

Assessing diets and dietary patterns

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structure

1. Definition of dietary patterns
2. Methodology of dietary assessment
3. Reproducibility and validity of dietary patterns
4. Important factors affecting dietary patterns
5. Dietary patterns and metabolic disease

1. Studies used

- Cross-sectional studies with sociodemographic associations and nutrient adequacy as outcome
- Cross-sectional studies of association with biomarkers and other biological outcomes
- Prospective cohort studies with mortality and morbidity as outcome
- Case-control studies
- Intervention trials

2. Dietary assessments methods

- Two 24-hr recalls
- 3-days diet record
- 1 day diet records and 48hr diet recalls
- diet history
- 24hr recall with 14d. diet records,
- One 24-hr recall 2 diet records 68-item FFQ
- 3-days weighed record

Dietary assessments methods (2)

- 162-item FFQ , 266-item FFQ , 1,980-item FFQ , 62-item FFQ 131-item FFQ 116-item FFQ 127-item FFQ 162-item FFQ, 266-item FFQ
- Intervention studies: 8-wk feeding study, Diet instruction, 30-d crossover feeding study

3. Components used in dietary quality comparison between popular diets

A Dietary Quality Comparison of Popular Weight-Loss Plans. YUNSHENG MA et al J. Am. Diet. Ass. 2007

- the Alternate Healthy Eating Index (AHEI), a measure that isolates dietary components that are most strongly linked to CVD risk reduction.
- The AHEI has nine components for evaluating and determining dietary quality, including fruit, vegetables, nuts and soy, ratio of white to red meat, cereal fiber, trans fat, ratio of polyunsaturated fat to saturated fat, alcohol, and duration of multivitamin use
- Each component received a score from 0 to 10, with 10 being the best and 0 being the worst

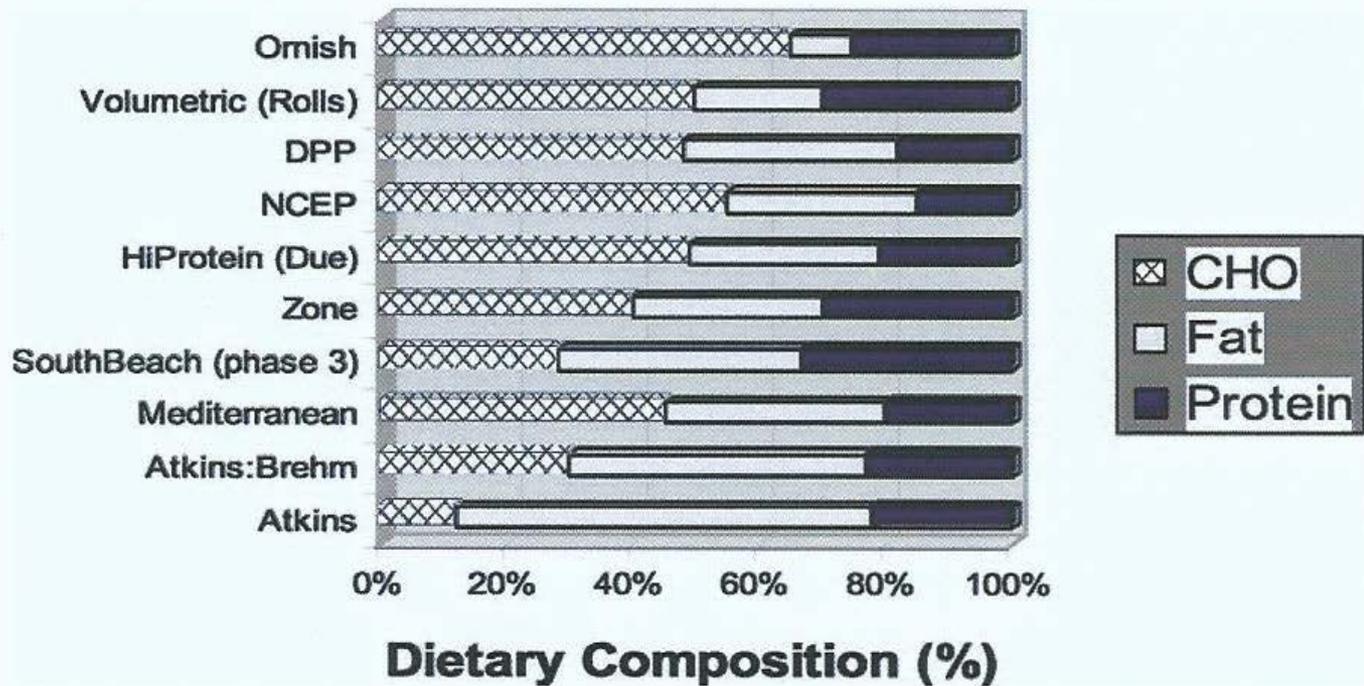


FIG 10. Dietary composition as a proportion of food energy of selected dietary plans aimed to promote weight loss. CHO = carbohydrate.

AHEI scores popular diets

1. Atkins 45 gr carbs: 41.6 ± 3.2
2. Atkins 100gr carbs: 42.1 ± 3.7
3. South Beach phase 2: 53 ± 3.3
4. South Beach phase 3: 46.4 ± 3.2
5. Zone: 54.9 ± 3.9
6. Ornish: 61.9 ± 3.4

4. Assesssing dietary patterns

Dietary patterns

- reflect habitual exposure of foods and nutrients and are a preferred means to assess diet and disease relations
- are useful in nutritional epidemiology, providing a comprehensive alternative to the traditional approach based on single nutrients.

Dietary patterns assessment methods

- Most of the published reports on the subject have used one of two methods to determine dietary patterns:
 - (a) diet indexes or scores that assess compliance with prevailing dietary guidance as dietary patterns
 - (b) data-driven methods that use factor or cluster analysis to derive dietary patterns

Dietary patterns studies reports

- Irrespective of the approach used, patterns characterized by *fruit/vegetable/whole grain/fish/poultry* consumption generally have been reported to relate to micronutrient intake, and to selected biomarkers of dietary exposure and disease risk in the expected direction.

Dietary patterns studies reports

- Age, income, and education have been reported to be among positive predictors of the so-called more healthful dietary patterns.
- An inverse association of healthful dietary patterns with all-cause mortality and cardiovascular disease risk was reported in most studies.
- the magnitude of risk reduction was modest and was attenuated after control for confounders.

