Does Physical Activity Have a Role in Reducing Obesity?

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The Myth About Exercise

Of course it’s good for you, but it won’t make you lose weight. Why it’s what you eat that really counts.

BY JOHN CLOUD
Changes in physical activity happened decades ago: Food is now driving increase in weight
## Energy Intake vs Energy Expenditure: No Contest

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration (min)</th>
<th>Cost (kcal)</th>
<th>Efficiency (kcal/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large burger</td>
<td>3</td>
<td>560</td>
<td>186.7</td>
</tr>
<tr>
<td>70% VO2 Max</td>
<td>60</td>
<td>560</td>
<td>9.3</td>
</tr>
<tr>
<td>40% VO2 Max</td>
<td>45</td>
<td>280</td>
<td>6.2</td>
</tr>
</tbody>
</table>
The Energy Balance System

Inherited Factors
- Efficiency
- Adaptive thermogenesis
- Food preferences

Environmental Factors
- Food environment
- Physical activity environment

Energy Stores

Energy Intake → Active Regulation → Energy Expenditure

Physical Activity

Efficiency
Adaptive thermogenesis
Food preferences
Food environment
Physical activity environment
Figure 1

Figure 1  Relationships between level of aerobic fitness ($\text{VO}_2\text{max}$) and percentage of body fat in 49 males subjects (A) and 45 female subjects (B).

Effects of aerobic fitness on fat oxidation and body fatness.
KRIKETOS, ADAMANDIA; SHARP, TERESA; SEAGLE, HELEN; PETERS, JOHN; HILL, JAMES

The Energy Balance System

- Energy Intake
- Energy Stores
- Active Regulation
- Energy Expenditure
- Physical Activity
What happens to body weight when physical activity is increased?

- Increase Physical Activity
  - Body weight increases
  - Body weight does not change
  - Body weight decreases

Other physical activity
Food Intake

No reductions in non-exercise physical activity/energy expenditure in response to prescribed physical activity/exercise training
- 100% of cross-sectional studies (n=4)
- 90% of short-term studies (n=10)
- 50% of non-randomized trials (n=10)
- 100% of RCTs (n=7)
Acute exercise and subsequent energy intake. A meta-analysis

Matthew M. Schubert et al. Appetite 2012

Despite variability among studies, results suggest that exercise is effective for producing a short-term energy deficit and that individuals tend not to compensate for the energy expended during exercise in the immediate hours after exercise by altering food intake.
Individual Variation in Body Weight & Fat Mass after 12 Weeks of Exercise (King et al, IJO 2008)
* NR have a significant increase in EI (Wk0 – Wk12; $p<0.005$)
The Energy Balance System

- Energy Stores
- Active Regulation
- Energy Intake
- Energy Expenditure
- Physical Activity
Does Decreasing Physical Activity Increase Energy Intake?

**OUTCOME**

<table>
<thead>
<tr>
<th>ACTIVE</th>
<th>SEDENTARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE</td>
<td>12.8</td>
</tr>
<tr>
<td>EI</td>
<td>14.6</td>
</tr>
</tbody>
</table>

- Decrease in PA from 1.8 - 1.4 x RMR does not induce a marked compensatory decrease in EI
- Majority of excess energy stored as fat
The Energy Balance System

Energy Stores

Energy Intake | Active Regulation | Energy Expenditure

Physical Activity
Skeletal Muscle Adaptations

Egan and Zierath
2013
Metabolic Flexibility and Inflexibility

Physical activity predicts metabolic flexibility.

Our biology works best at high flux

Physical Activity
Threshold for Optimal Weight Regulation

Energy Intake

Body Weight

“Unregulated” Zone

“Regulated” Zone

PHYSICAL ACTIVITY
Can Reduced Physical Activity Facilitate Weight Gain?

Daily Occupational Caloric Expenditure


Church et al, PLoS ONE, May 2011
Energy balance (MJ/day)

Sedentary

Active

Can Physical Activity Prevent Weight Gain?

Can Physical Activity Prevent Weight Gain?

Low-fat

Medium-fat

High-fat

Energy balance (MJ/day)

Can Physical Activity Prevent Weight Gain?

Energy balance (MJ/day)

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Can Physical Activity Prevent Weight Gain?

Energy balance (MJ/day)

Can Physical Activity Prevent Weight Gain?
Physical Activity Attenuates the Influence of FTO Variants on Obesity Risk: A Meta-Analysis of 218,166 Adults and 19,268 Children


The association of the FTO risk allele with the odds of obesity is attenuated by 27% in physically active adults, highlighting the importance of PA in particular in those genetically predisposed to obesity.
Can Physical Activity Help Treat Obesity?

-10% (20-30 lbs) = 170-250 kcal/day

-20% (40-60 lbs) = 325-480 kcal/day
Should We Tell People to Exercise

+Physical Activity

Body Fat Mass

\[ E_{\text{In}} \]
\[ \text{Prot}_{\text{In}} \]
\[ \text{CHO}_{\text{In}} \]
\[ \text{Fat}_{\text{In}} \]

\[ E_{\text{out}} \]
\[ \text{Prot}_{\text{Out}} \]
\[ \text{CHO}_{\text{Out}} \]
\[ \text{Fat}_{\text{Out}} \]
What Should we Tell People to Eat?

Is best diet for an active, fit person the same as for a sedentary, unfit person?
Carbohydrate intake during the Tour de France

Garmin Riders at TdF:

Total Energy Intake: 6000-9000 Kcal/day

- Carbohydrates: 75-80%
- About 1,000 g/day of CHO
  - 400g simple sugars!
- 4000 kcal/day of CHO
  - 1600 Kcal/day Simple Sugars!
- 13-14g/kg/day!!
Optimum Diet Depends on Level of Physical Activity

Diet Energy Density

Physical Activity Level

Achieving Energy Balance at Low Fat Mass
If we choose to focus on food alone what to we miss?

• Improved learning and cognitive function
• Improved cardiorespiratory fitness, chronic disease and mortality
• Improved mental state (e.g., reduced depression)
• Potentially higher productivity and economic growth
• National security

What is the one thing you could do to most improve human health? 

Increase cardiometabolic fitness
How to Get People to Move?

Focus on environment
Change behavior - why

What if it became policy that:

1. In every workplace, employees get 30 minutes of physical activity every day on the clock?
2. In every school, students get 60 minutes of physical activity every day
Conclusions

- Studies of energy balance suggest that changes in physical activity are directly related to changes in body weight in MOST people.
- The biggest impact of physical activity may be in impacting active regulation of energy balance.
- Increasing physical activity should be an effective way to prevent and treat obesity.
- A big challenge remains in how to permanently increase physical activity.

**WE CANNOT REVERSE THE OBESITY EPIDEMIC WITHOUT INCREASING PHYSICAL ACTIVITY IN THE POPULATION**
THANK YOU

Our Team

Thanks to our fantastic faculty and staff