnan

Karma

Mantra

Raja

Tantra

Moral observances

Breath control

Concentration

Meditation

Posture

Spiritual integration

# Yoga (more)

**Yoga** historically refers to the complex system of physical and spiritual disciplines that is fundamental to Buddhist, Jain and Hindu religious practice throughout Asia.

We must differentiate the use of the word **yoga** from participation in hatha yoga classes such as that experienced in many yoga studios and fitness centers in the United States.

Hatha yoga participation may or may not include spiritual, mindful, and related yogic lifestyle behaviors.

# Hatha Yoga

Viniyoga  
Iyengar  
Restorative  
Ashtanga  
Kripalu  
Integral  
Somatic  
Sivanada  
Ananda  
Bikram  
Kundalini  
Tibetan  
Etc.

# Muscular Contraction + Breath work + Mentation

(internal nonjudgmental focus)



# Most Evidence-based Health Related Outcomes of Meditation and other Mind-Body Therapies

Stress-related symptoms, e.g., anxiety measures

- Pain symptoms
- Blood pressure
- Addictive behaviors
- Balance

Agency for Healthcare Research and Quality (AHRQ),  
Ospina et. Al. 2007

# A systematic review of randomized control trials on the effects of yoga on stress measures and mood.

Pascoe MC, Bauer IE. J Psychiatr Res. 2015 Sep;68:270-82 (Sweden & UT Houston)

First systematic review of RCTs on the effects of yoga on mood and brain.

Overall the 25 randomised control studies discussed provide preliminary evidence to suggest that yoga practice leads to better regulation of the sympathetic nervous system and hypothalamic-pituitary-adrenal system, as well as a decrease in depressive and anxious symptoms in a range of populations

- Yoga decreases blood pressure, heart rate, cortisol and cytokine expression.
- Yoga associated with metabolic changes in the brain.
- Influence sympathetic nervous system, hypothalamic- pituitary-adrenal axis regulation

# Yoga in the Management of Chronic Disease: A Systematic Review and Meta-analysis.

Desveaux Let.al. Med Care. 2015 Jul;53(7):653-61 Univ. Toronto

A systematic review of the effectiveness of yoga on exercise capacity, health related quality of life (HRQL), and psychological well-being for individuals with chronic disease and describe the structure and delivery of programs.

**RESULTS:** 10 studies(431 individuals, mean age  $56\pm 8$  y) were included and were comparable in their design and components, irrespective of the chronic disease.

**CONCLUSIONS:** Yoga programs have similar designs and components across chronic disease populations.

Compared with usual care, yoga resulted in significant improvements in exercise capacity and a mean improvement in HRQL. Yoga programs may be a useful adjunct to formal rehabilitation programs.