Dietary patterns challenges

- Assess the relationship of health with overall diet rather than with single nutrients, foods, or food groups.
- people eat combinations of foods containing a mix of nutrients and non-nutrients.
- The food combinations consumed reflect individual food preferences modulated by a mix of genetic, cultural, social, health, environmental, lifestyle, and economic determinants

Dietary patterns assessment challenges

- In dietary interventions that advocate an increase or decrease of particular foods or nutrients, change in one dietary component is usually accompanied by compensatory changes in other components of the diet.
- Not only are foods consumed interrelated, but so are the nutrients.
- In vivo nutrient use and metabolism are also interdependent and correlated

Diet patterns assessment challenges

- These factors highlight the difficulty of interpreting results from studies that examine single dietary factors such as nutrients or foods given the highly correlated nature of dietary variables.

5. Reproducibility and validity of dietary patterns studies

Comparability of dietary patterns assessed by multiple dietary assessment methods: results from the 1946 British Birth Cohort.

SA McNaughton et. al. *European Journal of Clinical Nutrition* (2005)

- Participants (2265) of a longitudinal study
- 48-h dietary recall , followed by a 5-day food diary and with the 24 h recall immediately preceding the interview
- Correlations between factor scores on the 48-h recall and the food diary ($r=0.13-0.67$) were higher than those between the 24-h recall and food diary ($r =0.01-0.59$).
- The recall methods were effective at ranking subjects according to food and nutrient intakes, with the 48-h recall and food diary showing higher correlations in both males and females.

**Reproducibility and validity of dietary patterns assessed with a food-frequency questionnaire. *Frank B Hu*
Am J Clin Nutr 1999;**

- enrolled a subsample of men ($n = 127$)
- A 131-item FFQ was administered twice, 1 y apart
- two 1-wk diet records and blood samples were collected during this 1-y interval.
- Using factor analysis, 2 major eating patterns (prudent and westernised) identified, which were qualitatively similar across the 2 FFQs and the diet records
- The correlations (corrected for week-to-week variation in diet records) between the 2 FFQs and diet records ranged from 0.45 to 0.74 for the 2 patterns

**Reproducibility and validity of dietary patterns assessed with a food-frequency questionnaire. *Frank B Hu*
Am J Clin Nutr 1999 (2)**

- These data indicate reasonable reproducibility and validity of the major dietary patterns defined by factor analysis with data from an FFQ.

Reproducibility and Validity of Major Dietary Patterns among Swedish Women Assessed with a Food-Frequency Questionnaire

Bahram Rashid Khani et al. J Nutr 2004

- Defining dietary patterns by factor analysis is an alternative approach to dietary assessment
- aim was to assess both the validity and reproducibility of major dietary patterns based on data from a 60-item FFQ.
- 2 independent random samples among over 60,000 women aged 40–74 y participating in the Swedish Mammography Cohort

Reproducibility and Validity of Major Dietary Patterns among Swedish Women Assessed with a Food-Frequency Questionnaire (2)

Bahram Rashid Khani et al. J Nutr 2004

- In the validation study, the FFQ was compared with four 7-d dietary records (DRs) among 129 women.
- For the reproducibility study, the FFQ was administered twice, 1 y apart in 212 women.
- By conducting factor analysis, 3 major dietary patterns were identified: **healthy** (high in vegetables, fruits, fish, poultry, tomato, cereal, and low-fat dairy products), **Western** (processed meat, meat, refined grains, sweets, and fried potatoes), **and drinker** (beer, wine and liquor, snacks) pattern.

Reproducibility and Validity of Major Dietary Patterns among Swedish Women Assessed with a Food-Frequency Questionnaire (3)

Bahram Rashid Khani et al. J Nutr 2004

- The Spearman correlation coefficients between FFQ1 and FFQ2 (reproducibility) for healthy, Western, and drinker pattern were 0.63, 0.68, and 0.73, respectively (all $P < 0.0001$).
- Correlation coefficients between the FFQ and Diet Records (validity) for these patterns were 0.59, 0.50, and 0.85, respectively (all $P < 0.0001$).
- Conclusion: identification of dietary patterns through factor analysis is a reproducible and valid method. The dietary patterns approach might be used in nutritional epidemiology as an alternative method of dietary assessment.

Validity of dietary patterns to assess nutrient intake adequacy

Blanca Roman-Vinas et al. Br J Nutr 2009

- a systematic review of the literature on the value of the methods used to assess dietary patterns for measuring nutrient intake adequacy in the population.
- Systematic review on Pubmed database up to April 2008.
- Only studies that compared food patterns with nutrient intake adequacy or nutrient biomarkers were included in the analysis.

Validity of dietary patterns to assess nutrient intake adequacy

Blanca Roman-Vinas et al. Br J Nutr 2009 (2)

- The search resulted in 1504 articles
- The inclusion and exclusion criteria limited the selection to thirty articles.
- Nineteen studies evaluated the usefulness of the dietary patterns, either a priori defined (thirteen studies), or defined by factor analysis (four studies) or by cluster analysis (two studies),
- only nine of them tested their validity (four a priori defined and four a posteriori defined)

Validity of dietary patterns to assess nutrient intake adequacy

Blanca Roman-Vinas et al. Br J Nutr 2009 (3)

- Diet indices showed moderate to good validity results for measuring the adequacy of intakes for a-carotene, b-carotene, vitamin C, vitamin B6, Ca, folic acid, Fe and Mg
- The factor analysis approach showed moderate to good validity correlations with the adequacy of intake of a-carotene, b-carotene, lutein, lycopene, vitamin C, vitamin B6 and folic acid.
- Vitamin B12 and vitamin E are the micronutrients with less probability of being adequately assessed with dietary patterns a priori or a posteriori defined

Validity of dietary patterns to assess nutrient intake adequacy

Blanca Roman-Vinas et al. Br J Nutr 2009 (4)

- Diet indices are tools with fair to moderate validity to assess micronutrient intake adequacy.
- From the results shown, diet indices are valid tools to evaluate intake adequacy for certain micronutrients.
- the studies evaluating nutrient intake adequacy associated with dietary patterns showed that among men, the prudent pattern was valid to assess the intake adequacy of a-carotene, lycopene and lutein. For women, this methodology was valid for assessing the adequacy of b-carotene, vitamin C, vitamin B6 and folic acid

- magnitude of the protective effect of healthful diet patterns in most published studies was relatively modest
- More healthful dietary patterns were often reported with a constellation of other desirable health behaviors, thus confounding the pattern and health association
- In several studies, the dietary pattern and health association was markedly attenuated by control for confounders

- Most published studies did not show an association between risk of incident cancer at most sites and dietary patterns.
- Future research needs a continued comparative evaluation of patterns derived from various operational forms of nutrients or foods and from different methods in the same cohort with similar confounders.

