

**Weight-Loss Diets:
Fat, Protein, or Carbohydrate?
Behavior, Participation,
Commitment**

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**Vegetarian Low-Fat Diets Caused
Weight Loss**

- 20 Coronary Disease Patients, San Francisco
 - Fat <10%, meals provided
 - Body weight:
 - Baseline: 200 lb (91 kg)
 - After 1 year: 178 lb (81 kg)
 - After 5 years: 183 lb (83 kg)
 - Control group increased 5 lb (2 kg)
 - Difference = 22 pounds

Gould KL et al. JAMA 1995;274:894
Ornish D et al. Lancet 1990;336:129

Low-Fat Diets

Low-Carbohydrate Diets
Mediterranean, Higher-fat Diets

PoundsLost Study
(Sacks FM et al. N Engl J Med Feb 26, 2009)

**Superiority of Very Low Fat Vegan Diet
Compared to Standard Low-fat in 2 y:
Effect of diet type and behavioral support**

- **Vegan**
 - With support after 3 months: -5.3 kg
 - Without support: -0.4 kg
- **Standard low-fat**
 - With support: -2.7 kg
 - Without support: -0.5 kg

N=14-17 per group
P<0.05 for diet type and support

Turner-McGreevy G, Barnard N, Scialli A. Obesity 2007;15:2276

**Strict Vegetarian Low-Fat Diets
Caused Weight Loss**

- **Strict Vegetarians in Boston**
 - 73 men, 43 women, mostly in their 20's, adherent for 3 years
 - Fat 22%, Carb 65%, Protein 13%, High Fiber
 - Whole grains only; loads of vegetables
 - No white flour or sugar, few sweets, little fruit juice
 - Matched for age and sex with nearby nonvegetarians
 - Body weight: 128 lb (58 kg) vs 161 lb (73 kg)
= a 33 pound difference !!

Sacks FM et al. N Engl J Med 1975;292:1148

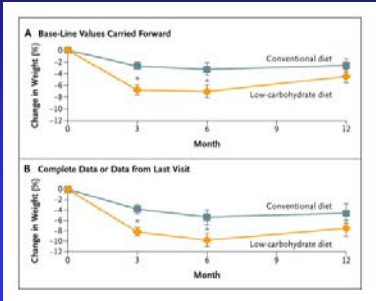
Low-Fat Diets

Low-Carbohydrate Diets

Mediterranean, Higher-fat Diets

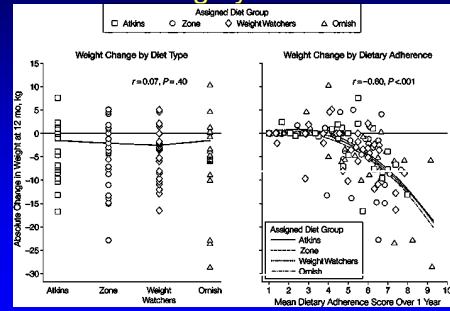
PoundsLost Study
(Sacks FM et al. N Engl J Med Feb 26, 2009)

Low-Fat vs Atkins Diet



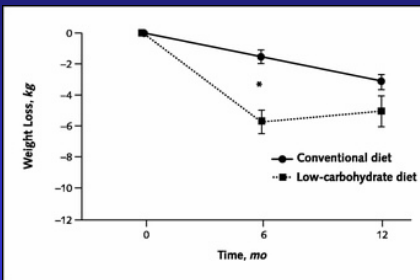
Foster et al NEJM 2003

Similar Results with Low-Carb, Calorie Control or Very Low-Fat: Counseling by diet book