# Restorative Yoga



# Restorative Yoga (cont.)

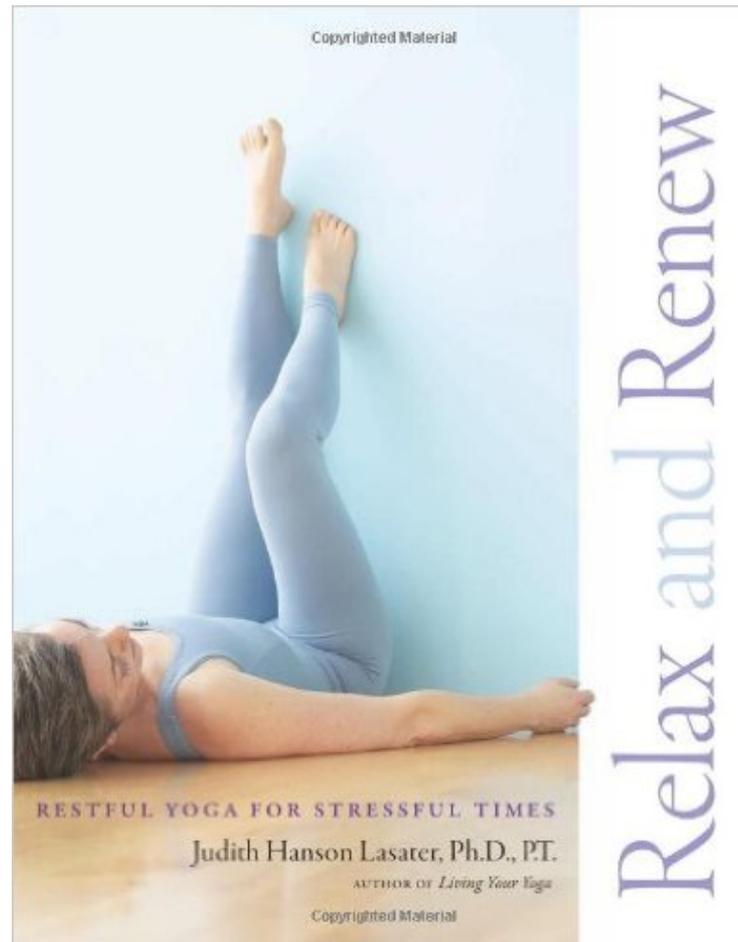


# Low level passive stretch + Breath work + Meditative Component



# Judith Lasater's Restorative Yoga Text: Relax and Renew: Restful Yoga for Stressful Times

Rodmell Press 2011



# Supported/Seated Angle Pose



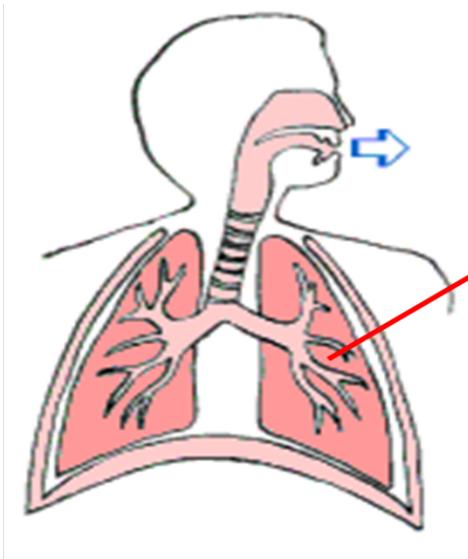
# Supported Angle Pose



# Yoga



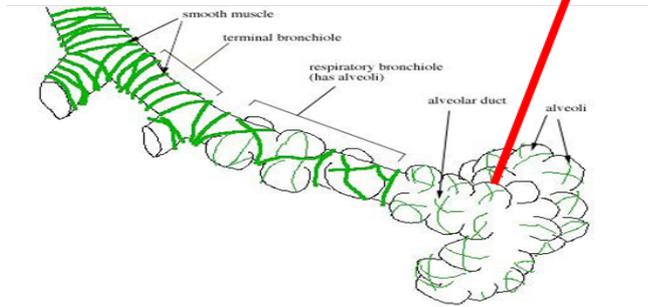
# Yogic Breathing



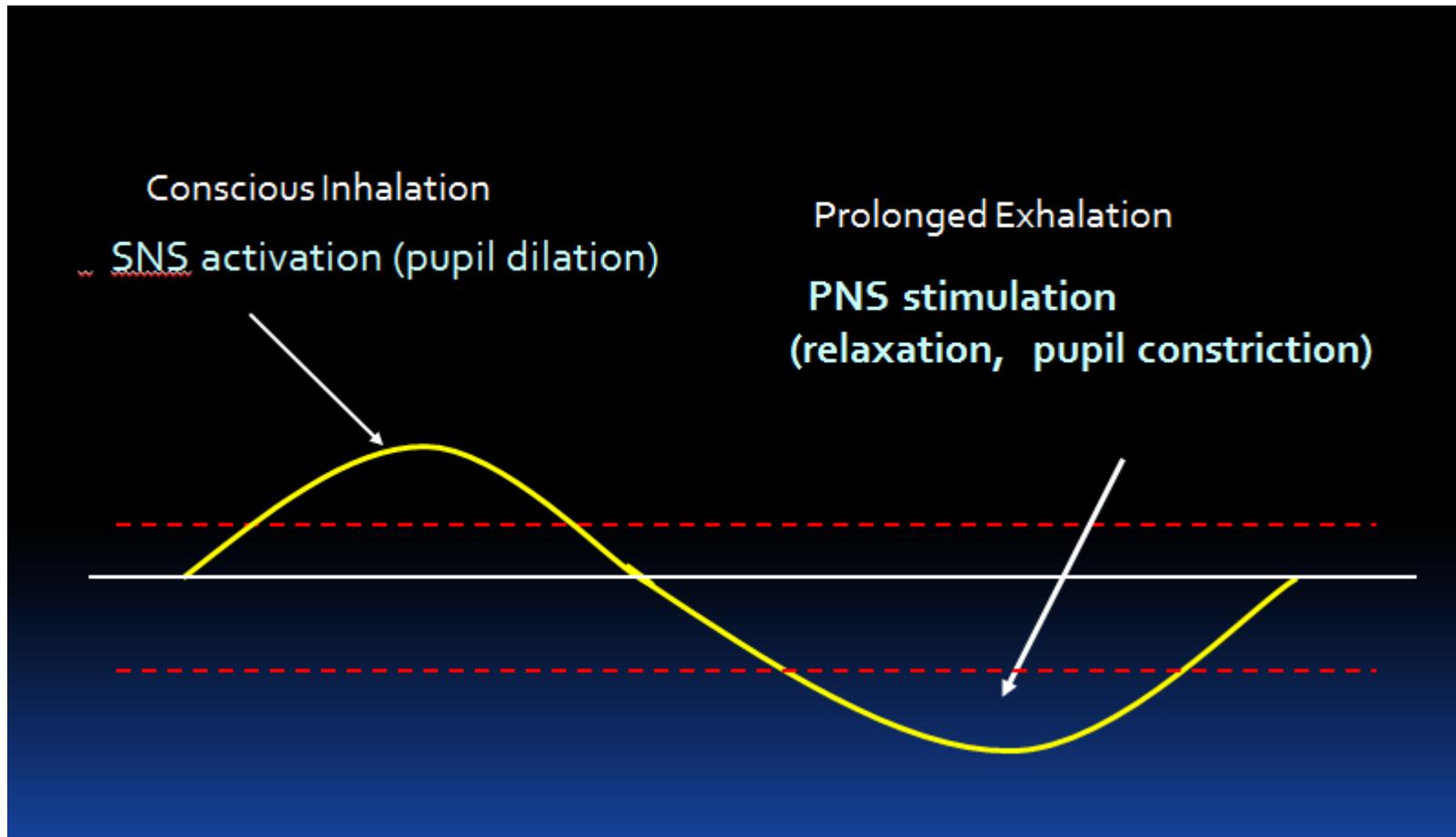
Inhalation & expiration:  
stretch receptors in  
pulmonary tissue stimulate  
vagus nerve (parasympathetic)

Prolonged expiratory phase:  
further enhancement of  
inhibitory tone

eg. chanting, singing,  
pranayama, diaphragmatic  
breathing.