Criteria to define a meal?

Question to audience

Answer to criteria to define a meal

- Time of consumption
- Energy content
- Social interaction
- Food quality
- Energy content + interval time since last eating event

criteria to assess eating patterns?

Question to audience

Answer to the criteria to assess eating patterns

- the number, the order and the format of the different courses.
- quantity and nutrient content but also with regard sequence and combinations of the different items.
- The "technique of preparation" (e.g. boiled, grilled, smoked, etc.).

Answer to the criteria to assess eating patterns 2?

- the time of intervals between the eating occasions (e.g. time budget surveys).
- “Social situation” is the scene where eating takes place (e.g. eating alone at home in the kitchen, out-door in the canteen, etc.).
- “Social space” refers to fellow-eaters—gender, age, the degree of familiarity and
- the degree of dependency should be surveyed.

Geography aspects of eating patterns

- A cooked meal at lunch time is the rule in central and eastern Europe. From other studies we know that this is also the case in southern European countries.
- A cooked meal at dinner time seems common in Finland, U.K., U.S.A., South Africa, New Zealand and Japan.
- A cooked meal both at lunch and dinner is common in Benin, China, Gambia, Hong Kong, Iceland, Kuwait and Lebanon; in many of these countries traditional eating patterns are strongly influenced by modern westernized diets.

6. Important Issues affecting dietary patterns

Breakfast patterns

Question to audience

1. Is ED of breakfast foods and beverages related to ED of non breakfast foods and beverages reported in the 24-h recall?
2. Is ED of breakfast foods and beverages an independent correlate of diet quality and nutrient intake in a 24-h recall?
3. Is ED of breakfast foods and beverages an independent correlate of BMI?

Association of breakfast energy density with diet quality and body mass index in American adults: National Health and Nutrition Examination Surveys, 1999–2004

Ashima K Kant et al. Am J Clin Nutr 2008

- dietary energy density (ED) is associated with diet quality, energy intake, and body weight.
- Breakfast consumption is also associated with diet quality and body weight; however, little is known about the association of breakfast consumption with dietary ED

Association of breakfast energy density with diet quality and body mass index in American adults: National Health and Nutrition Examination Surveys, 1999–2004

Ashima K Kant, Am J Clin Nutr 2008 (2)

■ **Objectives**

- 1. Is ED of breakfast foods and beverages related to ED of non breakfast foods and beverages reported in the 24-h recall?**
- 2. Is ED of breakfast foods and beverages an independent correlate of diet quality and nutrient intake in a 24-h recall?**
- 3. Is ED of breakfast foods and beverages an independent correlate of BMI?**

Association of breakfast energy density with diet quality and body mass index in American adults: National Health and Nutrition Examination Surveys, 1999–2004

Ashima K Kant, Am J Clin Nutr 2008;88:1396–404 (2)

- combined dietary data from the 3 continuous National Health and Nutrition Examination Surveys (1999–2004) to determine the ED (in kcal/g) of foods and nutritive beverages and the ED of foods only ($n=12\ 316$).

- The most frequently reported food group combinations were
 1. dairy and grain;
 2. grain only;
 3. dairy, fruit, and grain;
 4. grain and meat or alternate;
 5. fruit and grain.

Association of breakfast energy density with diet quality and body mass index in American adults: National Health and Nutrition Examination Surveys, 1999–2004 (3)
Ashima K Kant, Am J Clin Nutr 2008

- **Results:** The ED of 24-h dietary intake was lower among breakfast reporters than among non reporters.
- Women breakfast reporters (but not men) had lower BMI than did non reporters
- With increasing breakfast ED, non- breakfast ED and fat intake increased, but micronutrient intake and the likelihood of mention of all 5 food groups declined.
- BMI increased with increasing breakfast ED in men but with increasing non breakfast ED in women

Association of breakfast energy density with diet quality and body mass index in American adults: National Health and Nutrition Examination Surveys, 1999–2004 (4)
Ashima K Kant, Am J Clin Nutr 2008

- Breakfast ED was an independent positive correlate of the percentage of energy from total dietary and saturated fat,
- With increasing ED of breakfast foods and nutritive beverages, the 24-h intakes of all examined micronutrients and dietary fiber decreased .
- Breakfast ED of foods related inversely with intakes of fiber and some micronutrients (except folate, vitamin B-6, calcium, and zinc).

Association of breakfast energy density with diet quality and body mass index in American adults: National Health and Nutrition Examination Surveys, 1999–2004

Ashima K Kant, Am J Clin Nutr 2008;88:1396–404 (5)

- In conclusion, our results suggest that breakfast consumers had lower ED of the day's dietary intake.
- it is important that interventions that promote breakfast include information on food choices that result in lower ED of breakfast.

Dietary patterns during Childhood

Question to audience

- To what extent are dietary patterns during childhood important for adulthood?

Consistent dietary patterns identified from childhood to adulthood: The Cardiovascular Risk in Young Finns Study
V. Mikkila et al. Br J Nutr 2005

- food behaviour and concrete food choices are established already in childhood or adolescence and may significantly track into adulthood.
- Cardiovascular Risk in Young Finns Study is a prospective cohort study with a 21-year follow-up.
- detailed quantitative information on subjects' food consumption was obtained using a 48 h dietary recall method (n= 1768, aged 3 – 18 years)
- The interviews were repeated after 6 and 21 years (n=1200 and n= 1037, respectively).

Consistent dietary patterns identified from childhood to adulthood: The Cardiovascular Risk in Young Finns Study

V. Mikkilä et al. *Br J Nutr* 2005 (2)

- conducted a principal component analysis to identify major dietary patterns at each study point. A set of two similar patterns was recognised throughout the study
- Pattern 1 was positively correlated with consumption of traditional Finnish foods, such as rye, potatoes, milk, butter, sausages and coffee, and negatively correlated with fruit, berries and dairy products other than milk. Was more common among male subjects, smokers and those living in rural areas.

