

Destroying Myths about Weight Control

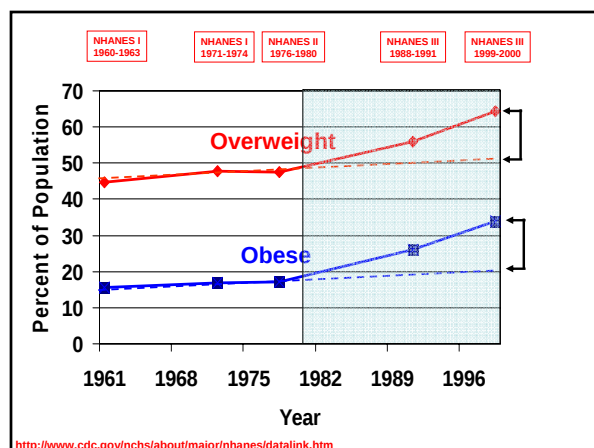
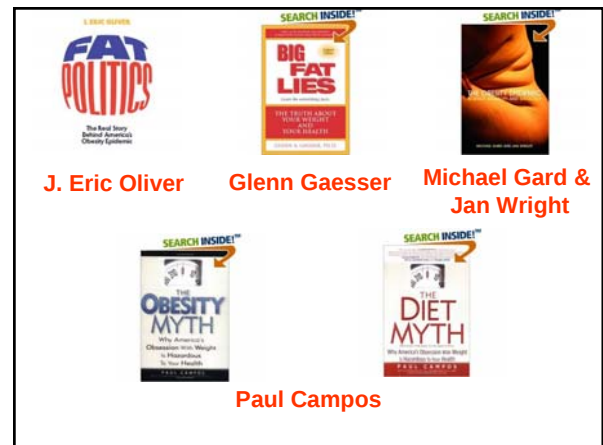


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Cornell University
October 30, 2006

Destroying Myths about Weight Control

1. There is no obesity epidemic



Destroying Myths about Weight Control

1. There is no obesity epidemic.
2. Obesity epidemic is caused by a decrease in energy expenditure.





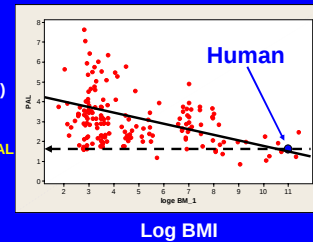
Professor John Speakman
Dept Biological Sciences
University of Aberdeen, UK

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.



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PAL
(total EE/basal)



227 values
98 species



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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.
3. Energy expenditure of Hunter/Gatherer societies no different from urban Europeans

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

Population	Males	Females
Gambia	2.02	1.97
Burkina Faso	1.89	1.80
Cameroon	1.87	
Cameroon	1.71	1.67
Botswana	1.71	1.51
Ivory Coast	1.68	
Uganda	1.63	
Cameroon	1.60	1.72
Cameroon	1.41	1.56
Kenya	1.29	1.37
Ethiopia		1.47
Swaziland		1.35
MEAN	1.68	1.60