# Yogic Breathing and Neuroaffective Response



# Simple Breathwork

Inhale to the count of two  
Exhale to the count of two

Inhale to the count of two  
Exhale to the count of three

Inhale to the count of two  
Exhale to the count of four

Inhale to the count of two  
Exhale to the count of five

Dr. Luciano Bernardi,  
Prof. of Internal Medicine, University of Pavia, Italy



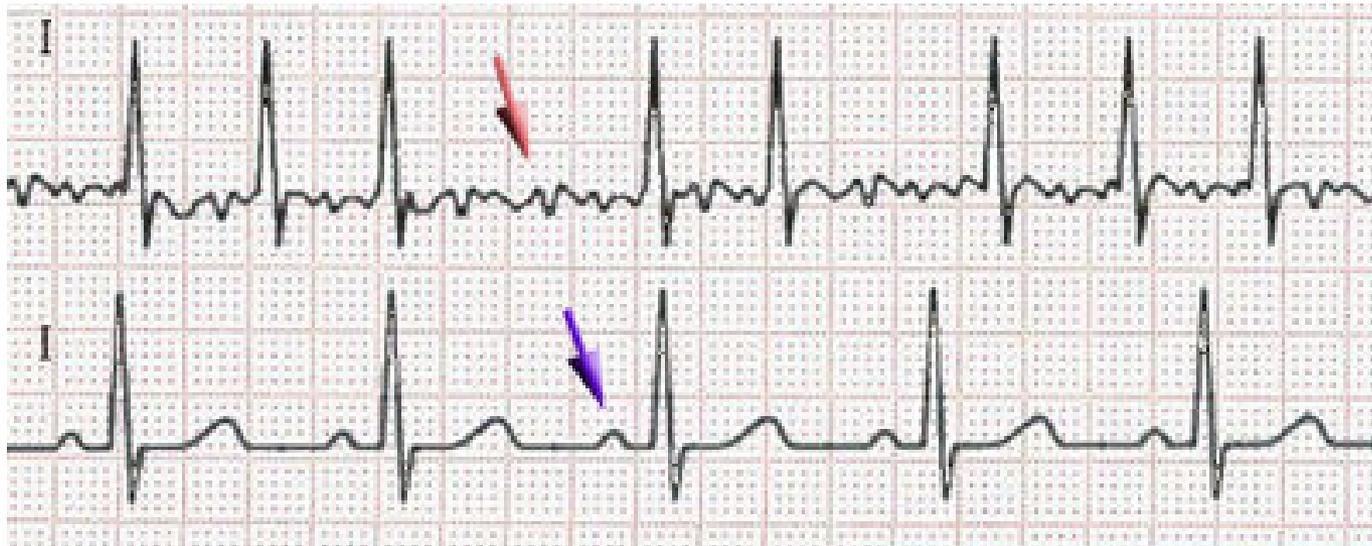
# Cardiovascular and respiratory effect of yogic slow breathing in the yoga beginner: what is the best approach?

Mason H, Bernardi L, et.al. Evid Based Complement Altern. 2013;2013:743504. UK

We compared BRS (baroreflex sensitivity) and ventilatory control under different breathing patterns (equal/unequal inspiration/expiration at 6 breath/min, with/without ujjayi), in 17 yoga-naive young healthy participants. BRS increased with slow breathing techniques with or without expiratory ujjayi ( $P < 0.05$  or higher) except with inspiratory + expiratory ujjayi.

- The slow breathing with equal inspiration and expiration seems the best technique for improving baroreflex sensitivity in yoga-naive subjects. The effects of ujjayi seems dependent on increased intrathoracic pressure that requires greater effort than normal slow breathing.
- Slow breathing increases cardiac-vagal baroreflex sensitivity (BRS), improves oxygen saturation, lowers blood pressure, and reduces anxiety

# Atrial Fibrillation



# Yoga and Atrial Fibrillation

Effect of yoga on arrhythmia burden, anxiety, depression, and quality of life in paroxysmal atrial fibrillation: the YOGA My Heart Study

Lakkireddy D et.al. J Am Coll Cardiol. 2013 Mar 19;61(11):1177-82. Ukan University of Kansas Medical Center, KC

49 patients with paroxysmal AF underwent a 3-month control phase in which they could engage in any type of physical activity they were previously accustomed to doing.

- 45 minutes, hatha yoga, 3x/wk for 3 months
- Results showed that during the yoga-intervention phase, the number of episodes of AF was significantly reduced--from a **mean of 3.8 to 2.1**. The number of phantom episodes was also reduced, from a mean of 2.6 to 1.4. In addition, 22% of patients did not have any AF episodes during the yoga phase. There was significant decrease in heart rate, and systolic and diastolic blood pressure before and after yoga ( $p < 0.001$ ).

Lakkireddy reported that there was also a "drastic" improvement in quality of life, with significant reductions in anxiety and depression scores.

# Comparing Once- versus Twice-Weekly Yoga Classes for Chronic Low Back Pain in Predominantly Low Income Minorities: A Randomized Dosing Trial.

Saper RB et.al. Evid Based Complement Alternat Med. 2013;658030. Boston University School of Medicine

**Methods.** We conducted a 12-week randomized dosing study for 95 adults recruited from an urban safety-net hospital and five community health centers comparing once-weekly (n = 49) versus twice-weekly (n = 46) standardized yoga classes supplemented by home practice.

**Results.** The preprogram mean pain intensity and function reflected moderate to severe back pain and impairment. Pain and back-related function improved within both groups ( $P < 0.001$ ).

However, there were no differences between once-weekly and twice-weekly groups for pain or back-related function.

**12 weeks of once-weekly or twice-weekly yoga classes were similarly effective for predominantly low income minority adults with moderate to severe chronic low back pain.**

# Select Yoga Exercises for Asanas for Low-Back Pain



5. Increasing exercise intensity provides additional benefit depending on the targeted health outcome in insulin resistant obese adults.

*Ross R Ann Intern Med. 2015;162(5):325-334*

# Effects of Exercise Amount and Intensity on Abdominal Obesity and Glucose Tolerance in Obese Adults: A Randomized Trial

Robert Ross et.al. Ann Intern Med. 2015;162(5):325-334. Ontario

24-week, 300 abdominally obese adults (BMI ~33.6).

**Control** (no exercise) (n = 75) or 5 weekly sessions of low-amount, **Low-intensity exercise** (LALI) (180 and 300 kcal/session for women and men, respectively, at 50%  $\dot{V}O_2p$  **High-amount, low-intensity exercise** (HALI) (360 and 600 kcal/session, respectively, at 50% of  $\dot{V}o_2peak$ ) or **high-amount, high-intensity exercise** (HAHI) (360 and 600 kcal/session, respectively, at 75% of  $\dot{V}O_2p$

Reductions in 2-hour glucose level were greater in the HAHl group (-12.5 mg/dL; P = 0.027) than the control group but did not differ for the LALI or HALI group versus the control group. Weight loss was greater in all exercise groups than the control group (P < 0.001); however, reduction in body weight did not differ among the exercise groups.

