

Food, Health, and Incomes: Economics of Dietary Behavior and Satiety

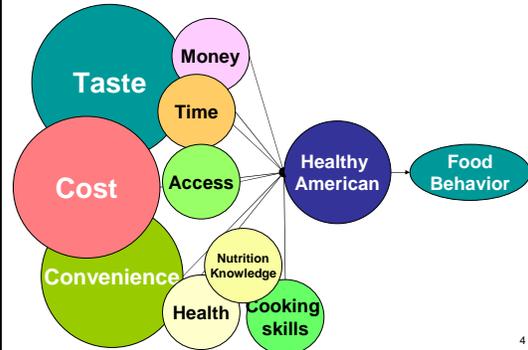
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What Drives Food Choices?



4

Disclosure

- Research on food prices supported by the USDA CSREES (NRI 2004-35215-14441)
- Research on diet quality and cost supported by the NIH NIDDK and by French Government
- Research on affordable nutrient dense foods supported by the Nutrient Rich Foods Coalition
- Research on satiety supported by industry sources: Danone (France), General Mills, Sudzucker (Germany), American Beverage Institute and American Beverage Association₂

Research Shows:

- Energy-dense foods cost less per kcal
- Such foods may contain added sugars and fats
- Diets composed of low-cost foods are energy-dense but nutrient-poor
- Such diets tend to be consumed by lower-income groups
- Lower-income groups are more likely to be obese
- Obesity and poverty are closely linked

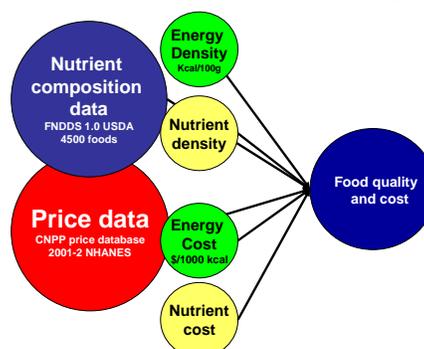
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Fundamental Questions:

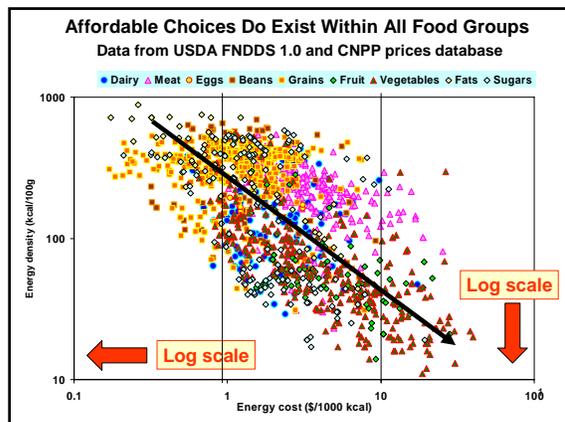
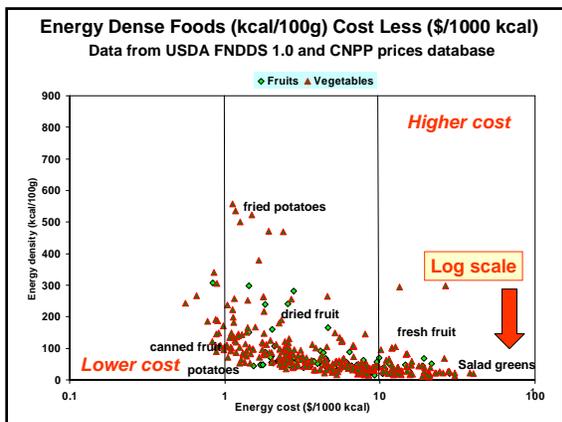
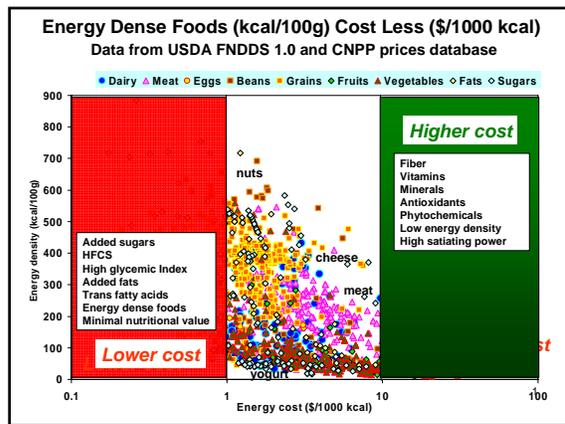
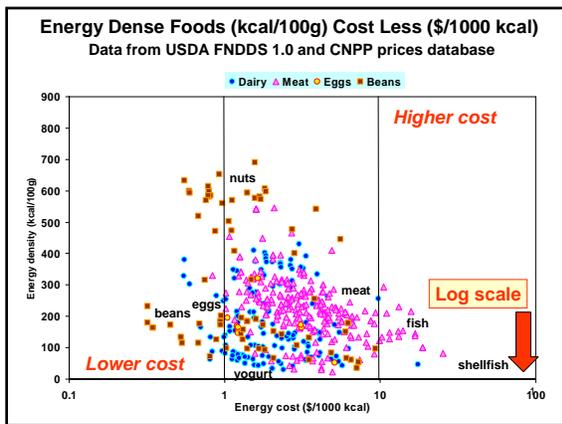
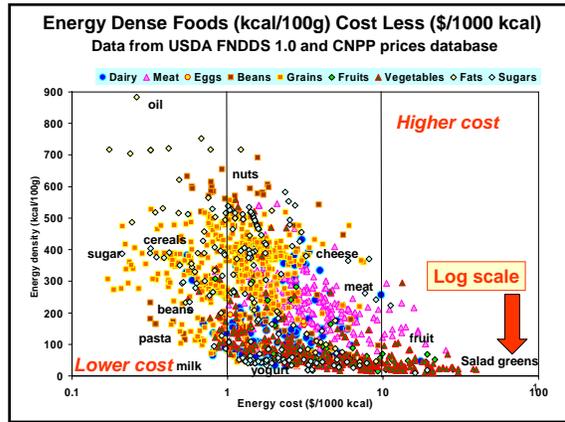
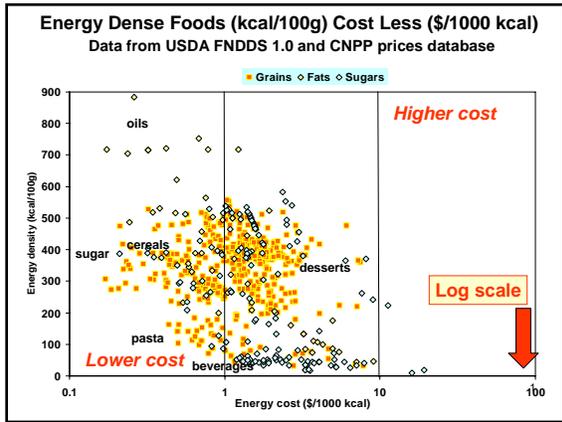
- Is it possible to improve diet quality while maintaining a lower diet cost?
- What is the relation between food prices and diet quality?
- What is the relation between food prices, poverty, and obesity?
- Are specific macronutrients (added sugars, fat) associated with obesity?
- Do liquid calories affect satiety and so contribute to obesity rates?

3

How Economics Affect Food Choices



6



From Foods to Diets:

Are low-cost diets likely to be energy-dense and nutrient poor?

13

Linking Food, Incomes and Health

Poverty and obesity may be linked by the low cost, high reward value, and easy access to energy-dense foods