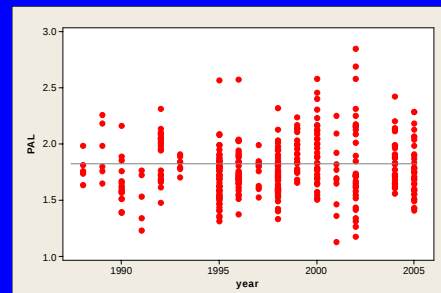


From Speakman Lecture at Penn, 2005

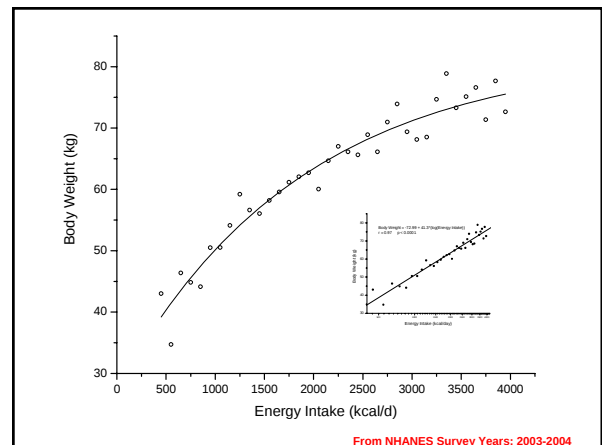
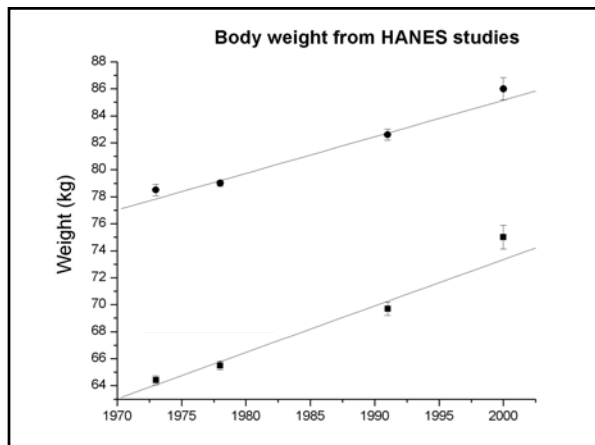
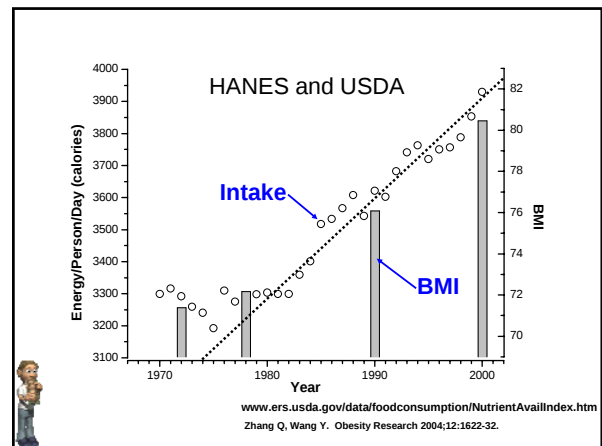
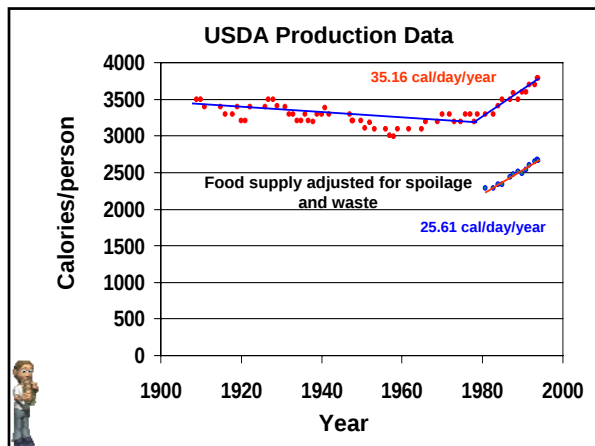


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1. Used double labeled water to estimate energy expenditure
2. Energy expenditure of contemporary humans is accurately predicted from their size when compared to all mammals.
3. Energy expenditure of Hunter/Gatherer societies no different from urban Europeans
4. Energy expenditure not different between SES
5. No difference in EE of humans measured by DDW since 1960's

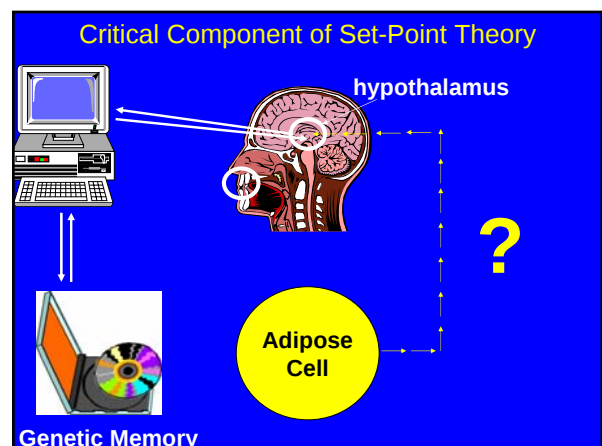


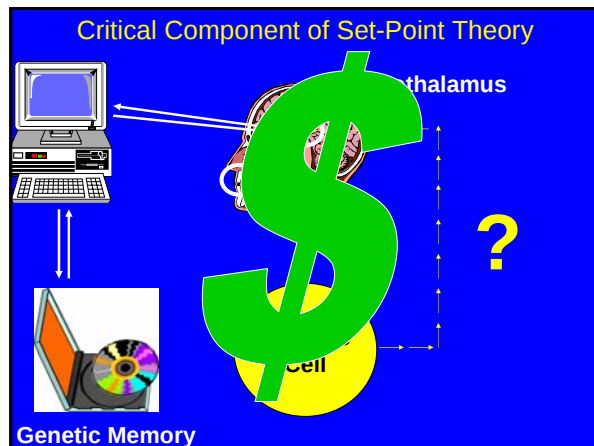
PAL against year of publication
(not significant – $p > .05$)