- **Fixed amounts (kcal expenditure) of exercise independent of exercise intensity resulted in similar reductions in abdominal obesity.**
- **Reduction in 2-hour glucose level was restricted to high-intensity exercise.**

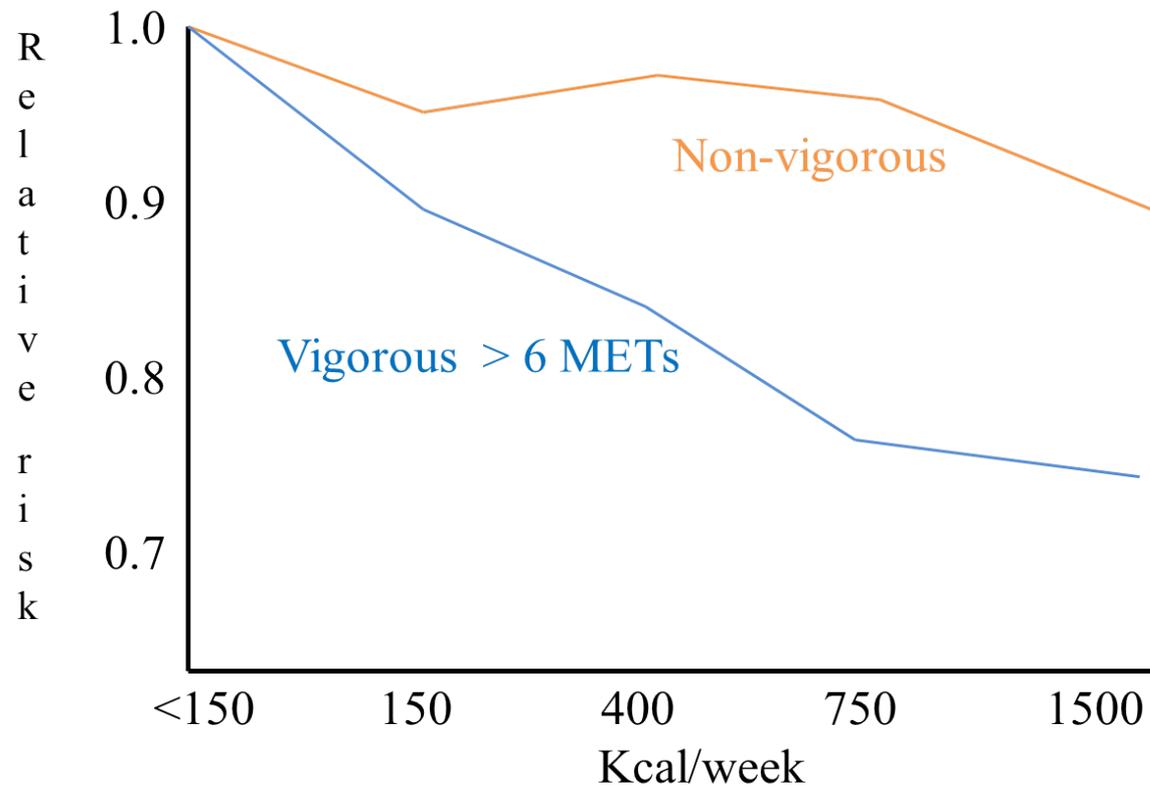
The improvement in cardiorespiratory fitness has clinical relevance because an increase in CRF of 1 metabolic equivalent is associated with a 15% to 20% decrease in risk for death from cardiovascular disease (Kodama 2007).

Ross 2015

For a given energy expenditure, exercise or physical activity performed at somewhat higher than moderate intensity (e.g., >60% of V02 Max or >75% of heart rate max) may confer additional cardiovascular disease risk reduction and related health benefits.

*Lee I-M et al JAMA 273:1179, 1995; Winett RA & Carpinelli RN Ann Behav Med 22:237, 2000; Kodama S et.al. JAMA. 2009;301:2024-35,2007; Williams PT Med Sci Spts Ex 33: 754, 2001.*

# All-Cause Mortality Harvard Alumni Study 10,269 men 12 yr f/u



Lee IM et al JAMA 273:1179, 1995

# High intensity intermittent exercise improves cardiac structure and function and reduces liver fat in patients with type 2 diabetes: a randomised controlled trial

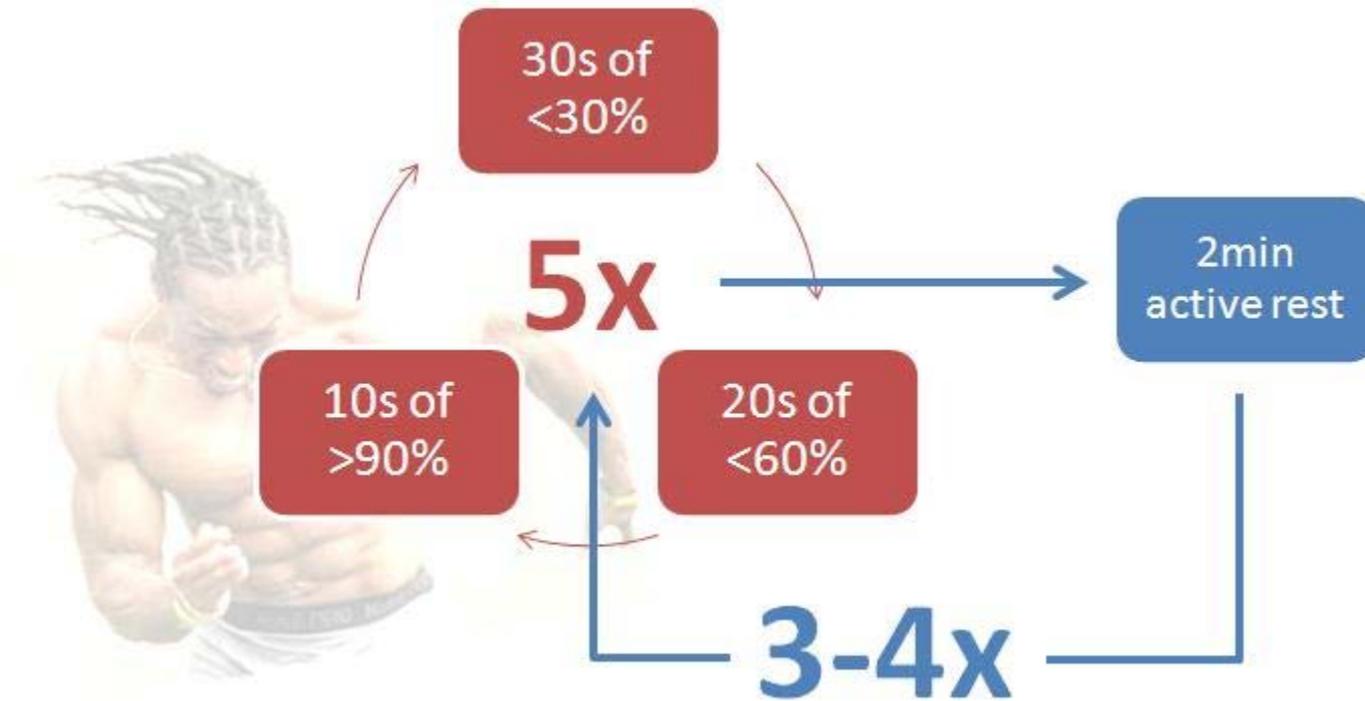
Sophie Cassidy, Christine Thoma, Kate Hallsworth, Jehill Parikh, Kieren G. Hollingworth, Roy Taylor, Djordje G. Jakovljevic, Michael I. Trenell

