The Role of Physical Activity in Obesity Management

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Disclosure

• Nothing to disclose

• No relevant financial relationships, off label, or investigational uses
Objectives

• Understand the breadth, scope, and ramifications of the current global epidemic of obesity and sedentary lifestyle

• Discuss the specific effects of aerobic exercise on obesity

• Discuss the specific effects of strength training exercise on obesity

• Discuss beneficial effects of exercise independent of weight loss
The Problem:

Almost two-thirds (67%) of American adults are overweight or obese.

In less than 30 years, the prevalence of overweight among children aged 6-19 has tripled.*

Causes of Death in the U.S. since 1990

- Tobacco use: 435,000
- Diet/PA: 400,000
- Alcohol: 85,000
- Infection: 75,000
- Toxic agents: 55,000
- MVA: 43,000
- STD: 20,000
- Illicit drug use: 17,000

Mokdad, JAMA, 2004
U.S. Physical Activity Participation

• Adults: 70% reported that they did not meet the recommendation (at least 30 minutes of moderate activity most days of the week)*

• Children: 65% of high school students reported that they did not meet the recommendation (60 minutes of physical activity five or more days/week)**

*2005 National Health Interview Survey
Sitting Time: An Independent Risk Factor

• Association between the amount of sedentary time in an individual’s life and their overall metabolic risk

• independent from time spent in moderate or vigorous activity

• standing and moving around and spending less time sitting produces healthier blood lipid profiles and blood glucose levels than those who meet minimum recommended activity levels but sit for prolonged periods

Hamilton, Healy 2008
Dangers of Sedentary Living

Physical inactivity increases the risk of developing:

- Cardiovascular disease
- Type 2 Diabetes
- Obesity
- High cholesterol
- Hypertension
- High blood triglycerides
- Congestive Heart Failure
- Breast, Colon, Pancreatic, and Prostate Cancers
- Gallstone Disease
- Peripheral vascular disease
- Osteoporosis
- Stiff joints
- Anxiety and Depression
- Decreased cognitive function
- Sleep Problems
- Physical frailty
- Reduced quality of life
- Premature death
Prevalence* of Self-Reported Obesity Among U.S. Adults BRFSS, 2012 CDC

Map showing prevalence of self-reported obesity among U.S. adults by state, with color coding for different percentage ranges.
What the future holds....

• Obese people in US will increase from 99 million in 2008 to 164 million by 2030

• Obesity rate rise from 32% to 50% for men

• Obesity rate rise from 45% to 52% for women

• Cost to treat obesity related disease increase $66 billion per year by 2030

• Disease burden: 7.8 million more cases DM, 6.8 million more cases CAD and stroke, 539,000 more cancers by 2030

Lancet, August 2011
A Global Concern

• Obesity in China:
  
  “Major health concern”  
  WHO, 2013

  Obesity rates approaching 20% in some cities  
  Levine, 2011

• More overfed than underfed in world today  
  WHO, 2013
Prevalence of obesity*, ages 20+, age standardized
Both sexes, 2008

Prevalence of obesity (%)
- <10
- 10–19.9
- 20–29.9
- ≥30
- Data not available
- Not applicable

* BMI ≥30kg/m²

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

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Morbidity of obesity

- **Type 2 DM:** weight gain of just 11 to 18 lbs doubles risk
- **Osteoarthritis:** for every 2 lb weight increase, risk of OA increases 9-13%
- **Pregnancy:** obesity increases risk of gestational diabetes, labor and delivery problems, birth defects, HTN
Mortality as Consequence of Obesity in Adults

- **BMI 30-34.0**: 200-300% higher mortality than normal weight adults
- **BMI 25-29.9**: 20-40% higher mortality than normal weight adults
  
  - Adams et al, NEJM, August, 2006

- **20 years of life lost** due to obesity in certain age and racial/ethnic groups
  
  - CDC Economic Consequences of Obesity 2004
Cost of Overweight/Obesity

• $98-147 billion
• $250 billion with DM2
• Average annual health care cost is 36% higher for an obese adult
• Obesity more expensive to treat than tobacco, alcohol abuse

How much is a healthy weight worth?

- Decrease heart disease: $14,990/yr in hospital inpatient stays
- High cholesterol: $678/yr in meds
- HTN: $559/yr in meds
- Cancer: $23,184/yr in hospital inpatient stays
- Joint problems/OA: $847/yr in MD visits
- Pregnancy complications: $8717/yr
Mayo Clinic Rochester data, 2013:

- Costs of smoking: $1300/yr
- Costs of obesity/morbid obesity: $1800/$4000/yr
- Similar to other population data:
  GWU School of Public Health overweight/obesity: $346/$1474/yr
Is Obesity “Genetic?”