Destroying Myths about Weight Control

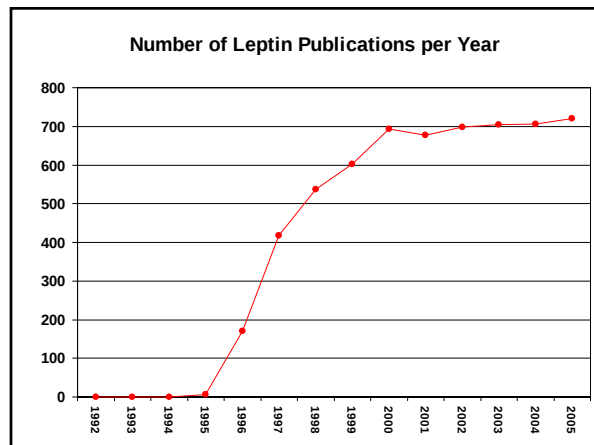
1. There is no obesity epidemic.
2. Obesity epidemic is caused by a decrease in energy expenditure.
3. Leptin is the messenger from fat cells to brain.





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

LEPTIN

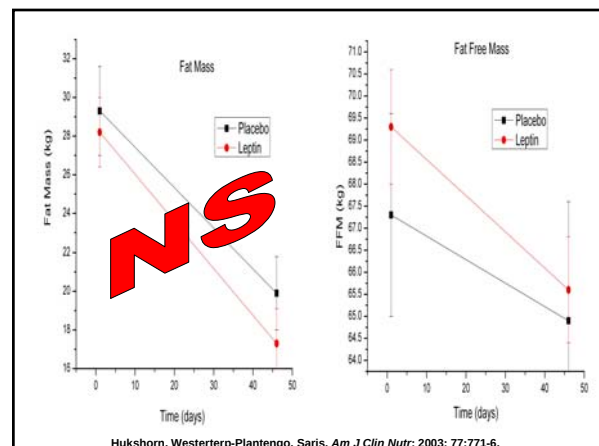


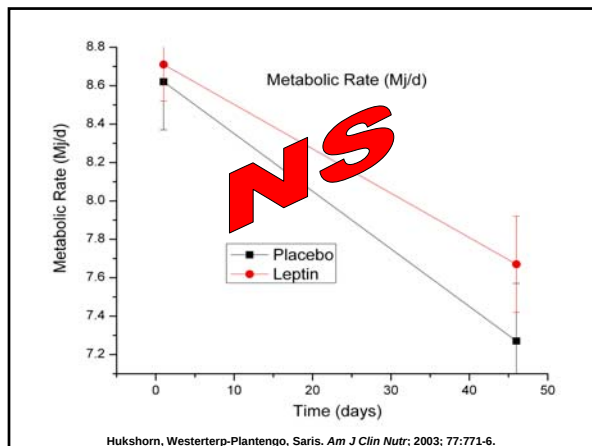
Evidence Supporting Leptin

- 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 (Grinspoon 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 correlated 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
- Chronic leptin injection do not suppress body weight in obese men (Lejeune et al, 2003)





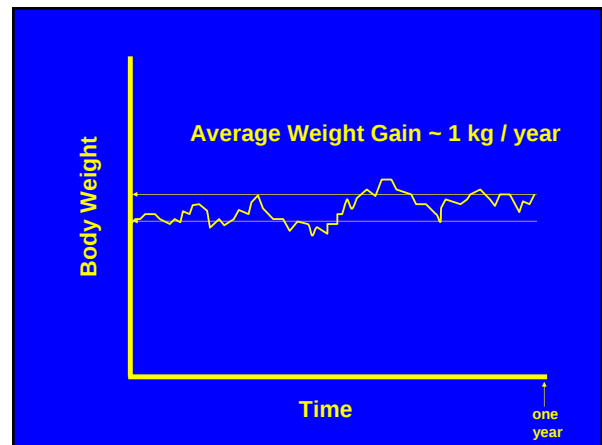
Total Leptin (ng/mL)	Placebo	Leptin
Day 1	7.1 ± 0.8	7.6 ± 1.2
Day 8	3.4 ± 0.6	1828 ± 183
Day 15	3.1 ± 0.5	2777 ± 194
Day 25	2.1 ± 0.3	4194 ± 285
Day 46	2.0 ± 0.2	3980 ± 203

Hukshorn, Westerterp-Plantengo, Saris. *Am J Clin Nutr*; 2003; 77:771-6.