- 28 patients with type 2 diabetes (metformin and diet controlled) were randomised to 12 weeks of HIIT (n=14) or standard care (n=14). High intensity cycling.
- Conclusions/interpretation: This is the first study to demonstrate improvements in cardiac structure and function, along with the greatest reduction in liver fat, to be recorded following an exercise intervention in type 2 diabetes. HIIT should be considered by clinical care teams as a therapy to improve cardiometabolic risk in patients with T2D.

30 – 20 - 10



# Interval Training



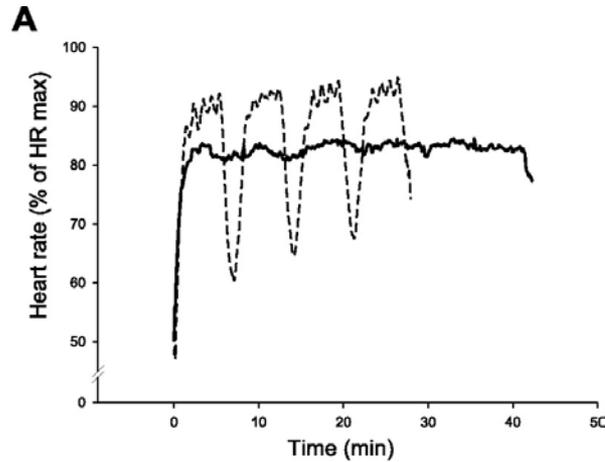
# The 10-20-30 training concept improves performance and health profile in moderately trained runners

Gunnarsson TP1, Bangsbo J J Appl Physiol (1985). 2012 Jul;113(1):16-24 Denmark

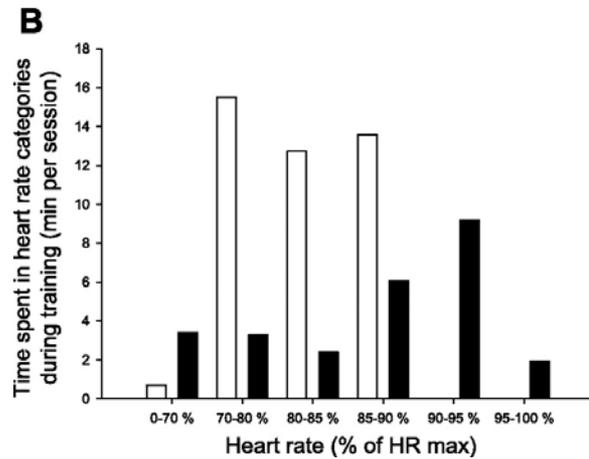
The effect of an alteration from regular endurance to interval (10-20-30) training on the health profile, muscular adaptations, maximum oxygen uptake ( $\text{Vo}(2\text{max})$ ), and performance of runners was examined.

<30%, <60%, and >90% of maximal intensity for 30, 20, and 10 s, respectively in three or four 5-min intervals interspersed by 2 min of recovery, reduced training volume by 54%