Consistent dietary patterns identified from childhood to adulthood: The Cardiovascular Risk in Young Finns Study

V. Mikkila et al. *Br J Nutr* 2005 (3)

- Pattern 2, predominant among female subjects, non-smokers and in urban areas, was characterised by more health-conscious food choices such as vegetables, legumes and nuts, tea, rye, cheese and other dairy products, and also by consumption of alcoholic beverages.
- Tracking of the pattern scores was observed, particularly among subjects who were adolescents at baseline. Of those originally belonging to the uppermost quintile of pattern 1 and 2 scores, 41 and 38 % respectively, persisted in the same quintile 21 years later.

Income and traditional dietary patterns change

- Does affect traditional healthy dietary patterns?

Assessment of dietary intake patterns and their correlates among university students in Lebanon
Pascale Salameh et al. Frontiers in Public Health 2014

- to examine common dietary patterns and their correlates among a large sample of university student population in Lebanon, focusing on correlation with gender and body mass index (BMI).
- A cross-sectional study was carried out on 3384 students, using a proportionate cluster sample of Lebanese students from both public and private universities.

Assessment of dietary intake patterns and their correlates among university students in Lebanon (2)
Pascale Salameh et al. Frontiers in Public Health 2014

- A self- administered food frequency questionnaire was used to assess dietary intake of university students.
- Factor analysis of food items and groups, cluster analysis of dietary patterns, and multivariate regressions were carried out.

Assessment of dietary intake patterns and their correlates among university students in Lebanon (3)
Pascale Salameh et al. Frontiers in Public Health 2014

- Three dietary patterns were identified
- a vegetarian/low calorie dietary pattern (characterized mainly by consumption of plant-based food)
- a mixed dietary pattern (characterized by high consumption of plant-based food, followed by composite dishes, bread, and a low consumption of western type food)
- a westernized dietary pattern (characterized by high consumption of white bread and western food, and a strong avoidance of plant food and composite dishes).

Assessment of dietary intake patterns and their correlates among university students in Lebanon (4)
Pascale Salameh et al. Frontiers in Public Health 2014

- Females were particularly more prone to adopt the vegetarian/low calorie diet
- males were more likely to adopt a westernized diet seemingly in private universities.

Students with high income and obese students (BMI 30 kg/m) were more likely to consume vegetarian/low calorie diets ($p < 0.05$).

7. Dietary patterns and metabolic disease

Question to audience

- Can dietary patterns predict risk of cardiovascular, cancer and all-cause mortality ?

Prospective study of major dietary patterns and risk of coronary heart disease in men

Frank Hu Am J Clin Nutr 2000

- examined whether overall dietary patterns derived from a food-frequency questionnaire (FFQ) predict risk of CHD in men.
- a prospective cohort study of 44875 men aged 40–75 y without diagnosed cardiovascular disease or cancer at baseline in 1986.
- 8 y of follow-up, 1089 cases of CHD
- identified 2 major dietary patterns using dietary data collected through a 131-item FFQ

Prospective study of major dietary patterns and risk of coronary heart disease in men

Frank Hu Am J Clin Nutr 2000 (2)

- The first factor, the “prudent pattern,” was characterized by higher intake of vegetables, fruit, legumes, whole grains, fish, and poultry,
- the second factor, the “Western pattern,” was characterized by higher intake of red meat, processed meat, refined grains, sweets and dessert, French fries, and high-fat dairy products.

Prospective study of major dietary patterns and risk of coronary heart disease in men

Frank Hu Am J Clin Nutr 2000 (3)

- After adjustment for age and CHD risk factors, the relative risks from the lowest to highest quintiles of the prudent pattern score were 1.0, 0.87, 0.79, 0.75, and 0.70 (95% CI: 0.56, 0.86; *P* for trend = 0.0009)
- relative risks across increasing quintiles of the Western pattern score were 1.0, 1.21, 1.36, 1.40, and 1.64 (95% CI: 1.24, 2.17; *P* for trend < 0.0001).
- **Conclusions:** These data suggest that major dietary patterns derived from the FFQ predict risk of CHD, independent of other lifestyle variables

Dietary Patterns and Risk of Mortality From Cardiovascular Disease, Cancer, and All Causes in a Prospective Cohort of Women

Heidemann C et al Circulation 2008

- evaluated the relation between dietary patterns and risk of cardiovascular, cancer, and all-cause mortality
- 72 113 women free of myocardial infarction, angina, coronary artery surgery, stroke, diabetes mellitus, or cancer
- followed up from 1984 to 2002.

Dietary Patterns and Risk of Mortality From Cardiovascular Disease, Cancer, and All Causes in a Prospective Cohort of Women

Heidemann C et al Circulation 2008 (2)

- Dietary patterns were derived by factor analysis based on validated food frequency questionnaires administered every 2 to 4 years
- High prudent pattern scores represented high intakes of vegetables, fruit, legumes, fish, poultry, and whole grains,
- high Western pattern scores reflected high intakes of red meat, processed meat, refined grains, french fries, and sweets/desserts

Dietary Patterns and Risk of Mortality From Cardiovascular Disease, Cancer, and All Causes in a Prospective Cohort of Women

Heidemann C et al Circulation 2008 (3)

- After multivariable adjustment, the prudent diet was associated with a 28% lower risk of cardiovascular mortality (95% CI, 13 to 40) and a 17% lower risk of all-cause mortality (95% CI, 10 to 24) when the highest quintile was compared with the lowest quintile.
- the Western pattern was associated with a higher risk of mortality from cardiovascular disease (22%; 95% CI, 1 to 48), cancer (16%; 95% CI, 3 to 30), and all causes (21%; 95% CI, 12 to 32).

Major dietary patterns are related to plasma concentrations of markers of inflammation and endothelial dysfunction

Esther Lopez-Garcia et al. Am J Clin Nutr 2004

- a cross-sectional study of 732 women from the Nurses' Health Study I cohort who were 43– 69 y of age and free of cardiovascular disease, cancer, and diabetes mellitus
- Dietary intake was documented by using a validated food-frequency questionnaire in 1986 and 1990.

Major dietary patterns are related to plasma concentrations of markers of inflammation and endothelial dysfunction (2)

Esther Lopez-Garcia et al. Am J Clin Nutr 2004

- A prudent pattern was characterized by higher intakes of fruit, vegetables, legumes, fish, poultry, and whole grains
- a Western pattern was characterized by higher intakes of red and processed meats, sweets, desserts, French fries, and refined grains.