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



Error Calculation

WT GAIN = 1 kg x 7700 kcal/kg = 7700 kcal/yr

INTAKE = 2500 kcal/day x 365 days/yr = 912,500 kcal/yr

ERROR = 7700 kcal / 912,500 kcal

ERROR = **0.84 %**



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Physiological Regulation

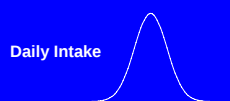


Computer Simulation



Three Assumptions

1. Total daily intake is normally distributed.

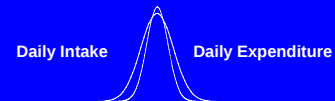


Computer Simulation



Three Assumptions

1. Total daily intake is normally distributed.
2. Total daily expenditure is normally distributed.



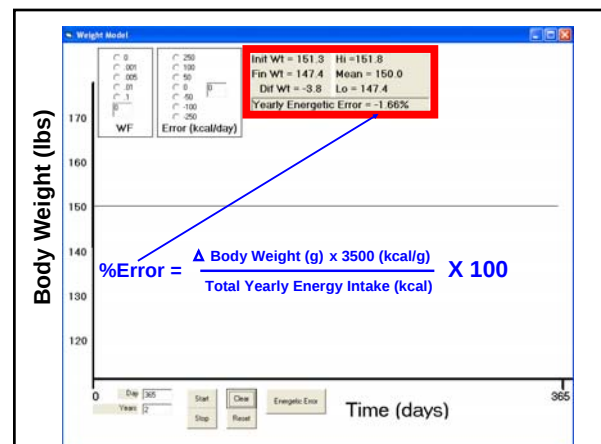
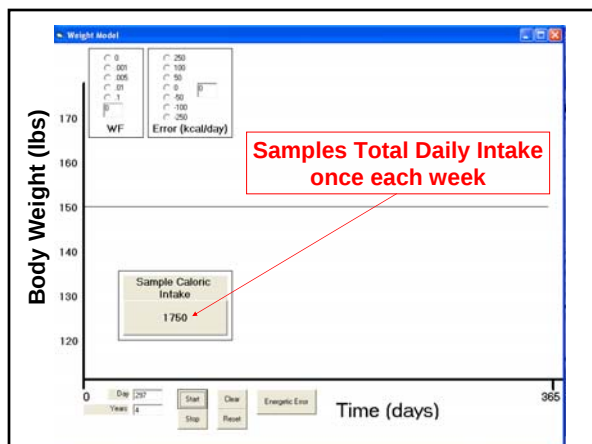
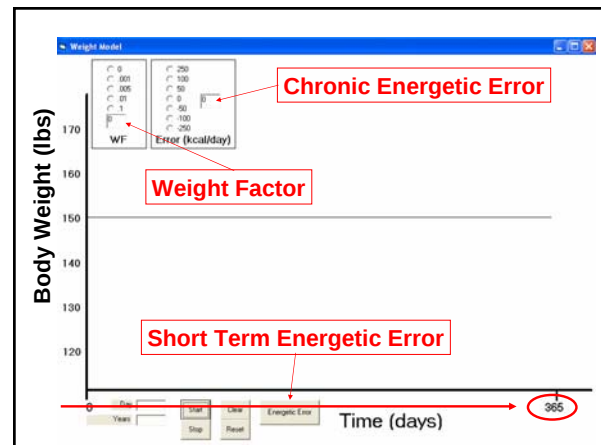
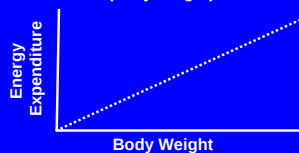
Computer Simulation



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)



Computer Simulation

Starting Weight = 150 lbs

Average Energy Intake = 2250 kcal



Computer Simulation Demonstration



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5. Must be a physiological explanation as to why low carb diets and diets low in animal protein inhibit intake.

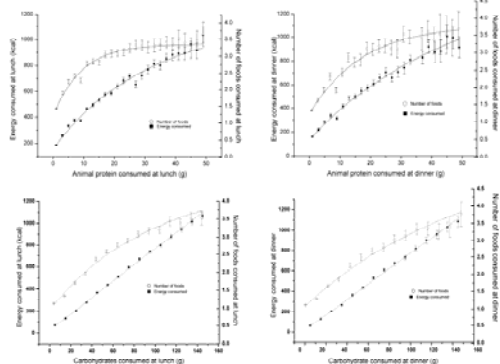
Weight Loss Diets that really Work

Low Carb Diet

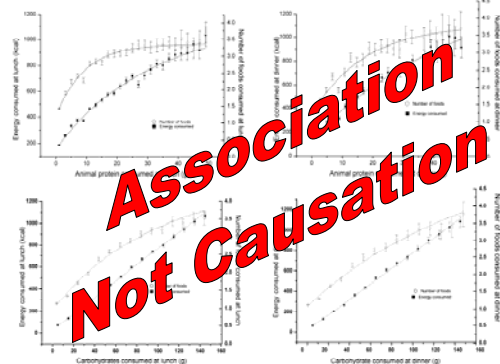
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Vegetarian Diet