# Discussion



Gunnarsson TP1, Bangsbo J J Appl Physiol (1985). 2012 Jul;113(1):16-24



# Neighborhood Circuit

**H**

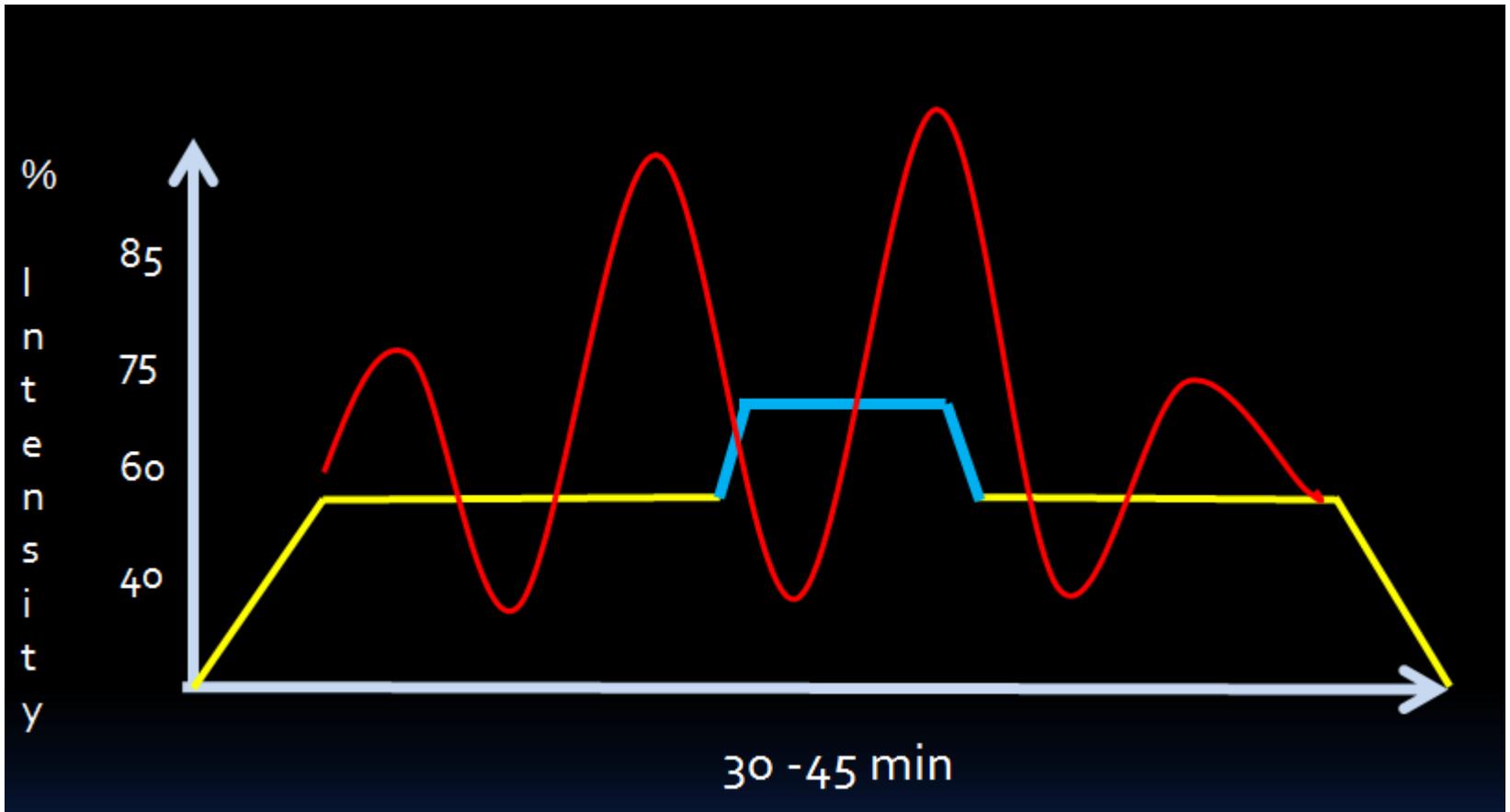
**~300+ kcal**

1  
Mile  
walk

1  
Mile  
walk



# Multi-intensity continuous aerobic exercise session



6. Diverse types of moderate exercise is also associated with lower cardiovascular disease mortality. This includes such utilitarian activities as walking, gardening, climbing, and household/yard chores.

Those who expend 1000 – 1200kcal per week in such utilitarian activities may require very little additional exercise to lower CVD risk.

*Armstrong M et.al. Circ. 2015; Pate, RR et. al., JAMA 1995;273:402, Haskell W., Medicine & Science in Exercise and Sports 1994;26:649.*

# Are there Health Risk Reduction Differences?

1. An active lifestyle expending  $\geq 1000$  kcal/week from a variety of domestic, recreational and work-related activities



2. An inactive work and recreational lifestyle but works out 3-5 days/week for 1000 kcal/week



# Frequent Physical Activity May not Reduce Vascular Disease Risk as Much as Moderate Activity: Large Prospective Study of UK Women

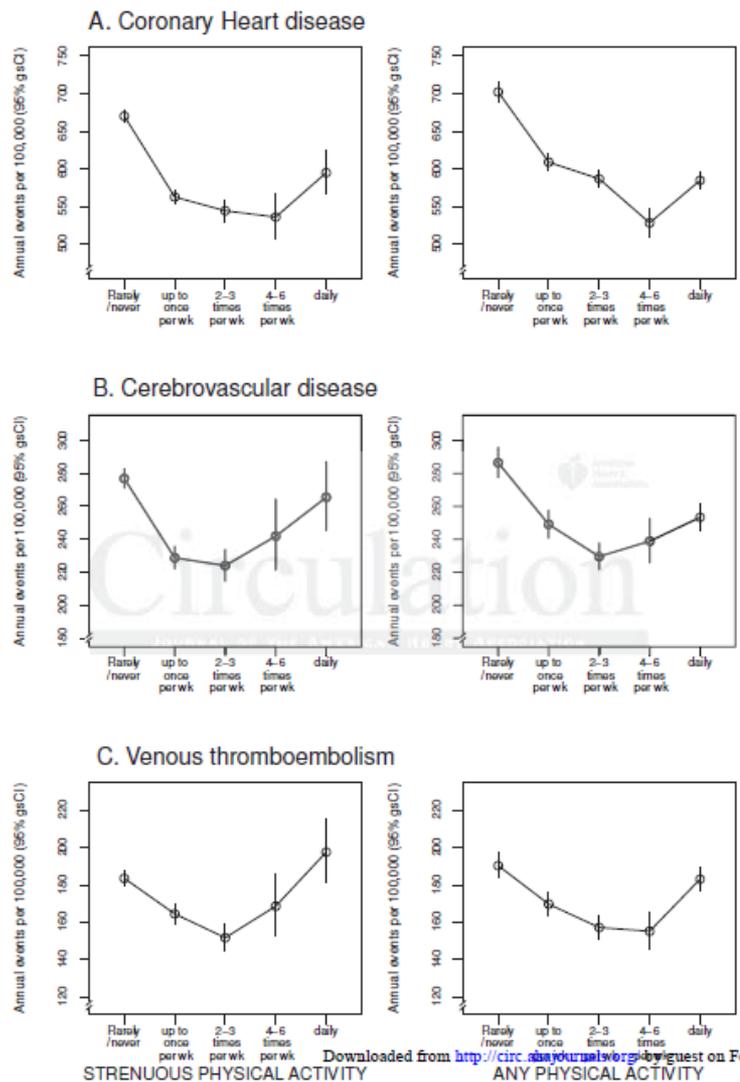
Armstrong et al Circulation. 2015 Feb 24;131(8):721-9.

The **1.1 million woman UK Women's Health Study** recently published by Miranda Armstrong from Oxford showed that women who walked, who do housework, who garden on a daily basis but not to extreme ends, just the moderate level of activity, can reduce their all-cause mortality about 25%.

Armstrong found a U-shaped trend, however. That is if they overindulged in exercise (both intensity and duration) their risk increased dramatically,

**Moderate levels of activity—meaning anywhere from 120 to 150 minutes per week of moderate physical activity, - especially household chores and utilitarian tasks was the best to reduce risk.**

# Frequent Physical Activity May not Reduce Vascular Disease Risk as Much as Moderate Activity: Large Prospective Study of UK Women



Armstrong 2015

# Characteristics of Leisure Time Physical Activity Associated with Decreased Risk of Premature All-Cause and Cardiovascular Disease Mortality in Middle-aged Men

Nina Haapanen et.al. Am J Epidemiol 1996;143:870-80. Finland

Finnish cohort of 1,072 men aged 35-63 years who were followed up for 11 years

For minimum health benefits, energy expenditure in leisure time activities should be at least 700-800 kcal per week.

