Physical (In)activity & the Metabolic Syndrome

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The health obstacles of a modern lifestyle (a short list)

- Too little exercise
- Too much time spent sitting
- Work sites, schools, homes, and public spaces have been re-engineered in ways that minimize human movement and muscular activity

Guidelines for Physical Activity (ACSM/AHA 2007)

- ~150 minutes per week engaged in moderate-to-vigorous activity to reduce risk of multiple chronic conditions (CVD, NIDDM, obesity, and perhaps cancer)
  - In addition to routine activities of daily living
  - Moderate-to-vigorous – equivalent to a brisk walk
Being sedentary is distinct from being inactive

- Physically active – meeting ACSM/AHA recommendations
  - Participating in moderate intensity activities (biking, swimming, running) that expend 3 – 8 METs

- Physical inactive – lack of moderate to vigorous physical activity, as defined by ACSM/AHA
  - Still spend high proportion of day performing light intensity activities (standing, slow walking) that expend 1.6 - 2.9 METs

- Sedentary (Latin sedere, “to sit”) – spending a high proportion of wakeful day engaged in behaviors that have level of energy expenditure barely above resting energy expenditure (1.0 – 1.5 METs)
  - sitting, lying down, using the computer, watching TV, sitting in a car

Australian Diabetes, Obesity, and Lifestyle Study (AusDiab)

- 11,000 Adults from Australia and Northern Territory

- Among adults without diabetes, self-reported TV time was positively associated with abnormal glucose metabolism and metabolic syndrome;

- This association was sustained after adjusting for leisure time Physical Activity

  Dunstan, Diabetologia, 2005
  Dunstan, Diabetes Care, 2004

Television Time and Continuous Metabolic Risk in Physically Active Adults

Healy, MSSE, 2008
The association between television viewing and overweight among Australian adults participating in varying levels of leisure-time physical activity

Salmon, IJO, 2006

High levels of sedentary time increase risk of the metabolic syndrome

Bankoski, Diabetes Care, 2011

Physical inactivity and metabolic health

In a follow-up study, VO2_max ↓ 7% (Krogh-Madsen, J Appl Physiol, 2010)
The biology of sedentary behavior

1. Non-exercise activity (NEAT) represents a high proportion of total daily energy expenditure

   Hamilton, Diabetes, 2007

The biology of sedentary behavior

2. Even light activity substantially increases muscular activity in large postural muscles of back, legs, and trunk

   Hamilton, Diabetes, 2007

The biology of sedentary behavior

3. Low levels of activity and muscular contraction reduces clearance of FFA from Triglyceride

   Zderic, J Appl Physiol, 2006
   Hamilton, Ex Sci Sports Rev, 2004
The biology of sedentary behavior

3. Low levels of activity and muscular contraction reduces insulin stimulated glucose removal

4. Increased sitting time decreases HDL (also due to decreased LPL activity)

5. Too much sitting time is also associated with deep vein thrombosis

6. THESE EFFECTS OCCUR RAPIDLY
   - LPL activity decreases within 4 hrs
   
   Hamilton, Diabetes, 2007

Breaking it up

- Total sedentary time
- Proportion of sedentary time
- Distribution of sedentary time – how much time between bouts of activity?

Healy, Diabetes Care, 2008
Sedentary behavior and mortality

- Higher self-reported sitting time associated with all-cause and CVD mortality rates (N=17,013); Relationship stronger among OB/OW
  Katzmarzyk, MSSE, 2009

- AusDiab follow-up (6.5 yrs, N=8800); high levels of TV viewing time associated with increased all-cause and CVD mortality rates
  - Each 1-h increment in TV time increased risk by 11% and 18%
  Dunstan, Circulation, 2010

- In men (N=7744), spending more time in car (≥10 vs <4 h/wk) and watching TV (≥23 vs. <11 h/wk) associated with greater CVD mortality (82%, 64%)
  Warren, MSSE, 2009

TV viewing is associated with other health-related behaviors

Summary and Recommendations

- Reduce total sedentary time by reducing participation in sedentary behaviors (TV, computer)
- Avoid prolonged periods of uninterrupted sedentary time by increasing number of activity breaks (minimum of 10 minutes)
- Risk of metabolic syndrome and time spent in sedentary behavior increases with age, so decreasing sedentary behavior in older adults is especially important
Too much sitting is time is a real and substantial risk to health

Recommended readings