• Genetic factors can play a role in obesity development  Maes, 1997

• PA associated with 40% reduction in genetic predisposition as measured by number of gene risk alleles  Li, 2010

• Adolescents meeting the PAG may overcome the effect of the obesity associated gene polymorphism on obesity related traits  Ruiz, 2010
Your Genes Are Not Your Fate

“Comprehensive lifestyle changes significantly increase telomerase activity and consequently telomere maintenance capacity in human immune-system cells”

Ornish D  The Lancet Oncology, Volume 9, Is 11 November 2008
Adult Minimum Physical Activity Needs

• 150 minutes moderate activity a week; 75 minutes vigorous activity

• Interval training effective

• Can “accumulate” activity throughout the day

• Strength training should also be included

PA Guidelines  HHS, Oct. 2008
Is Exercise Effective in the Treatment of Obesity?

• Complex problem to study: diet/caloric intake, duration of study, adherence to program, and type, volume, and intensity of exercise are all variables

• Weight loss achieved by change in energy balance: reduction in calories in, increase in calories burned, or both
Aerobic Exercise Effects

- Aerobic exercise alone produces weight loss, but gains smaller (<3%) if not combined with calorie restriction  Moineddin 2012
- PA alone less effective than diet alone or diet plus PA  Wing, Jakicic 1998
- PA alone has not been proven to produce significant weight loss, especially when “dose” of PA is similar to PAG of 150 minutes/week  Lee, JAMA, 2010
Aerobic Exercise Effects

- Single bout of aerobic exercise (2 hrs at 60% VO2 max) reduced VLDL-TG by 30%
- Acute exercise superior to calorie restriction in lowering blood lipid levels, at least over the short term (MSSE, 2013)
- 2 hours PA to see effect; 30 minutes not enough to improve plasma TG after single bout
Aerobic Activity and Weight Gain Prevention

- Women successful at maintaining normal weight and limiting weight gain over 15 years averaged **300 minutes/week** of moderate intensity activity  
  Lee, JAMA, 2010

- **150 minutes PA/week not enough** to limit weight gain **if no caloric restriction**

- **BMI >40**: significant weight loss and reduction in cardiac risk factors with **diet and 300 min/week PA**, even when PA introduced after 6 months of 12 month study  
  Goodpaster 2010
Aerobic Exercise and Weight Gain Prevention (Svetkey, JAMA, 2010)

- In BMI over 40: initial weight loss greater if PA included at start, but similar at end of 1 year
- Either early or late PA: reduced visceral abdominal fat, hepatic fat, insulin resistance, and BP
- Addition of PA produced greater reduction in waist circumference and hepatic fat
- Addition of PA promoted greater weight loss, no matter when introduced
The Effect of PA in the Prevention of Weight Gain

• Majority of individuals who lose weight are not able to maintain their weight loss  Jeffery, 2000

• Problems with exercise sustainability and compliance well known  Katan, 2009

• Home treadmills given free: initial 6 month weight loss could not be sustained at 2 years  Jakicic, 2008

• Weight regain after weight loss, regardless of behavioral interventions used to maintain weight loss  Svetkey, JAMA, 2008
The Effect of Resistance Training on Weight Loss

• Resistance training increases lean muscle mass and decreases fat mass  Avila, 2010

• Resistance training increases insulin sensitivity and decreases LDL cholesterol  Ibanez, 2010

• In absence of aerobic activity, resistance training plus dietary modification does not increase weight loss compared to diet alone  Wing, 1998
Effect of Resistance Training on Weight Loss

- Performed 3 times per week, may reduce the metabolic syndrome z-score, with decreases in fasting blood glucose, improvement in body composition and muscle strength.

- In people with CAD, strength training and aerobic training more effective than aerobic alone in improving body comp and CV fitness.

Marzolini, 2012
Take Home Messages

• We are in the midst of a global obesity epidemic

• Low levels PA related to weight gain and increased risk CV disease in men and women

• Physical activity reduces health care costs, missed work, and hospitalizations

• Increased sitting time is an independent risk factor for the development of metabolic risk factors

• Most studies show that exercise has a small, independent effect on body weight, typically less than 3% weight loss…but has significant additive effect when combined with caloric restriction
Take Home Messages

• Exercise can help **sustain** long term weight loss and **minimize weight gain** over a lifetime, especially if volume in range of **300 min/week**

• **Strength training** independent of aerobic exercise has **not** been shown to produce additional weight loss compared to calorie restriction alone, but does **increase lean muscle** and produce beneficial metabolic changes

• Even in absence of weight loss, **exercise** has many cardiovascular and metabolic benefits, including **decrease in BP, harmful lipids and insulin resistance**
Thank you!!