Furthermore, our results are in agreement with the recommendation encouraging individuals to engage in activities requiring up to 2,000 kcal per week for maximum health benefits.

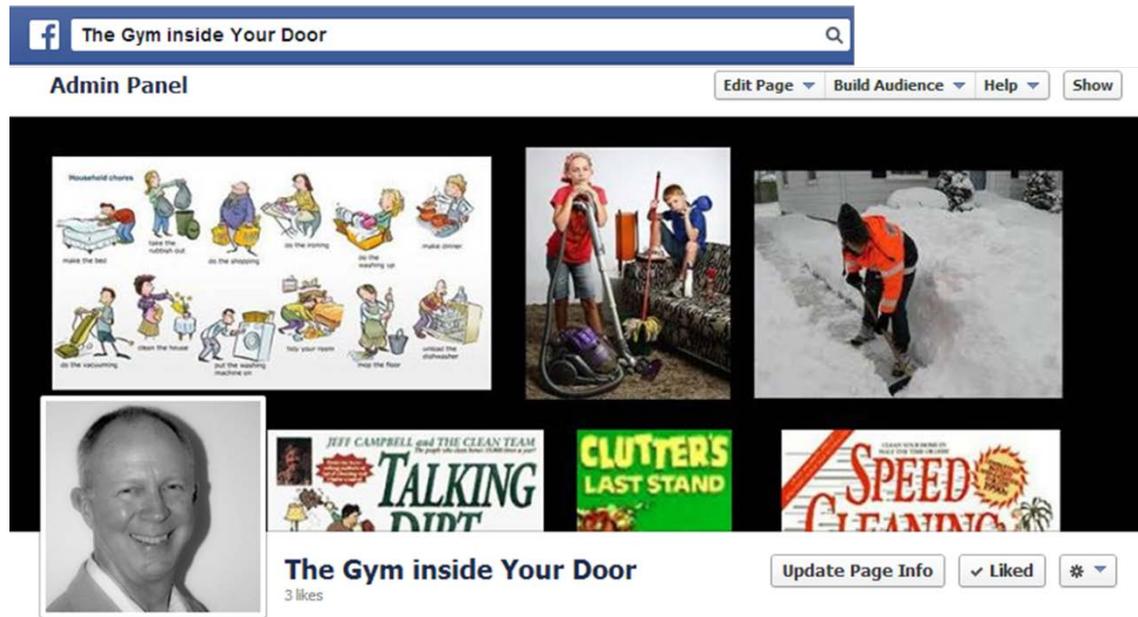
# Condition and non-conditioning physical activities with assigned metabolic equivalent (MET) values, Northeastern Finland, 1980

**TABLE 2. Conditioning and nonconditioning physical activities with assigned metabolic equivalent (MET) values, northeastern Finland, 1980**

Activity	MET value
<b>Conditioning physical activity and sports (some examples)</b>	
Gymnastics, motor sports, shooting, riding, downhill skiing	2.5
Walking, cycling, ball games	4.0
Jogging, cross-country skiing, skating, swimming, rowing	6.5
<b>Nonconditioning physical activity</b>	
Strenuous household activities, indoor household repairs, engine repairs, fishing	3.0
Outdoor household repairs, construction work, gardening, growing vegetables on an allotment, picking berries, gathering mushrooms, hunting	4.0
Hiking	5.0
Leisure time forestry work	6.0

# The Gym Inside Your Door

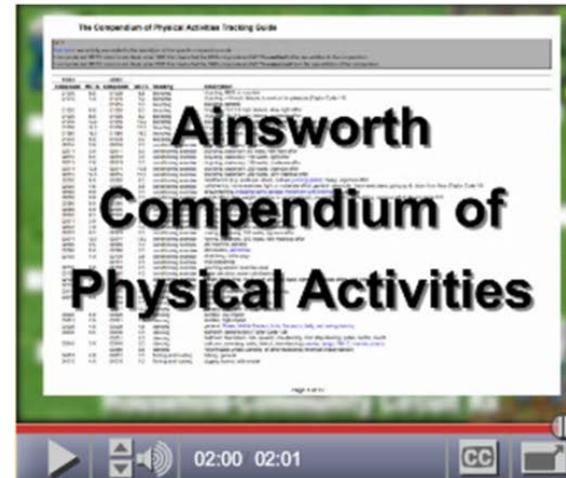
Utilitarian household and yard chore circuit "workouts" that can be systematically and creatively organized into one productive workout expending 150-500 kcal. Prediabetes and diabetes-centric focus.