Major dietary patterns are related to plasma concentrations of markers of inflammation and endothelial dysfunction (3)

Esther Lopez-Garcia et al. Am J Clin Nutr 2004

- The prudent pattern was inversely associated with plasma concentrations of CRP and E-selectin after adjustment for age, BMI, physical activity, smoking status, and alcohol
- The Western pattern showed a positive relation with CRP, interleukin 6, E-selectin, sICAM-1 and sVCAM-1 after adjustment for all confounders except BMI;

Major dietary patterns are related to plasma concentrations of markers of inflammation and endothelial dysfunction (4)

Esther Lopez-Garcia et al. Am J Clin Nutr 2004

- with further adjustment for BMI, the coefficients remained significant for CRP , E-selectin, sICAM-1, and sVCAM-1.
- **Conclusion:** Because endothelial dysfunction is an early step in the development of atherosclerosis, this study suggests a mechanism for the role of dietary patterns in the pathogenesis of cardiovascular disease.

Question to audience

- Is there a beneficial effect of fibre into CVD and T2DM risk?

Question to audience

- What type of cereal fibre is associated with protection from CHD and diabetes?

Viscous dietary fibre and metabolic effects

David J.A. Jenkins Clin Nutr 2004

- Fibre has recently been classified by the Dietary Reference Intake Committee of the Food and Nutrition Board of the Institute of Medicine of the National Academy of Sciences as total fibre, which is made up of dietary fibre and functional fibre.
- as a separate entity, viscous fibre has consistently been associated in short term and acute studies with serum cholesterol reduction and reduced postprandial glucose and insulin responses.

Viscous dietary fibre and metabolic effects

David J.A. Jenkins Clin Nutr 2004 (2)

- it is the insoluble cereal fibre, which is associated with protection from CHD and diabetes in cohort studies despite a relative absence of demonstrated metabolic effects.
- reducing the rate of absorption from the small intestine.
- slowing the rate of absorption by other means such as sipping versus bolus ingestion of glucose, increasing meal frequency, or reducing the rate of glucose absorption by the use of low glycaemic index foods.

Viscous dietary fibre and metabolic effects

David J.A. Jenkins Clin Nutr 2004 (3)

- benefits have also been noted in cohort studies in terms of diabetes and CHD risk reduction.
- benefits also appear in relation to the incidence of certain cancers.

Table 1 Current FDA health claims for CHD risk reduction.

Vegetable proteins

- Soy

Viscous fibres

- Oat β -glucan
- Psyllium

Nuts

Phytosterols

- Sterols
 - Stanols
-

Table 2 Daily intakes of vegetable protein, fibre, phytosterols and nuts.

	NCEP step 2	High-fibre starch-based	High-fibre vegetable-based simian
Vegetable protein (g/d)	28	64	93
Total dietary fibre (g/d)	26	46	143
Phytosterols (g/d)	0.3	0.5	1.0
Nuts (g/d)	0	0	30

Adapted from Jenkins et al., 2001⁴⁴ with permission from Elsevier.

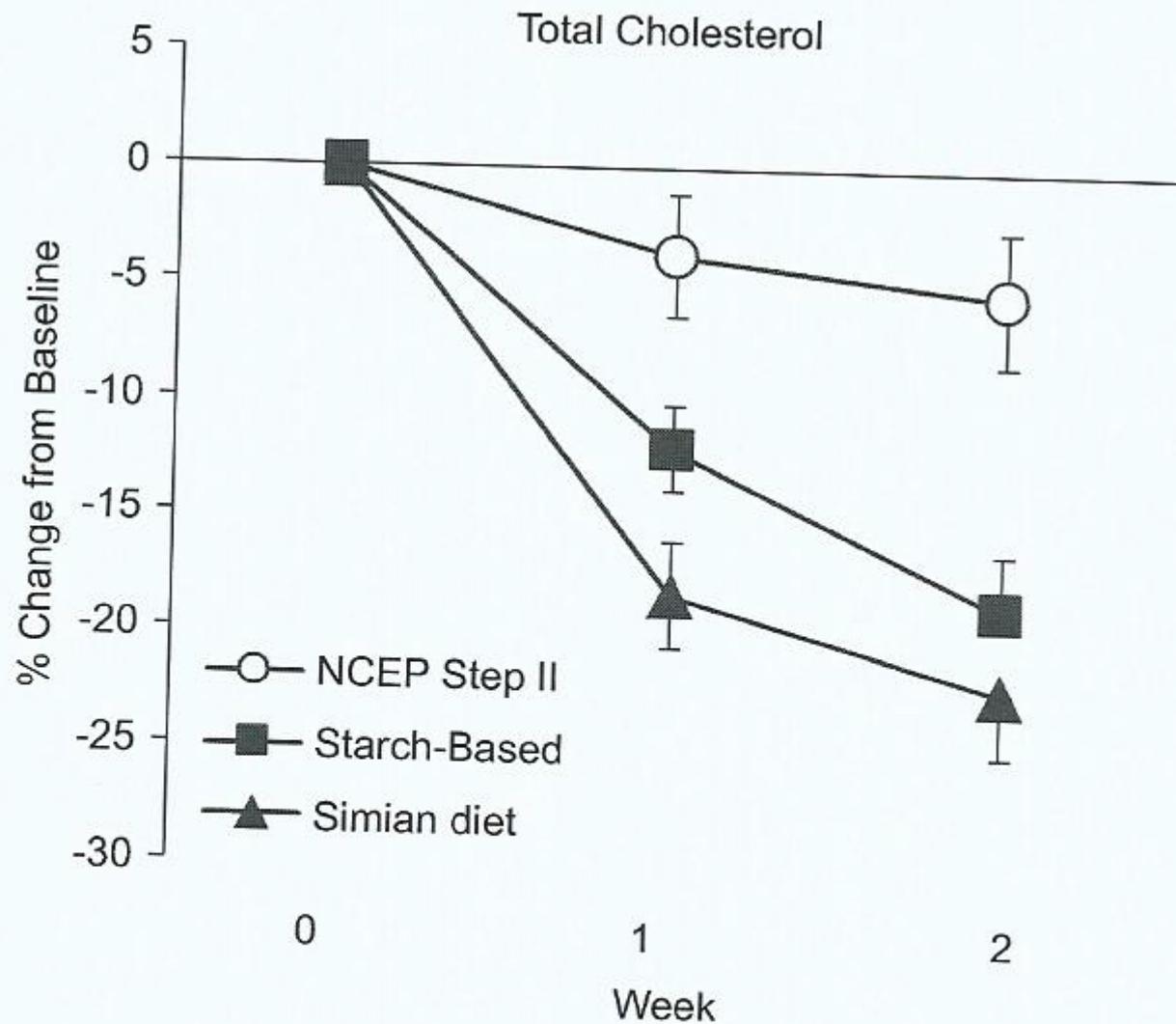


Figure 3 Serum lipid response to a diet very high in fibre from vegetables and fruit (Simian diet) compared with a starch-based and NCEP step II diet ($n = 10$). Reproduced from Jenkins et al., 2001⁴⁴ with permission from Elsevier.

