

- ⑥ Metabolism
- ⑥ Diet
 - △ Starvation, Diabetes, and Atkin's Diet
 - △ Vitamins

Compare two diets reported in medical literature.

1. Low Fat: McMillan-Price et al., *Archives Internal Medicine*, Vol. 166, July 24, 2006
A 12-week study of "129 overweight or obese young adults".
2. High Fat: Yancy et al., *Nutrition and Metabolism*, Vol. 2(34), 2005.
A 16-week study of "28 overweight participants with type 2 diabetes".

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Subject & Diet Details

	Low Fat	High Fat
Number	32	21
Men/Women	9/23	20/1
Age	30.5	56.0
Weight (kg)	87	131
Carbs (g)	217	41
Fat (g)	38	98
Protein (g)	73	108
Calories	1540	1480
%Calories from Fat	22%	60%

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Results

	Low Fat	High Fat	
Weight (kg)	-4.8 (-5.5%)	-8.7 (-6.6%)	≈
Cholesterol	-0.18 (-3.8%)	-0.07 (-1.5%)	Low
HDL (good)	+0.03 (+2.6%)	+0.07 (+7.6%)	High
LDL (bad)	-0.17 (-5.9%)	+0.26 (+10.4%)	Low
$\frac{HDL}{LDL}$	0.403 → 0.440	0.366 → 0.357	Low
Triglycerides	-0.05 (-3.6%)	-1.12 (-41.6%)	High
Glucose	-0.06 (-1.2%)	-1.51 (-16.6%)	High

Conclusions

Results

- ⑥ Low fat diet can lower cholesterol and improve $\frac{HDL}{LDL}$ ratio.
- ⑥ High fat diet can significantly lower blood triglycerides.
- ⑥ High fat diet can significantly lower blood glucose.

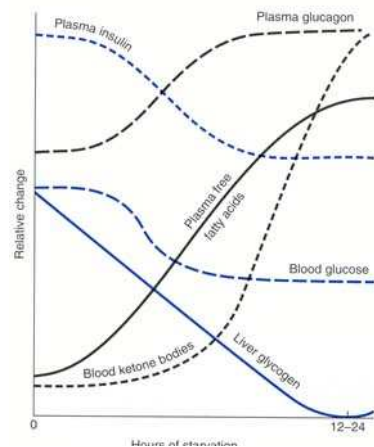
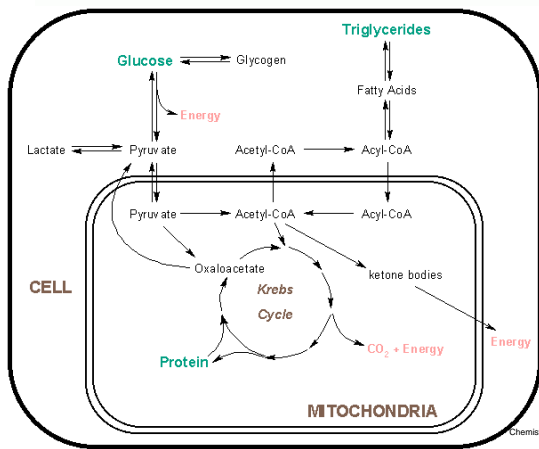
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Unanswered Questions

Questions

- ⑥ Is 12-16 weeks long enough?
- ⑥ Are these samples representative?
- ⑥ Do differences in sex matter with diet?
- ⑥ Do differences in age matter with diet?
- ⑥ Which is more important: Cholesterol or Triglycerides?



Diabetes

Atkin's Diet

Untreated diabetes similar (from a metabolism perspective) to starvation.

The Atkin's Diet, Protein Power Plan, and other diets require:

- ⦿ Blood sugar is high (especially after eating) because either insulin is not formed (Type I) or insulin receptors broken (Type II). Insulin is responsible for bringing glucose from bloodstream into cells.
- ⦿ Since cells think glucose concentration is low, hormones released to produce more glucose.
- ⦿ Cell concentration of glucose is low, so metabolism of fats primary fuel source.
- ⦿ High metabolism of fat can lead to ketone bodies (acetone smell on breath).

- ⦿ Very low carbohydrate intake
- ⦿ High fat intake (for fuel)
- ⦿ High protein (to avoid muscle degradation)

Claim is that we consume too much simple sugar, which gives rise to diabetes. American Heart Association recently warned that these diets can be dangerous.

Energy Expenditures

Exercise and Calories

Activity	Calories/min (180 lb person)
Aerobics (vigorous)	11
Basketball (vigorous)	15
Bicycling (11 mph)	9
Jogging (10 min/mile)	14
Running (7 min/mile)	18
Swimming (fast)	13
Walking (20 min/mile)	5

One pound of fat \approx 3500 Calories

If 180 pound person runs 3 miles a day, 7 days a week he/she will use:

$$(7 \text{ min/mile}) * (21 \text{ miles}) = 147 \text{ minutes}$$

$$(18 \text{ Calories/min}) * (147 \text{ minutes}) = 2646 \text{ Calories}$$

But only \sim 1/3 of these are due to fat.

$$2646 / 3 = 882 \text{ Calories of fat per week}$$

To lose 1 pound fat

$$(3500 \text{ Calories}) / (882 \text{ Calories/week}) \approx 4 \text{ weeks}$$

Exercising this much will allow you to lose 1 pound of fat per month!

Taken from ACS Textbook "Chemistry in Context", 3rd Edition, Table 11.6 (p. 441)

Basal Metabolism - Energy required to survive (heart, lungs, ...)

For most individuals:

$$\text{Basal Metabolism} = 1 \frac{\text{Cal}}{\text{kg hr}}$$

Thus, for our 180 pound individual:

$$180 \text{ lbs} \simeq 80 \text{ kg}$$

$$1 \frac{\text{Cal}}{\text{kg hr}} \times 80 \text{ kg} \times 24 \text{ hours} = 1920 \text{ Calories/day.}$$

A key role of exercise is to increase basal metabolism.

Direct calorie burning helps, but alone is not enough.