

Physical Activity and Long-Term Body Weight Regulation

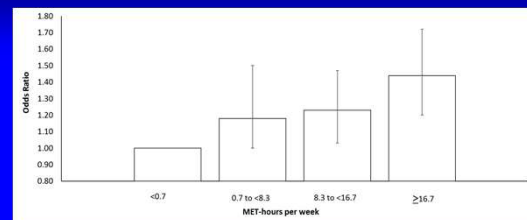
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Orlando, FL

Effects of Physical Activity on Weight and Weight Change Status

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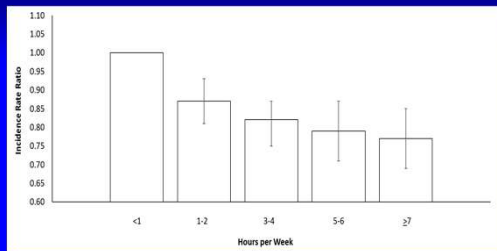
Maintenance of a Healthy Body Weight and Prevention of Obesity

Odds of Maintaining a Healthy Weight by Level of Physical Activity



Source: Adapted from data found in Brown et al., 2016.
Figure Published in: 2018 Physical Activity Guidelines Advisory Committee Report

Incidence Rate Ratio of Developing Obesity at Various Levels of Vigorous Physical Activity



Source: Adapted from data found in Rosenberg et al., 2013.
Figure Published in: 2018 Physical Activity Guidelines Advisory Committee Report

Intensity and Type of Physical Activity

- Total leisure-time physical activity was consistently inversely associated with weight change.
- Studies reporting on moderate intensity and moderate-to-vigorous intensity physical activity showed consistent patterns of inverse associations with weight gain.
 - Light-intensity physical activity was either not associated with weight change or was associated with weight gain.
- Walking was not consistently associated with change in weight or BMI or with the incidence of developing obesity.
 - However, achieving 10,000 steps or more per day attenuated weight gain compared with not achieving 10,000 steps per day.
- Occupational activity was inversely associated with weight gain.
 - This association was observed with moderate- and vigorous intensity occupational activity.
 - This association was not observed with light-intensity occupational activity.
- Household activity did not appear to minimize weight gain.

2018 Physical Activity Guidelines Advisory Committee Report

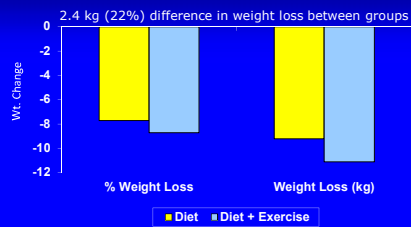
Effects of Physical Activity on Weight and Weight Change Status

Weight Loss

Weight Loss from Physical Activity without Dietary Restriction

- Mean weight loss resulting from physical activity alone
 - Approximately 0.5-3.0 kg.
 - Weight Loss is observed when physical activity is ≥150 min/week
 - Reference: 2008 Physical Activity Guidelines Advisory Committee Scientific Report
- There appears to be a dose response between Physical Activity and Weight Loss
 - <150 min/week promotes minimal weight loss
 - >150 min/week results in modest weight loss of ~2-3 kg
 - 225-420 min/week results in weight loss of 5-7.5 kg
 - Reference: Donnelly et al. ACSM Position Stand on Appropriate Physical Activity Intervention Strategies for Weight Loss and Prevention of Weight Regain for Adults. 2010

Short-Term Changes in Body Weight in Response to a Lifestyle Intervention in Class II and III Obesity

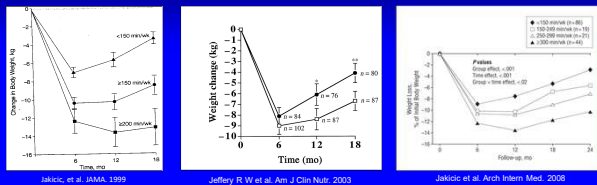


Goodpaster et al. JAMA 2010

Is Physical Activity Effective for Enhancing Short-Term Weight Loss?

- With Moderate Dietary Restriction
 - Physical activity will enhance short-term weight loss by 20-25% above what can be achieved with modest dietary restriction alone.
 - References: Wing et al. 1998; Goodpaster et al. 2010
- With Severe Dietary Restriction
 - Physical activity will have minimal impact on additional weight loss above what is achieved with severe dietary restriction (i.e., <kcal/wk needed to meet RMR).
 - Reference: Donnelly et al. 2009

Is Physical Activity Effective for Enhancing Long-Term Weight Loss?