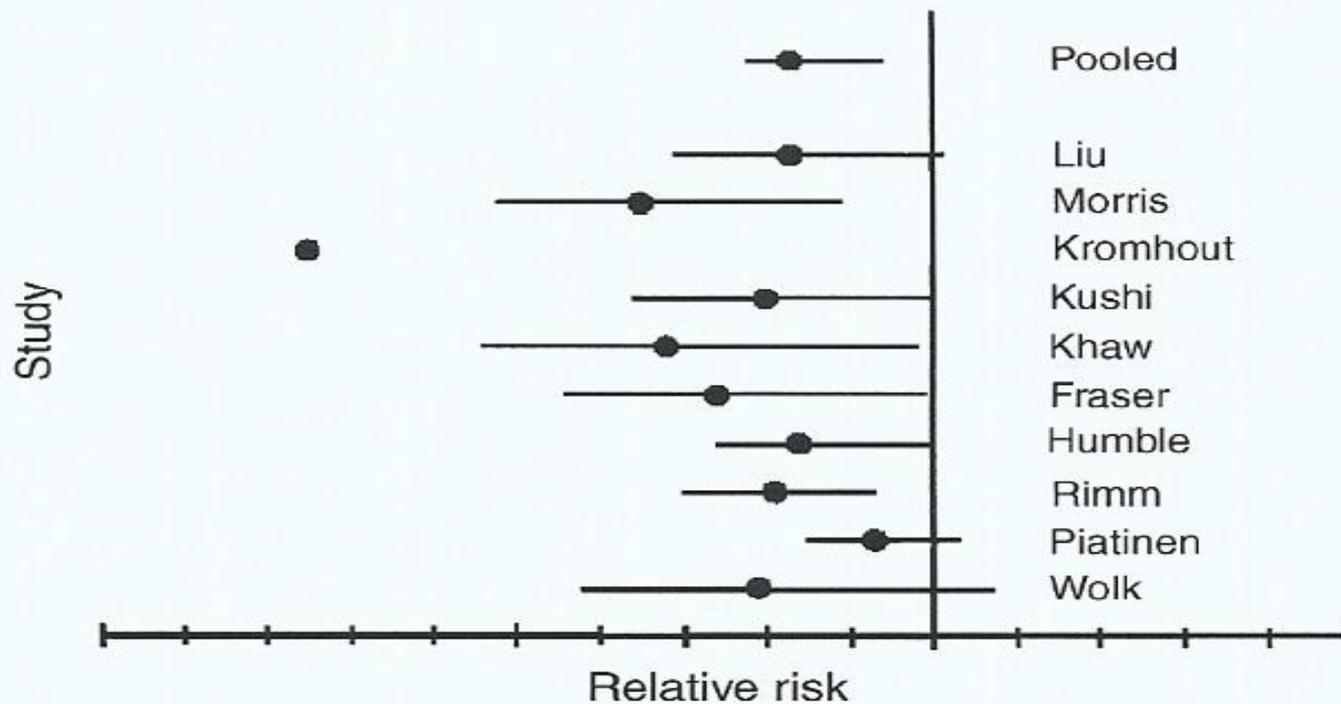


Figure 5 Ten studies assessing the effect of dietary fibre/whole grain intake and risk for CVD. Adapted from Liu et al., 2002⁵² with permission from Elsevier.

Dietary fiber and body weight

JL Slavin Nutrition 2005

- The average fiber intake of adults in the **United States** is less than half recommended levels
- is lower still among those who follow currently popular low-carbohydrate diets, such as Atkins and South Beach
- Increasing consumption of dietary fiber with fruits, vegetables, whole grains, and legumes across the life cycle is a critical step in stemming the epidemic of obesity found in developed countries.

Question to audience

- Have popular diets CVD benefits during the weight maintenance period?
- What are the differences we see in metabolic benefits between the popular diets?

Comparative Effects of Three Popular Diets on Lipids, Endothelial Function, and C-Reactive Protein during Weight Maintenance

MICHAEL MILLER, MD et al. J Am Diet Ass 2009

- low-carbohydrate Atkins diet ,
- The South Beach diet
- the high-carbohydrate, low-fat Ornish diet

- a randomized and counter-balanced cross- over study evaluated the biological impact of these diets during weight maintenance.

- Participants completed each of the three 4-week isocaloric dietary intervention phases followed by a 4-week wash- out period

Comparative Effects of Three Popular Diets on Lipids, Endothelial Function, and C-Reactive Protein during Weight Maintenance

MICHAEL MILLER, MD et al. J Am Diet Ass 2009

- Brachial artery testing revealed an inverse correlation between flow-mediated vasodilatation and intake of saturated fat ($r=0.33$; $P=0.016$).

Important Changes of variables after maintenance

	South Beach	Atkins	Ornish
LDL	-11.8%		-16.6%
apoB	$P=0.05$		$p=0.006$

Table. The effect of three popular diets on lipids, lipoproteins, apolipoproteins A-I and B (mg/dL), and C-reactive protein (mg/L) before and after completion of each 4-week dietary phase of the crossover study^{ab}