Dansinger, Schaefel. JAMA 2005;293:43

Low-Carb Diet vs Low-Fat Diet for Weight Loss



Stern L...Samaha F. Ann Intern Med 2004;140:769

Low-Fat Diets

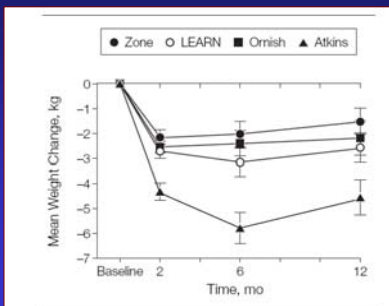
Low-Carbohydrate Diets

Mediterranean, Higher-fat Diets

PoundsLost Study

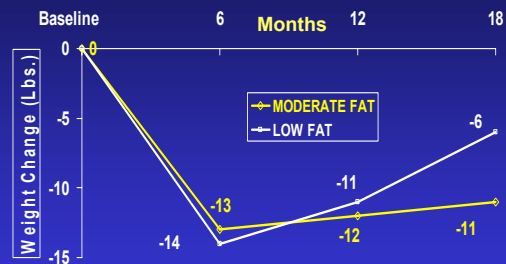
(Sacks FM et al. N Engl J Med Feb 26, 2009)

Slightly Better Result with Low-Carb Compared to Calorie Control or Very Low-fat



Gardner C. et al. JAMA 2007

Superiority of High-Unsaturated Fat, Mediterranean-style diet for weight loss



McManus, Antinoro, Sacks. Int J Obesity 2001;25: 1503-11

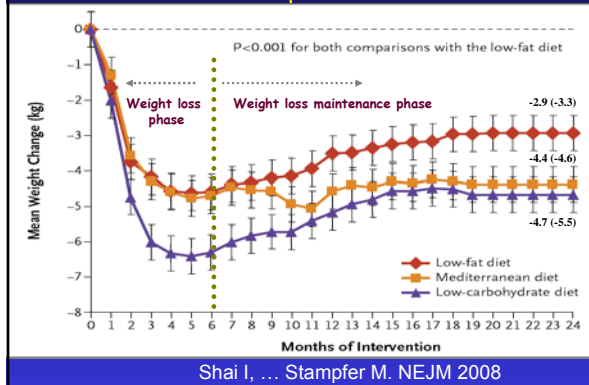
Weight Gain in the Dropouts: Mediterranean and Low-Fat Groups Combined

- Dropouts had a net gain in weight of 9 pounds from the starting weight after 18 months.
- Those staying in the program lost 11 pounds.

Limitations in Some Comparative Trials of Diet Types and Weight Loss

- Short duration, most lasted a few months.
- Some control groups had lower intensity of intervention
- Lack of blinded ascertainment of weight
- Underrepresentation of men
- Lack of information on adherence
- Large percentage of dropouts, up to 50%
- Novelty of one of the diets, media attention, and its marketing may have affected expectations of success.
- Equipoise may not have been achieved; researchers may have subtly favored a diet.

Mild Superiority of Mediterranean and Atkins Low-Carb compared to Low-fat



PoundsLost Trial Organization: Study Sites, Researchers, Funding

- Harvard School of Public Health and Brigham & Women's Hospital, Boston; F. Sacks, PI, Study Chairperson; Kathy McManus, Meryl LeBoff
- Pennington Biomedical Research Center, Louisiana State University System, Baton Rouge, G. Bray PI; Donna Ryan, Steven Smith, Steven Anton, Don Williamson, Cathy Champagne, Jennifer Rood
- Coordinating Center: Channing Laboratory, Brigham & Women's Hospital, V Carey Director; N Laranjo
- National Heart Lung and Blood Institute, NIH; Cay Loria, Eva Obarzanek, Project Officers
- Investigator Initiated proposal to NHLBI funded by cooperative agreement grant to Harvard School of Public Health.

Sacks FM et al. N Engl J Med Feb 26, 2009

Interpretation of Comparative Weight Loss Trials

- Divergent results among studies
- Each diet type showed superiority over other types in certain trials.
- No obvious pattern of results favoring a specific fat, carb or protein content for weight loss.
- Superiority of a diet type in the first 3-6 months often not sustained by 1 to 2 y.