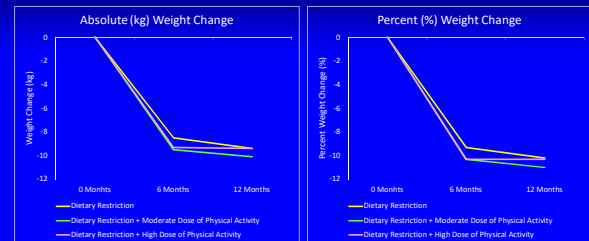


Jakicic, et al. JAMA. 1999

Jeffery R W et al. Am J Clin Nutr. 2003

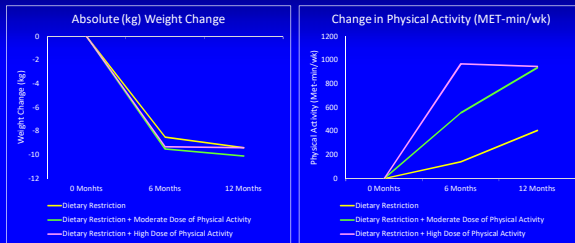
Jakicic et al. Arch Intern Med. 2008

Change in Weight in Response to Diet vs. Diet plus Physical Activity



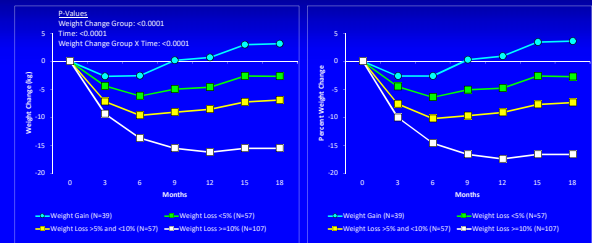
Jakicic JM, Rogers KL, Long W, et al. Weight loss with diet or diet plus physical activity on cardiac MRI and CVD risk factors: Heart Health Study Randomized Trial. Obesity (in Review)

Change in Weight and Physical Activity in Response to Diet vs. Diet plus Physical Activity



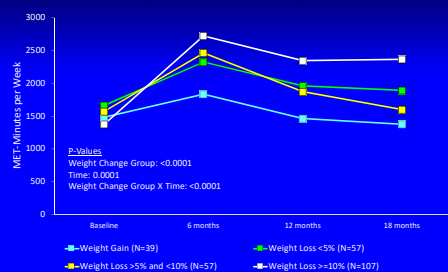
Jakicic JM, Rogers RJ, Lang W, et al. Weight loss with diet or diet plus physical activity on cardiac, MR and CVD risk factors: Heart Health Study Randomized Trial. Obesity [in Review].

Change in Body Weight by 18-month Weight Change Category



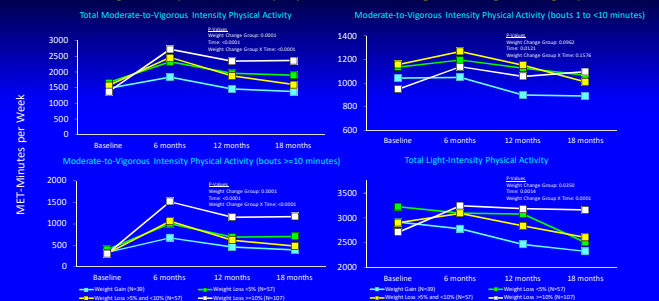
Jakicic et al. Obesity. 2014; 22: 2284-2292.

Change in Total Moderate-to-Vigorous Intensity Physical Activity by 18-Month Weight Change Category



Jakicic et al. Obesity. 2014; 22: 2284-2292.

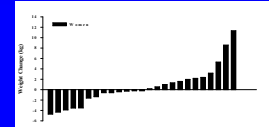
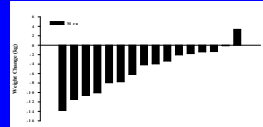
Change in Physical Activity by 18-Month Weight Change Category



Jakicic et al. Obesity. 2014; 22: 2284-2292.

Variability in Weight Change in Response to Physical Activity

Responders and Non-responders at the Same Prescribed Dose



Donnelly et al. Archives of Internal Medicine, 2003

Variability in Weight Change in Response to Physical Activity

Metabolic Equivalent Task (MET)

- Estimates the amount of energy used by the body during physical activity compared to resting energy expenditure.
- Is standardized so it can apply to people of varying body weight and compare different activities.

