1. There is no obesity epidemic.
1. Used double labeled water to estimate energy expenditure
2. Energy expenditure of contemporary humans is accurately predicted from their size when compared to all mammals.

Energy expenditures (PAL) of African tribes peoples
subsistence farming/hunter gathering

<table>
<thead>
<tr>
<th>Population</th>
<th>Males</th>
<th>Females</th>
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<tbody>
<tr>
<td>Gambia</td>
<td>2.82</td>
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<td>Burkina Faso</td>
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<td>1.80</td>
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<tr>
<td>Cameroon</td>
<td>1.97</td>
<td>1.67</td>
</tr>
<tr>
<td>Cameroon</td>
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<td>1.71</td>
</tr>
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<td>Botswana</td>
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</tr>
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<td>Ivory Coast</td>
<td>1.40</td>
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<td>Cameroon</td>
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<tr>
<td>Kenya</td>
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<td>Ethiopia</td>
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<td>Swaziland</td>
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<tr>
<td><strong>MEAN</strong></td>
<td><strong>1.68</strong></td>
<td><strong>1.60</strong></td>
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</tbody>
</table>

From Speakman Lecture at Penn, 2005

PAL against year of publication
(not significant – p > .05)
Destroying Myths about Weight Control

1. There is no obesity epidemic.
2. Obesity epidemic is caused by a decrease in energy expenditure.
3. Leptin is the messenger from fat cells to brain.
Evidence Supporting Leptin
- Two strains of obese mice were deficient in leptin (Zhang et al, 2004)
  - Overeat
  - Low metabolic rate
- Inject leptin into these obese mice (Halaas et al, 1995, Campfield et al, 1995)
  - Stop eating
  - Increase in metabolic rate
  - Weight normalizes
- Leptin produced by adipose cells (Zhang et al, 2004)
- Serum leptin concentrations proportional to fat composition. (Hardie et al, 1997)
- Leptin blood levels drop with hours with starvation (Rosenbaum et al, 1997)
  - Increase within an hour after eating in rat – days for humans
- Injected leptin reduces food intake in animals (Halaas et al, 1995, Campfield et al, 1995)
  - Injected into brain at lower doses – VMH and Arcuate Nucleus
- Leptin receptors found in hypothalamic structures (Mercer et al, 1996)
  - Defect in leptin receptor found in Zucker rat (Phillips, 1996)
  - Neurons containing leptin receptor connect to other neuropeptides that control feeding behavior (e.g. Neuropeptide Y and others)

Evidence against Leptin
- Obese humans have more leptin than non-obese (Considine et al, 1996).
  - Leptin concentrations are proportional to body fat.
- Huge amount of variability in humans (Considine et al, 1996).
- Women have higher leptin levels than men, but also high fat composition (Ostlund et al, 1996).
- Concentrations increase during pregnancy, but intake does not decrease (Hardie et al, 1997).
- Fasting causes a greater reduction in leptin than decrease in body fat (Bodin et al, 1996).
- Leptin levels are lower during weight loss than weight maintenance (Rosenbaum et al, 1997).
- Refeeding causes an almost immediate return of leptin levels, well before recovery of body fat (Girrau et al, 1997).
- Abdominal fat mRNA does not change after 6 day fast despite the sensitivity of abdominal fat to lipolysis and a 40 percent reduction in serum leptin (Dubic et al, 1998).
- No effect of feeding high fat diet on leptin, despite changes in body composition (Schrauwen et al, 1997).
- Post-prandial leptin levels do not correlate with measures of hunger or satiety (Joannic et al, 1998).
- Very few cases of leptin deficiency has been observed (Gibson et al, 2004).
- No correlation between genetic disturbances of leptin and obesity. (Paracchini et al, 2005)
- "Knock-out" mice without Neuropeptide Y are normal weight (Bannon, 2000).
- Leptin receptors operate by controlling release of Neuropeptide Y.

1994 - Zhang, Proenca, Maffei, Baronne, Leopold, Friedman.

LEPTIN

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4. Stability of body weight means there must be physiological regulation.

Error Calculation

\[
\text{WT GAIN} = 1 \text{ kg} \times 7700 \text{ kcal/kg} = 7700 \text{ kcal/yr} \\
\text{INTAKE} = 2500 \text{ kcal/day} \times 365 \text{ days/yr} = 912,500 \text{ kcal/yr} \\
\text{ERROR} = 7700 \text{ kcal} / 912,500 \text{ kcal} = 0.84\% 
\]
Computer Simulation

Three Assumptions
1. Total daily intake is normally distributed.
2. Total daily expenditure is normally distributed.
3. Energy Expenditure = f(Body Weight)
   lean body mass = f(body Weight)
   total mass = f(body weight)

Daily Intake

Daily Expenditure

Chronic Energetic Error

Short Term Energetic Error

Weight Factor

Samples Total Daily Intake once each week

%Error = \frac{\text{Body Weight (g)} \times 3500 \text{ kcal/g}}{\text{Total Yearly Energy Intake (kcal)}} \times 100
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5. Must be a physiological explanation as to why low carb diets and diets low in animal protein inhibit intake.

Weight Loss Diets that really Work

**Low Carb Diet**


**Vegetarian Diet**


**Association**

The Third National Health and Nutrition Examination Survey

The Third National Health and Nutrition Examination Survey

Association Not Causation
Experimental Design

<table>
<thead>
<tr>
<th>Session</th>
<th>Choice: Chicken, Rice, Peas</th>
<th>Choice: Chicken, Peas</th>
<th>Choice: Rice, Peas</th>
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</thead>
<tbody>
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<td>Session 1</td>
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</tr>
<tr>
<td>Session 2</td>
<td>Choice: Chicken, Peas</td>
<td>Choice: Rice, Peas</td>
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</tr>
<tr>
<td>Session 3</td>
<td>Choice: Rice, Peas</td>
<td>Choice: Chicken, Peas</td>
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ENERGY BALANCE

Weight = $\text{Energy}_{\text{in}} - \text{Energy}_{\text{out}}$

That's all folks