PoundsLost Trial: Diets

These diets with target nutrient levels:

1. Low-fat (20%), average protein (15%), highest carbohydrate (65%)
2. Low-fat (20%), high protein (25%), carbohydrate (55%)
3. High fat (40%), average protein (15%), carbohydrate (45%)
4. High fat (40%), high protein (25%), lowest carbohydrate (35%)

Similar foods used for all diets but in different proportions. All dietary approaches adhered to healthful guidelines to prevent cardiovascular disease.

Sacks FM et al. N Engl J Med Feb 26, 2009

Diet Comparisons Tested

- Factorial Design: N~400 per group
 - Dietary Fat Level
 - low 20% vs high 40%
 - Dietary Protein Level
 - Average 15% vs high 25%
- Carbohydrate: N~200 per group
 - Highest 65% vs lowest 35%
 - Linear dose effect: 65%, 55%, 45%, 35%

Sacks FM et al. N Engl J Med Feb 26, 2009

PoundsLost: Primary Trial Outcome, 2 years Body Weight Change: All randomized participants.

Macronutrient	High vs Low or average (Mean, 95% CI, P)
Protein	-0.6 (-1.6, 0.4) (P=0.22)
Fat	0.04 (-0.9, 1.0) (P=0.94)
Carb	0.6 (-0.8, 1.9) (P=0.42)

Sacks FM et al. N Engl J Med Feb 26, 2009

Dietary Program for Weight Loss

- Macronutrient targets were the paramount teaching objective.
- Specified menus for 2 week cycles for each group.
- Participants taught to follow meal plans exactly.
- Energy reduction goal was 750 Kcal daily
- Physical activity goal was 90 minutes per week
- Same technique and intensity for all groups
- Group sessions:
 - 3 of every 4 weeks x 6 months, then 2 of every 4 weeks
- Individual counseling sessions: Every 8 wks for 2 yr
- Web-based system for participants to record diet and exercise and obtain rapid feedback on goals.
- Contact among groups avoided
- Investigators and staff taught participants that each diet had an equal chance of success in line with divergent results of past studies: goal was trial-wide “equipoise”.

Sacks FM et al. N Engl J Med Feb 26, 2009

PoundsLost. Body Weight Change 2 years: Completers, N=645 (80%).

Macronutrient	High vs Low or average (Mean, 95% CI, P)
Protein	-0.94 (-2.1, 0.2) (P=0.11)
Fat	0.2 (-1.0, 1.3) (P=0.76)
Carb	0.7 (-0.9, 2.3) (P=0.37)

Sacks FM et al. N Engl J Med Feb 26, 2009

Baseline Characteristics

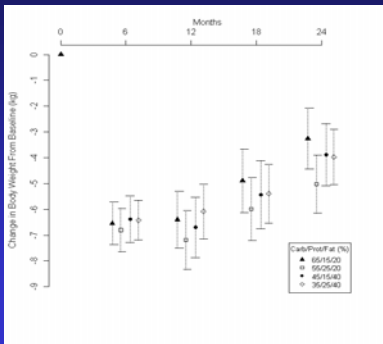
	All	Completers
• Number	811	645 (80%)
• Age	51	52
• Women	64%	62%
• White race	79%	81%
• BMI, mean	33	33 kg/m ²
• BMI 25-30	27%	28%
• BMI ≥30	73%	72%
• Waist circumference	103 cm	104 cm
• Completed college	68%	69%
• Attended college	22%	20%
• Married	70%	69%

Sacks FM et al. N Engl J Med Feb 26, 2009

PoundsLost, Body weight change each diet: All randomized participants, N=811, missing data imputed.

Sacks FM et al. N Engl J Med Feb 26, 2009

PoundsLost, Body Weight Change, Each Diet: Completers, N=645 at 2 years.