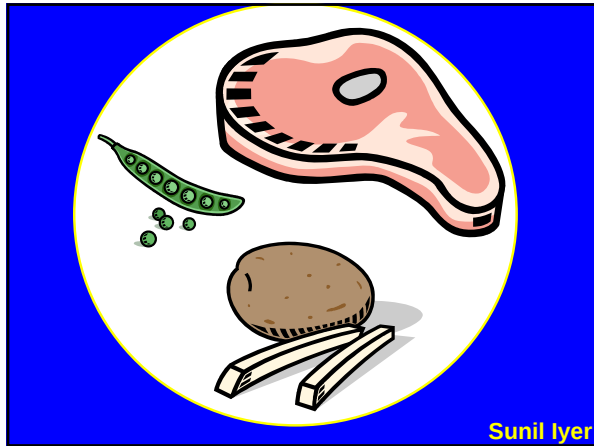
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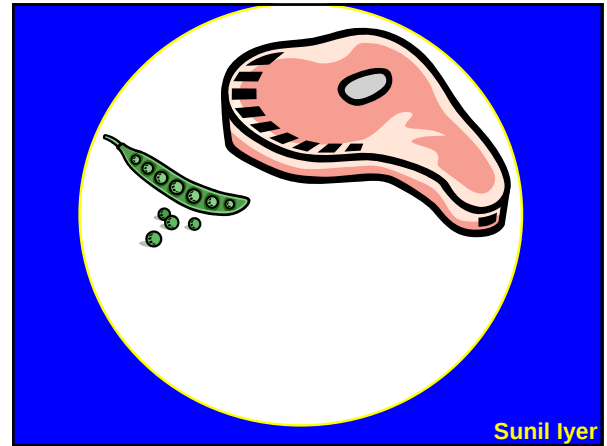
The Third National Health and Nutrition Examination Survey
NHANES III (1988-94)



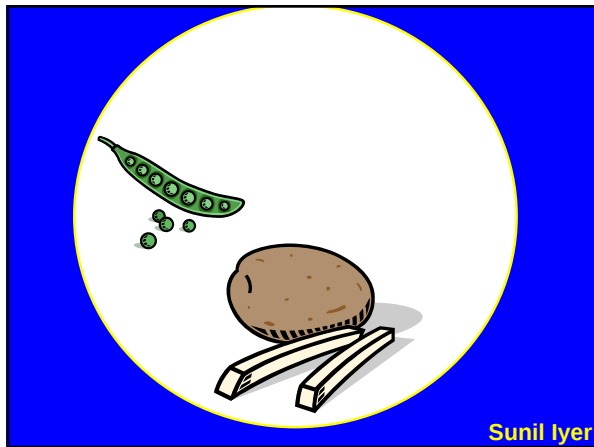
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Sunil Iyer



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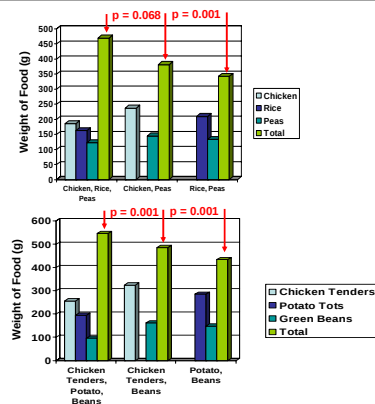
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Experimental Design

Session 1	Choice: Chicken, Rice, Peas	
Session 2	Choice: Chicken, Peas	Choice: Rice, Peas
Session 3	Choice: Rice, Peas	Choice: Chicken, Peas

Sunil Iyer



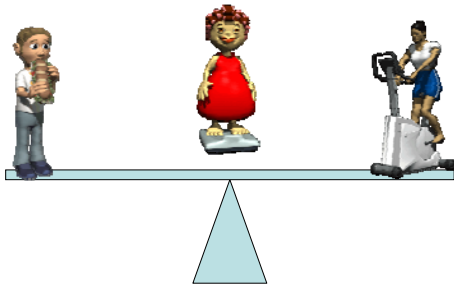
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ENERGY BALANCE



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

That's all folks