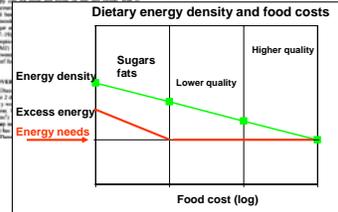
Special Article

Poverty and obesity: the role of energy density and energy costs¹²

Alan Drewnowski and Jill Specter

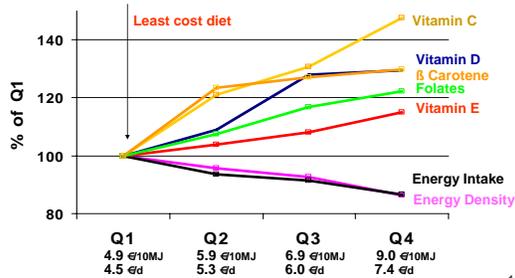
ABSTRACT
While health disparities in the United States are linked to inequalities in education and income, little is known about the relationship between education and diet quality, dietary energy density, and energy costs. The purpose of this study was to examine the relationship between the highest poverty rates and the food education. Second, there is an inverse relation between energy density (kcal/g) and energy cost (\$/MJ), such that the energy dense foods composed of refined grains, added sugars, and fats are the most expensive and difficult to obtain. Third, the high energy density and low energy cost foods are associated with higher rates of obesity, as well as chronic and degenerative diseases. Fourth, energy and food insecurity are associated with lower food expenditures, less food and vegetable consumption, and lower quality diets. In response to this study, we have developed a model to help guide the development of a low-cost, high-quality diet. The model is based on the premise that the most nutritious and least expensive diets are those that are high in fiber, low in energy density, and high in nutrient density. The association between poverty and obesity may be mediated, in part, by the low cost of energy-dense foods and may be mitigated by the high availability of sugar and fat. **Keywords:**

Public health policies for the prevention of obesity require a better understanding of the relationship between diet quality and energy costs. The purpose of this study was to examine the relationship between the highest poverty rates and the food education. Second, there is an inverse relation between energy density (kcal/g) and energy cost (\$/MJ), such that the energy dense foods composed of refined grains, added sugars, and fats are the most expensive and difficult to obtain. Third, the high energy density and low energy cost foods are associated with higher rates of obesity, as well as chronic and degenerative diseases. Fourth, energy and food insecurity are associated with lower food expenditures, less food and vegetable consumption, and lower quality diets. In response to this study, we have developed a model to help guide the development of a low-cost, high-quality diet. The model is based on the premise that the most nutritious and least expensive diets are those that are high in fiber, low in energy density, and high in nutrient density. The association between poverty and obesity may be mediated, in part, by the low cost of energy-dense foods and may be mitigated by the high availability of sugar and fat. **Keywords:**



Drewnowski & Specter, Am J Clin Nutr 2004;79:6-16

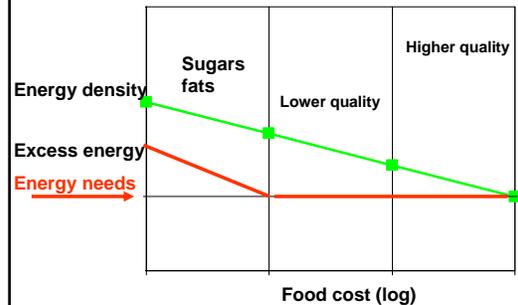
Least Cost Diets: More Energy, Fewer Nutrients



Andrieu, Darmon, Drewnowski, Eur J Clin Nutr, 2006

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Dietary energy density and food costs



Food Choices in Poverty

- Economic pressures drive consumer food choices toward cheaper, more energy-dense foods (and sweetened beverages)
- Added sugars and fats provide more calories per dollar
- Low cost energy-dense diets may lead to overeating and weight gain
- Paradoxically – spending less may mean eating more
- Low diet quality = low adherence to guidelines

15

Lower-Cost, Poor Quality Diets are Consumed by Lower Income Groups

18

Demographic and Behavioral Factors Associated with Daily Sugar-sweetened Soda Consumption in New York City Adults

Rehm et al. J. Urban Health 2008;85:375-385

- Data from 2005 CHS (n=9865; age>18y)
- Population based telephone survey by NYC neighborhoods
- Frequent consumption = ≥ 12 oz/day
- Reported by 27% of the sample

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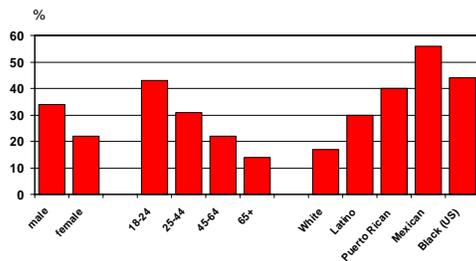
Conclusions