Metabolic Equivalent Task (MET)

- Defining the MET (estimates)
 - 1 MET = 0.250 L/min of oxygen consumption
 - 1 MET = 3.5 ml/kg/min of oxygen consumption
 - 1 MET = 1 kilocalorie per kilogram of body weight
- MET Categories
 - 1.5 to <3 METS = Light-Intensity Physical Activity
 - 3 to 6 METS = Moderate-Intensity Physical Activity
 - >6 METS = Vigorous-Intensity Physical Activity

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Are these categories appropriate across individuals with varying levels of fitness?

Implications for Intensity base on Fitness Level

MET Level of Activity	Cardiorespiratory Fitness (5 METS = 17.5 ml/kg/min)	Cardiorespiratory Fitness (10 METS = 35 ml/kg/min)	Cardiorespiratory Fitness (15 METS = 52.5)
2.9	58% of max	29% of max	19% of max
3.0	60% of max	30% of max	20% of max
4.5	90% of max	45% of max	30% of max
6.0	120% of max	60% of max	40% of max

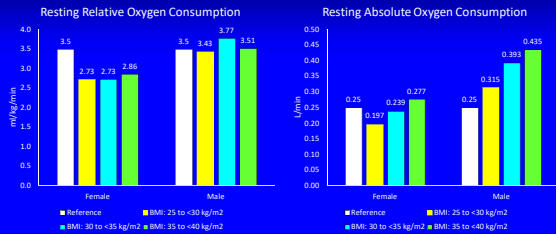
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Variability in the Energy Cost of the MET

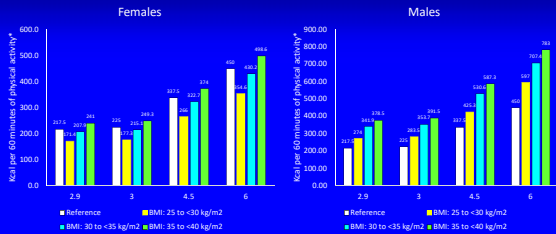
Implications on Energy Expenditure

Comparison of Estimated and Measured Resting Energy Expenditure in Adults with Overweight or Obesity



Rogers RJ, Jakicic JM. Examination of the estimated resting metabolic equivalent (MET) in overweight and obesity. *Obes Res Open J*. 2016; 3(1): 6-9. doi: 10.17140/OROJ-3-121

Comparison of Estimated and Measured Energy Expenditure Based on MET Equivalent in Adults with Overweight or Obesity



*Energy expenditure based on an estimated caloric equivalent of 5.0 kcal per liter of oxygen consumed during physical activity.

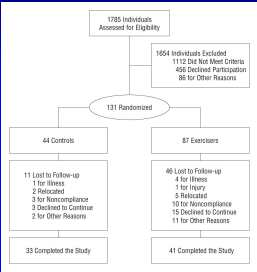
Correlations between measures of physical activity following weight loss and weight stability in adult women.

	TEE:RMR	PA (MJ/d)	PAI (MJ · kg ⁻¹ · d ⁻¹)	PAR (MET · h)
TEE:RMR	-----			
PA (MJ/d)	0.948	-----		
PAI (MJ · kg ⁻¹ · d ⁻¹)	0.955	0.899	-----	
PAR (MET · h)	0.413	0.355	0.472	-----
HR (MET · h)	0.451	0.496	0.558	0.517

PA = energy expended in physical activity by doubly labeled water assessment
PAI = physical activity index by doubly labeled water assessment
PAR = 7-day physical activity recall
HR = 3-day heart rate recording

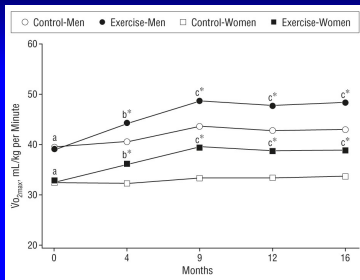
Schoeller DA, Shay K, Kushner RF. How much physical activity is needed to minimize weight gain in previously obese women? *Am J Clin Nutr*. 1997; 66: 551-556.