	Pre ^c (SD ^d)	Changes	SE ^e	95% CI ^f	P Value			
					Between Diets ^g			
					AS	AO	SO	
TC^h								
Atkins	183.8 (44.0)	9.2	4.7	0.0 to 18.3	0.06			
South Beach	182.6 (47.6)	-9.8	4.7	-19.0 to 0.7	0.04			
Ornish	191.7 (51.2)	-22.7	4.7	-31.8 to -13.5	<0.001	0.007	<0.0001	0.06
TGⁱ								
Atkins	83.3 (29.7)	-3.7	7.9	-19.1 to 11.8	0.65	0.95	0.08	0.07
South Beach	94.9 (47.6)	-4.3	7.9	-19.8 to 11.1	0.59			
Ornish	86.1 (41.3)	16.2	7.9	0.7 to 31.6	0.048			
TG^j								
Atkins	4.37 (0.34)	-0.08	0.08	-0.23 to 0.08	0.35	0.56	0.03	0.10
South Beach	4.44 (0.50)	-0.01	0.08	-0.16 to 0.15	0.91			
Ornish	4.35 (0.47)	0.18	0.08	0.02 to 0.33	0.03			
HDL^k								
Atkins	62.9 (18.0)	1.2	2.6	-3.9 to 6.4	0.64	0.98	0.01	0.01
South Beach	62.0 (15.3)	1.1	2.6	-4.0 to 6.3	0.67			
Ornish	64.3 (14.7)	-8.7	2.6	-3.6 to 13.9	0.002			
LDL^l								
Atkins	96.1 (24.8)	8.1	4.4	-0.4 to 16.7	0.07	0.003	0.0004	0.44
South Beach	93.1 (48.4)	-11.8	4.4	-20.4 to -3.3	0.01			
Ornish	102.2 (37.1)	-16.6	4.4	-25.2 to -8.1	0.0006			
ApoA-I^m								
Atkins	168.4 (35.7)	3.0	4.0	-4.7 to 10.7	0.45	0.83	0.0007	0.001
South Beach	170.2 (29.3)	1.8	4.0	-6.1 to 9.6	0.67			
Ornish	171.9 (29.8)	-17.8	4.0	-10.1 to -25.6	0.0001			
ApoBⁿ								
Atkins	81.7 (28.9)	4.8	2.7	-0.45 to 10.0	0.08	0.05	0.006	0.37
South Beach	77.9 (26.8)	-2.9	2.7	-8.3 to 2.4	0.29			
Ornish	83.4 (31.0)	-6.4	2.7	-1.2 to -11.6	0.02			
CRP^o								
Atkins	0.39 (0.31)	0.18	0.11	-0.04 to 0.41	0.12	0.13	0.04	0.63
South Beach	0.64 (0.65)	-0.09	0.13	-0.33 to 0.16	0.50			
Ornish	0.60 (0.51)	-0.17	0.12	-0.4 to 0.06	0.16			

^an=18.

^bRepeated measures of analysis of variance using general linear modeling for each variable.

^cPre=predietary phase baseline.

^dSD=standard deviation.

^eSE=standard error.

^fCI=confidence interval.

^gDifferences between Atkins and South Beach (AS), Atkins and Ornish (AO), and South Beach and Ornish diets (SO).

^hTC=total cholesterol.

ⁱTG=triglyceride.

^jLog-transformed analysis.

^kHDL=high-density lipoprotein.

^lLDL=low-density lipoprotein.

^mApoA-I=apolipoprotein A-I.

Comparative Effects of Three Popular Diets on Lipids, Endothelial Function, and C-Reactive Protein during Weight Maintenance

MICHAEL MILLER, MD et al. J Am Diet Ass 2009

- Conclusion:
- High saturated fat intake may adversely impact lipids and endothelial function during weight maintenance.
- popular diets such as Atkins may be less advantageous for CHD risk reduction when compared to the Ornish and South Beach diets once weight loss has been achieved.

Weight Loss with a Low-Carbohydrate, Mediterranean, or Low-Fat Diet

Iris Shai, R.D.et al. NEJM 2008

- 2-year trial,
- randomly assigned 322 moderately obese subject
- mean age, 52 years; mean body-mass index 31
- male sex, 86%
- to one of three diets: low-fat, restricted-calorie; Mediterranean, restricted-calorie; or low-carbohydrate, non-restricted-calorie.

Weight Loss with a Low-Carbohydrate, Mediterranean, or Low-Fat Diet

Iris Shai, R.D.et al. NEJM 2008

- rate of adherence to a study diet was 95.4% at 1 year and 84.6% at 2 years.
- the Mediterranean-diet group consumed the largest amounts of dietary fiber and had the highest ratio of monounsaturated to saturated fat.
- The low-carbohydrate group consumed the smallest amount of carbohydrates and the largest amounts of fat, protein, and cholesterol and had the highest percentage of participants with detectable urinary ketones

Weight Loss with a Low-Carbohydrate, Mediterranean, or Low-Fat Diet

Iris Shai, R.D. et al. NEJM 2008

completers	Low fat	Low carbs	Mediterranean
Weight loss	3.3 kg	5.5 kg	4.6 kg
Chol/HDL	-12%	-20%	

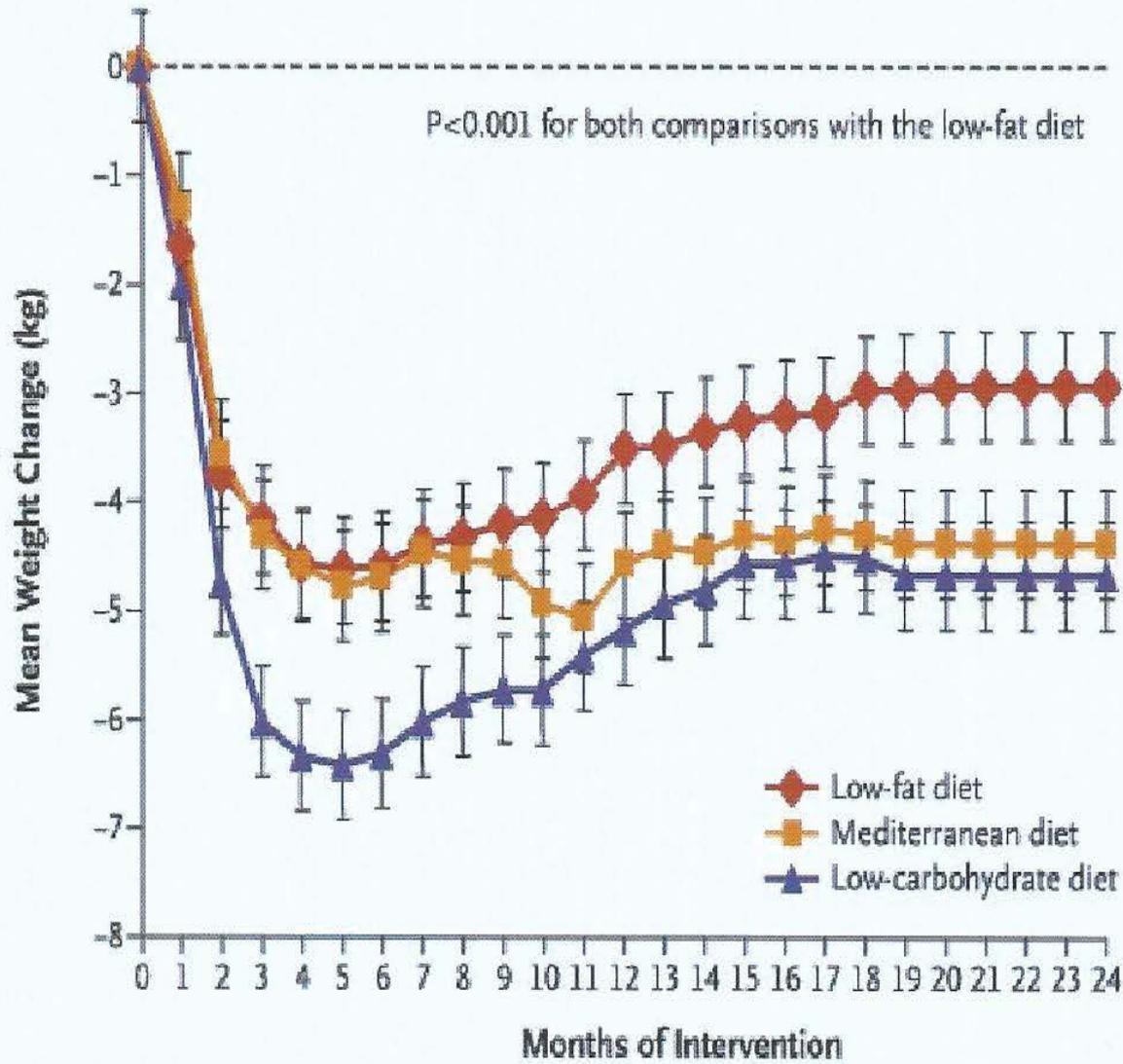
Weight Loss with a Low-Carbohydrate, Mediterranean, or Low-Fat Diet