Rehm et al. J. Urban Health 2008;85:375-385

- Adjusting for demographics, frequent soda consumption was associated with more TV viewing and less physical activity
- Adjusting for demographics *and* behaviors, frequent soda consumption was associated with higher BMI among women (0.7 BMI units), but not among men
- Disparities in soda consumption mirrored those in obesity rates

Adjusted for age, race/ethnicity, income to poverty ratio, education, sex interaction, television viewing and physical activity

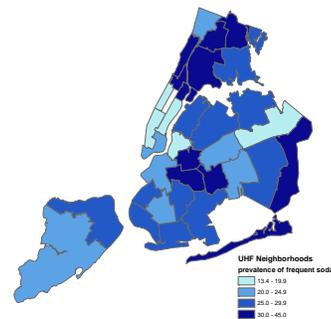
Age-adjusted Prevalence of Frequent Soda Consumption (>1/day) by Demographics



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Rehm et al. J. Urban Health 2008;85:375-385

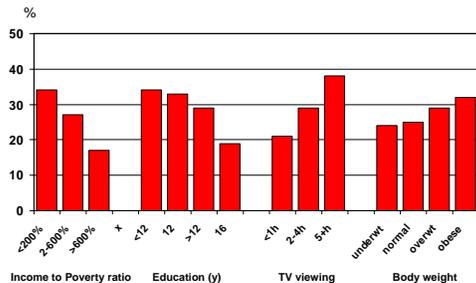
Prevalence of Frequent Soda Consumption (>1/day) by NYC Neighborhoods



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Data from Rehm et al. J. Urban Health 2008;85:375-385

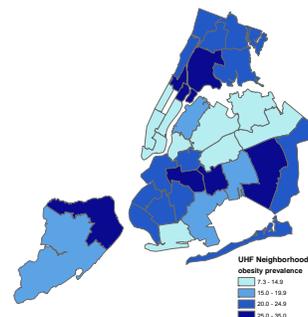
Age-adjusted Prevalence of Frequent Soda Consumption (>1/day) by SES: Links to TV Viewing and Obesity



21

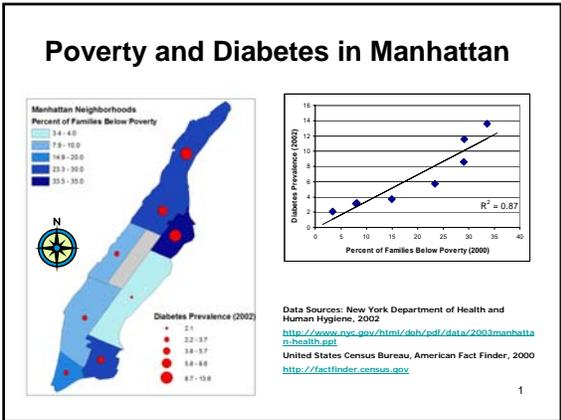
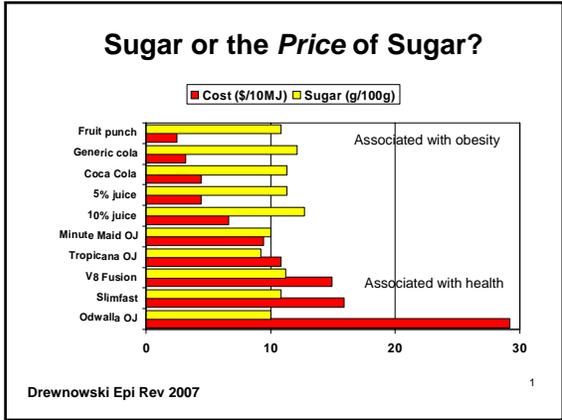
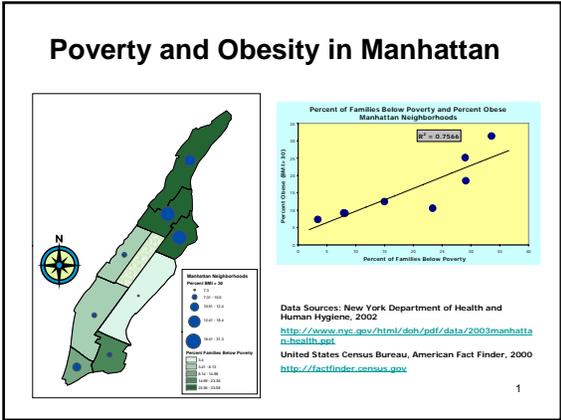
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Prevalence of Obesity by NYC Neighborhoods