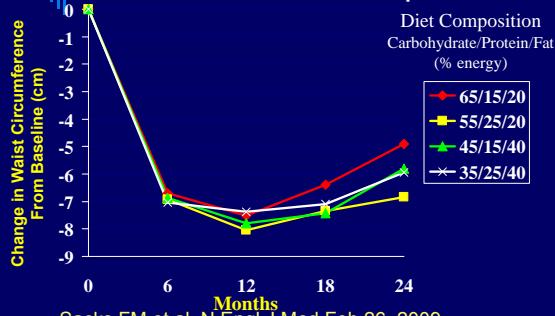
Sacks FM et al. N Engl J Med Feb 26, 2009

Continued Weight Loss: from 6 months to 2 years

- 23% lost weight after 6 months
- Mean additional weight loss = 3.6 kg
- Total weight loss = 9.3 kg
- No differences among the diets

Sacks FM et al. N Engl J Med Feb 26, 2009

POUNDS LOST Waist circumference in Completers



Sacks FM et al. N Engl J Med Feb 26, 2009

Satiety, Diet Satisfaction: Participants' reports at 6 months and 2 years

- Satiety by visual analogue scales
- Diet Satisfaction (Urban 1992)
- Food Craving: fats, sweets, carbohydrates, fast food fats, fruits & veg (FCI-II)
- Dietary restraint, disinhibition, hunger (Three Factor Eating Questionnaire, White M 2002)
- Quality of Life (SF-36)

No significant differences by diet group

Sacks FM et al. N Engl J Med Feb 26, 2009

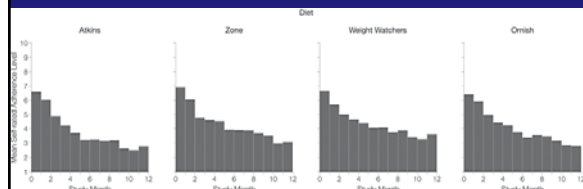
Achievement of Specific Weight Loss, 2y (Post-hoc Analysis)

	Carbohydrate/Protein/Fat, Target Intake, % Kcal			
	65/15/20	55/25/20	45/15/40	35/25/40
• Number	204	202	204	201
• ≥5% initial	30%	39%	31%	36%
• ≥10% initial	14%	15%	16%	14%
• ≥20 kg	4%	4%	2.5%	2%
• 90 th p'tile	11.3 kg	12.3 kg	12.9 kg	10.9 kg

No significant differences by diet

Sacks FM et al. N Engl J Med Feb 26, 2009

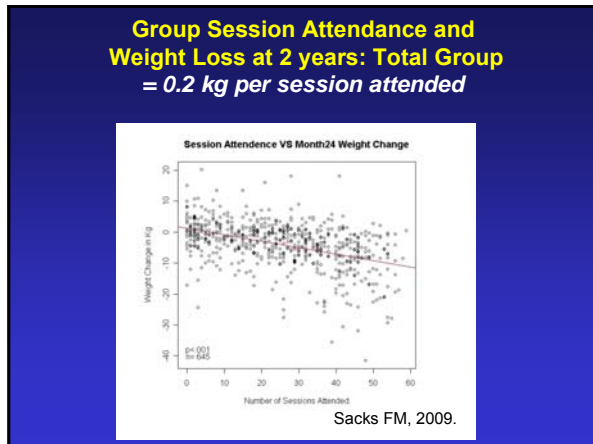
Dansinger et al: One-Year Adherence in Four Diet Groups



Possible range of self-rated adherence level was from 1 (none) to 10 (perfect).