Iris Shai, R.D.et al. NEJM 2008

- Among the 36 subjects with diabetes, changes in fasting plasma glucose and insulin levels were more favorable among those assigned to the Mediterranean diet than among those assigned to the low-fat diet

Figure 2. Weight Changes during 2 Years According to Diet Group.

Vertical bars indicate standard errors. To statistically evaluate the changes in weight measurements over time, generalized estimating equations were used, with the low-fat group as the reference group. The explanatory variables were age, sex, time point, and diet group.



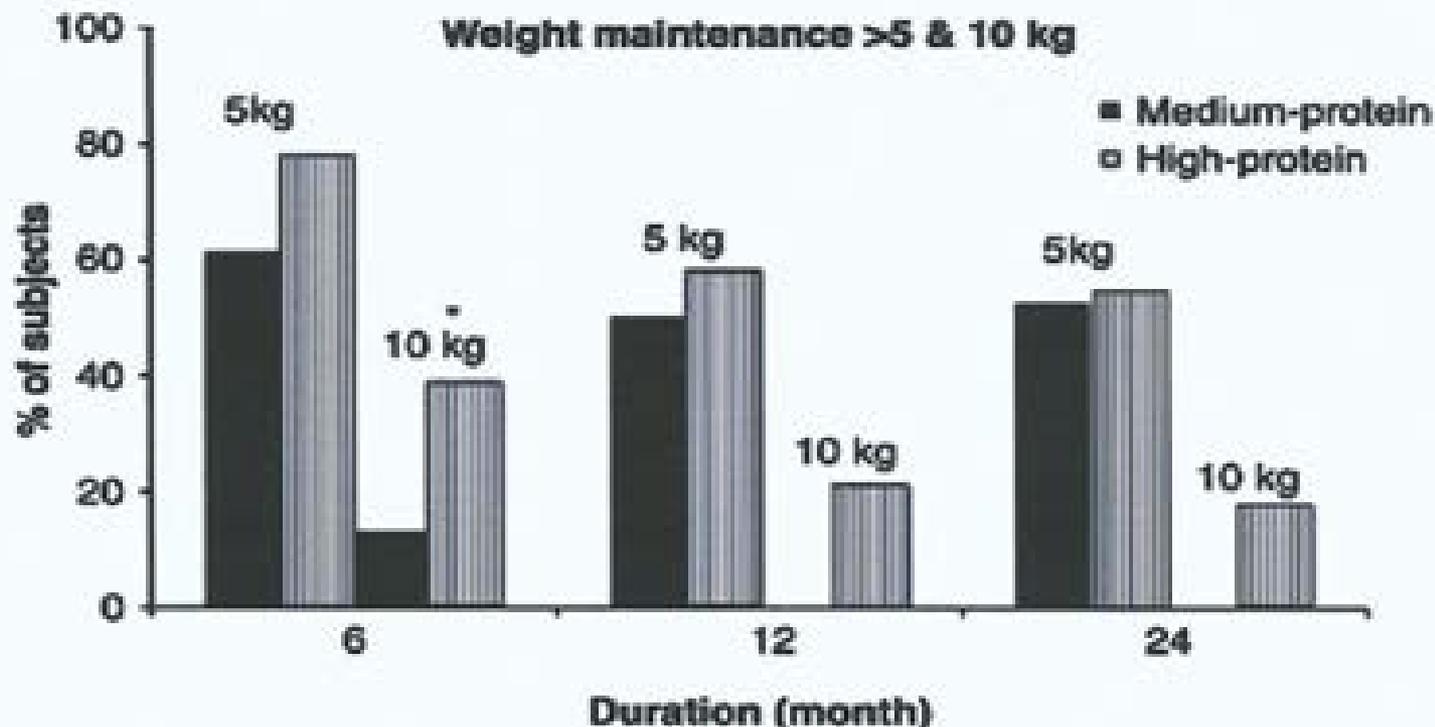


FIG 12. Proportion of subjects having lost and maintained >5 and 10 kg body weight after 6, 12, and 24 months of dietary intervention. Comparisons between groups were made by χ^2 test. Difference between medium- and high-protein groups: * $P < 0.05$. Used with permission from Due A, Teubro S, Skov AR, et al. Effect of normal-fat diet, either medium or high in protein, on body weight in overweight subjects: A randomized 1-year trial. *Int J Obesity* 2004;28:1283-1290. Copyright © 2004, Nature Publishing Group.

Weight Loss with a Low-Carbohydrate, Mediterranean, or Low-Fat Diet

Iris Shai, R.D.et al. NEJM 2008

■ Conclusion:

1. Mediterranean and low-carbohydrate diets may be effective alternatives to low-fat diets.
2. The more favorable effects on lipids (with the low-carbohydrate diet) and on glycemic control (with the Mediterranean diet) suggest that personal preferences and metabolic considerations might inform individualized tailoring of dietary interventions