# Utilitarian-Domestic Activities of sufficient volume do condition and reduce risk

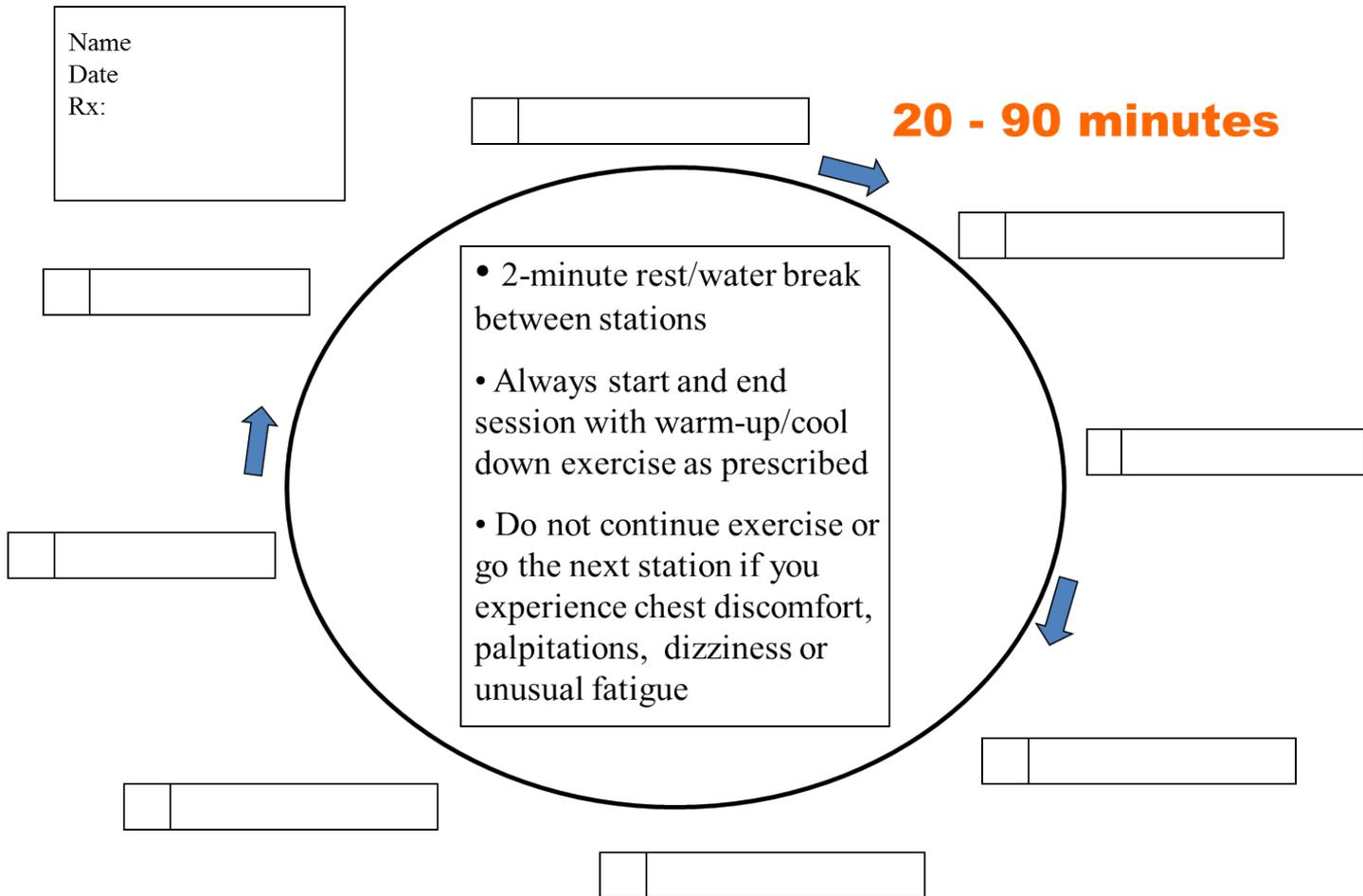
- Yardwork
- Gardening
- Housework
- Painting, cleaning, scrubbing, washing
- Repair work
- ADL's

# Household Circuit Activity Program

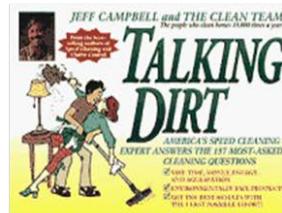
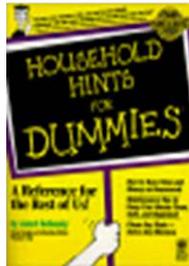


[www.ihs.gov/MedicalPrograms/Diabetes/index.cfm?module=toolsPAHowtoHCircuit](http://www.ihs.gov/MedicalPrograms/Diabetes/index.cfm?module=toolsPAHowtoHCircuit)

# Household-Community Circuit Rx



# Utilitarian Domestic Activities



# Utilitarian Domestic Activities (cont.)



Utilitarian and domestic physical activities when executed at sufficient intensity and regularly are at least as effective in reducing risk of chronic disease as organized systematic workouts when matched for total energy expenditure

+ sense of accomplishment

# Special Diabetes Program for Indians (SDPI)



## Two Women Changed Their Lives by Walking, Walking, Walking! February 2014, Tucson, Arizona

Native people living in and near Tucson, Arizona, are finding a way to become fit, or keep their fitness regimens going strong. Once a week they can join a walking group held at the Tucson Indian Center in downtown Tucson.

Both Isabella Enriquez, Tohono O'odham Nation, and Erolinda Ramon, Tohono O'odham Nation, started regular walking about two years ago. Isabella was in the Center's *Lifestyle Balance* class when she joined the walking group. For a while she was the only client in the group. She walked the over 2-mile course with the Diabetes Prevention Program Coordinator, Arcenio Trujillo.

"She would show up even when it was freezing cold!" recalls Arcenio.

Erolinda started walking when she was in the SDPI Healthy Heart Program at the San Xavier Health Clinic. She has diabetes, and, at that time, had severe pain in her feet. "I've had a hard time controlling my diabetes. But the walking helps me," she says.

Erolinda has lost weight, no longer needs insulin shots, and eats more fruits and vegetables and fewer sweets. "My blood sugar has come down and I've been feeling real good," she says.

Isabella walks up to seven miles a day. She has become stronger and improved her balance. She has lost weight, and eats more fruits and vegetables and less high-fat food. She cut back on soda and drinks more water.

These lifestyle changes have helped Isabella feel better. "At one time, I couldn't even move. But now I don't feel pain so much. I don't feel depressed. I don't have diabetes. I'm 67, and feel like I'm getting younger!"

Every week Isabella and Erolinda join the Center's walking group, which has grown from one participant to about 20. The two women have made regular walking a part of their lives.

# Exercise: it's the real thing!

A single bout of exercise generates more real-time favorable metabolic, arterial, and psychobiologic changes than any single medical therapy.

# Core text for candidates preparing to sit for the ACE Medical Exercise Specialist Certification exam

- Definitive resource for experienced professionals who provide medical exercise and post-rehabilitative fitness programs to clients with cardiovascular, pulmonary, metabolic and musculoskeletal issues
- Incorporates insight from 24 leading experts from sports fitness and healthcare

[www.acefitness.org/fitness-certifications/certified-medical-exercise-specialist/](http://www.acefitness.org/fitness-certifications/certified-medical-exercise-specialist/)



# Complete Guide to Fitness and Health