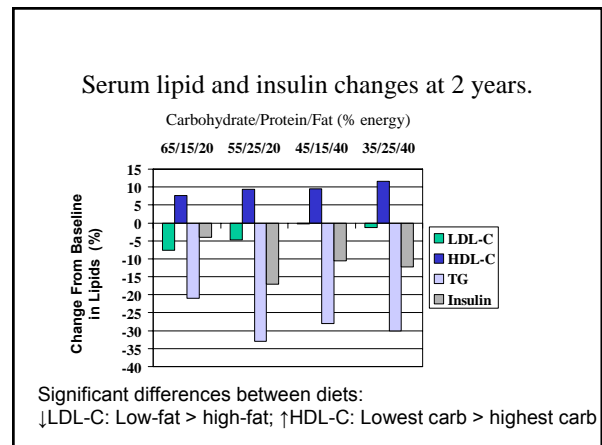
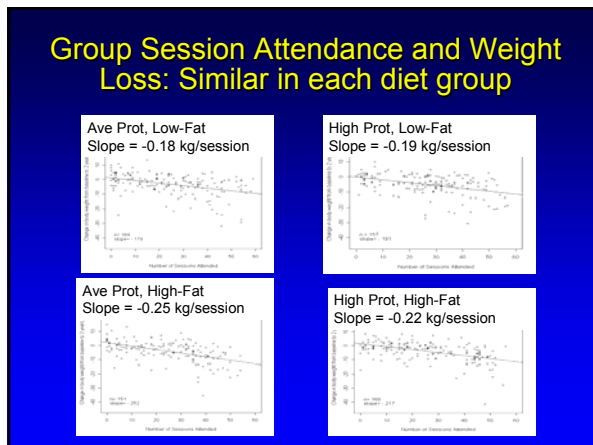
Dansinger, M. L. et al. JAMA 2005;293:43-53.





Carbohydrate/Protein/Fat: Target and Reported Intakes

Diet Type	Target	6 month	2 year
Low-Fat, Av-Prot	65/15/20	58/18/26	53/20/26
Low-Fat, Hi-Prot	55/25/20	53/22/26	51/21/28
Hi-Fat, Av-Prot	45/15/40	49/18/34	49/20/33
Hi-Fat, Hi-Prot	35/25/40	43/23/34	43/21/35



- Weight Loss: Therapeutic Techniques**
- “Self-help” vs Weight Watchers, 2 years
 - Self-help: 2 dietitian consultations
 - Weight Loss = 0.5 pounds
 - Weight Watchers: weekly meetings
 - Weight Loss = 6.4 pounds overall, 11 pounds in good attenders
 - Internet behavioral “e-counseling”
 - 10 pound weight loss at 1 year
- Heshka S et al; Tate D et al. JAMA, April 9, 2003

Summary

Reduced calorie diets achieve similar weight loss after 2 years regardless of emphasis on fat, carbohydrate or protein.

Diet satisfaction, satiety, cravings similar with all approaches.

Average weight loss = 9 pounds

Average reduction in waist circumference = 2 inches

Favorable changes in serum lipid risk factors and serum insulin

Conclusion

Successful diets for weight loss can emphasize a large range of macronutrient intakes.

These diets are made with foods that reduce risk of cardiovascular disease.

Serum lipids and insulin are improved on all such diets. But low-fat may not be best for metabolic syndrome or diabetes.

Ongoing counseling sessions are important to achieve and maintain weight loss in all groups.