Designs to Examine Dose-Response of Volume



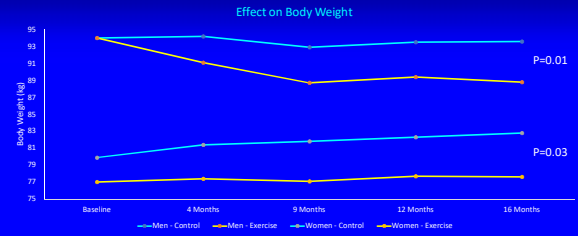
Donnelly et al. *Archives of Internal Medicine*. 2003

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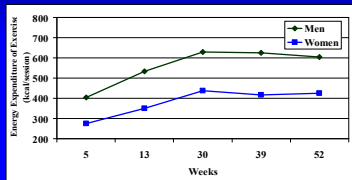
Donnelly et al. Archives of Internal Medicine, 2003

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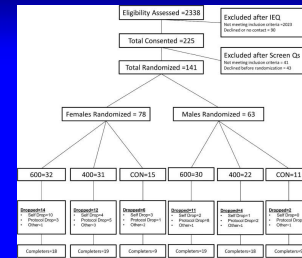
Donnelly et al. Archives of Internal Medicine, 2003

Energy Expenditure of Exercise (kcal)

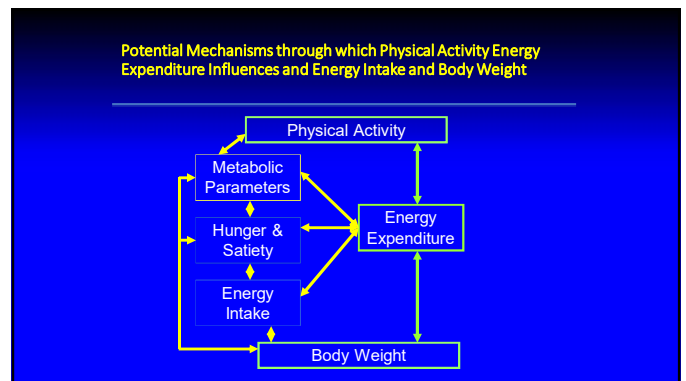
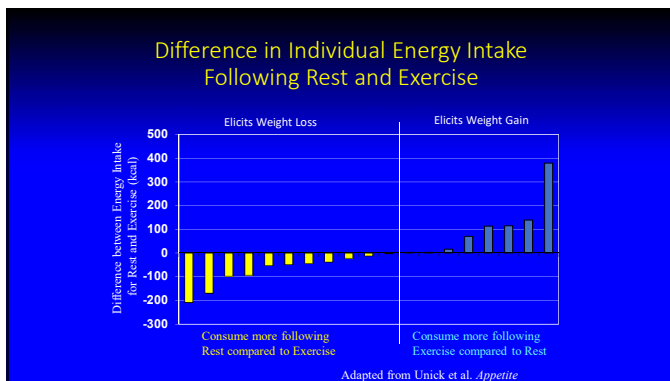
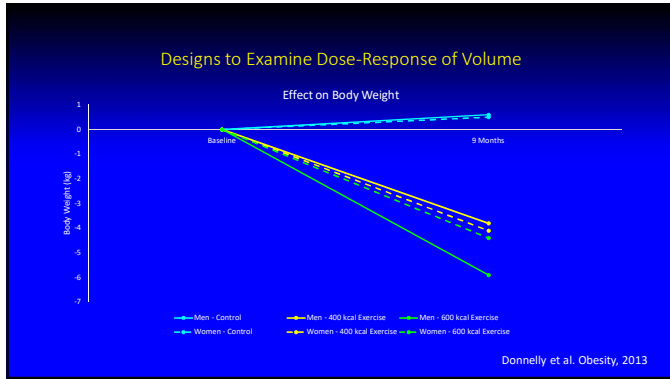


Donnelly et al. Archives of Internal Medicine, 2003

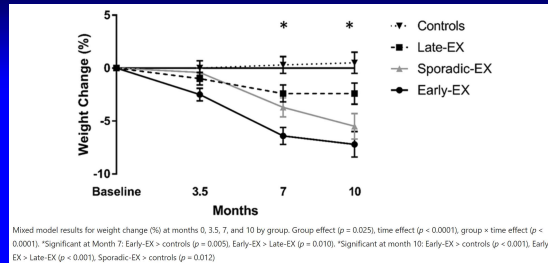
Designs to Examine Dose-Response of Volume



Donnelly et al. Obesity, 2013



Timing of Physical Activity and Weight Loss



Willis et al. The effects of exercise session timing on weight loss and components of energy balance: Midwest Exercise Trial 2. *Int J Obes (Lond)*. 2020; 44(1): 114-124.

Physical Activity Considerations that may Impact Body Weight Regulation

- Variability in MET equivalents
- Light-intensity physical activity
- Relative vs. absolute intensity and its potential effects on energy expenditure
- Does the pattern of physical activity matter?
- Effects of activity on energy intake patterns
- Exercise/Physical Activity Efficiency

Thank You!