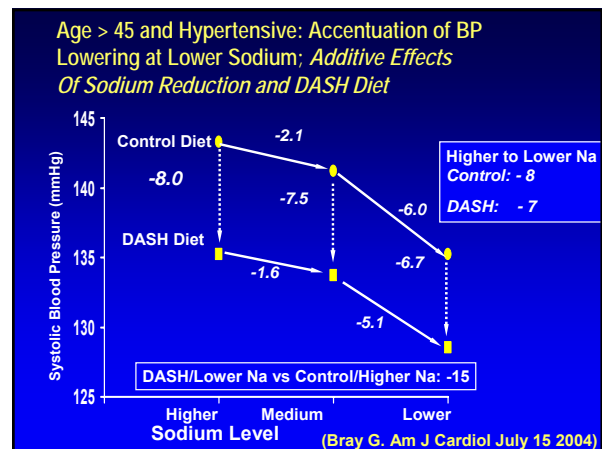
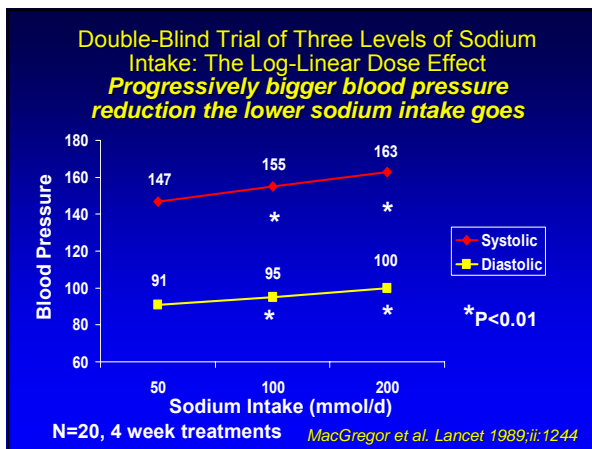
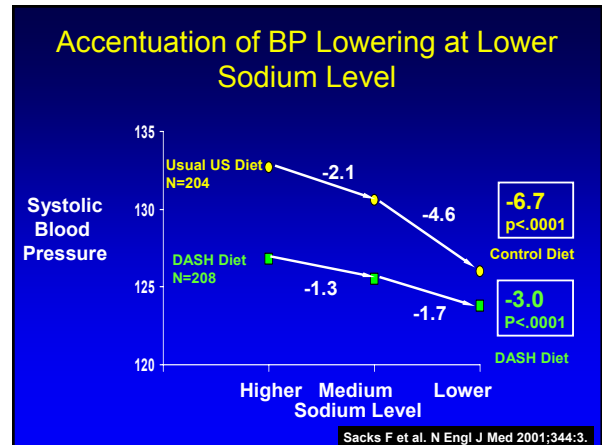
Successful diets for weight loss can be tailored to individual patients' personal and cultural preferences to achieve long-term success.

**DASH-Sodium:
Sodium Levels Tested in 412 People**

- n "Higher": 150 mmol/d (3.5 g Sodium, 8 g salt)
 - Similar to average U.S. intake
- n "Medium": 100 mmol/d (2.3 g Sodium, 6 g salt)
 - Upper limit of current guidelines for hypertension prevention and treatment
- n "Lower": 50 mmol/d (1.2 g Sodium, 3 g salt)
 - Possible optimal level

Body weight kept constant.

**Sodium, Hypertension,
Cardiovascular Disease:
Intervention Studies**

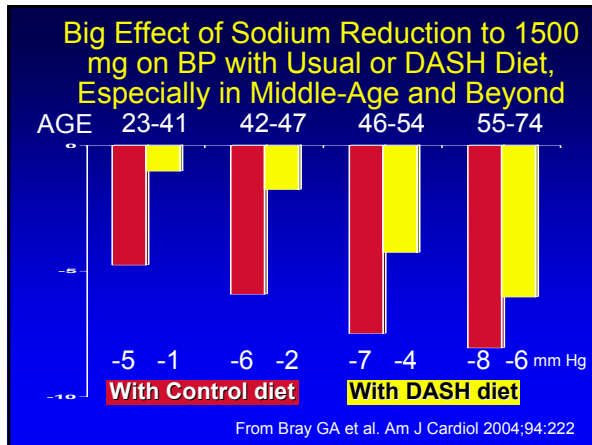


DASH-Sodium Study
The Lower the Sodium the Lower the BP

Sodium Change	African American		Non African American	
	HT	NT	HT	NT
150 vs 100	-2.3*	-2.2*	-1.9	-2.2*
100 vs 50	-7.0***	-4.7***	-4.8**	-1.9
150 vs 50	-9.4***	-6.9***	-6.8***	-4.0**

* p<.05 ** p<.001 *** p<.00001

Vollmer et al. Ann Intern Med 2001;135:1019 | Bray G. Am J Cardiol 2004



- Dietary Sodium Goal**
- Accentuation of BP lowering in 1500 to 2500 mg range of sodium compared to 2500 to 3000 mg.
 - Most population groups are responsive, about 70% of the population (CDC MMWR March 27, 2009)
 - Low sodium and DASH diet are additive