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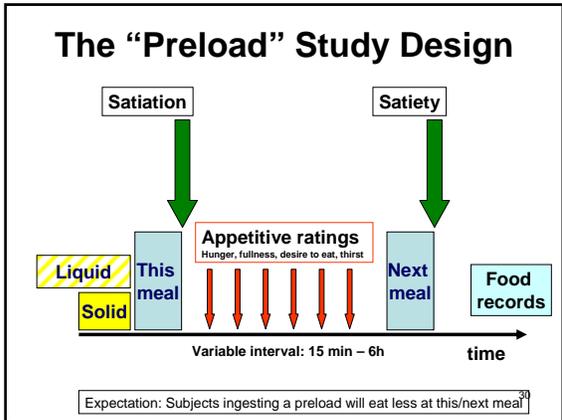
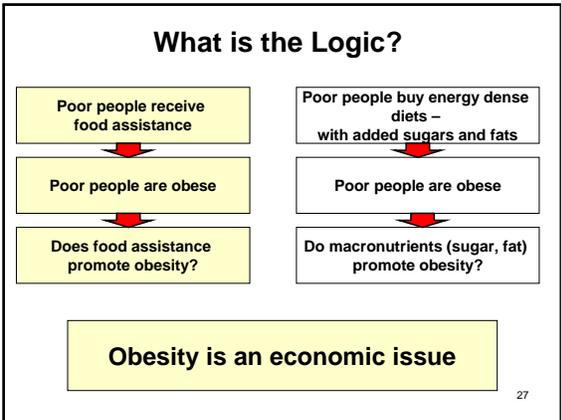
Data from Rehm et al. J. Urban Health 2008;85:375-385



Liquid Sugar Calories:

Low Satiety or Easy Access and Low Cost?

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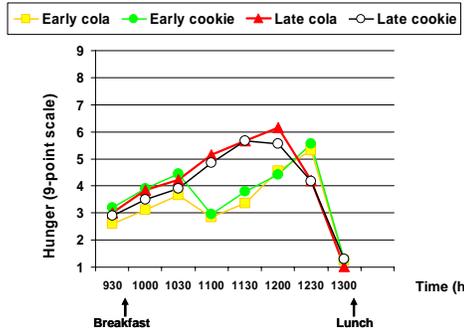


Solids Versus Liquids: Unresolved

- Liquid soups may be more satiating than solids
 - Kissileff AJCN 1985
- Solid carbohydrates (jelly beans) elicited precise 100% dietary compensation; liquids (soda) elicited none
 - DiMeglio & Mattes IJO 2000
- Solid watermelon led to lower intakes at lunch compared to watermelon juice (24% vs 6%). No difference in hunger ratings
 - Mourao, Bressan, Campbell & Mattes IJO 2007
- Solid apples did not lead to lower energy intakes compared with apple juice. There was a difference in hunger ratings
 - Mattes & Campbell JADA 2009

31

Soda and Cookies Suppress Hunger



Almiron-Roig, Flores, Drewnowski, *Physiol & Behav* 2004;82:671

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Liquids, Solids and Satiety: A Direct Test



Composition	Cola	Raspberry cookie
Carbohydrate (g)	81.5	69.0
Sugar (g)	81.5	48.0
Protein (g)	0	3.0
Fat (g)	0	0
Fiber (g)	0	1.5
Serving size	710 ml (24 oz)	87 g (6 units)
Total kcal	300	300

Almiron-Roig, Flores, Drewnowski, *Physiol & Behav* 2004;82:671

32

Three Equicaloric Beverages had the Same Effects on Hunger and Energy Intakes

Compare cola, juice and milk

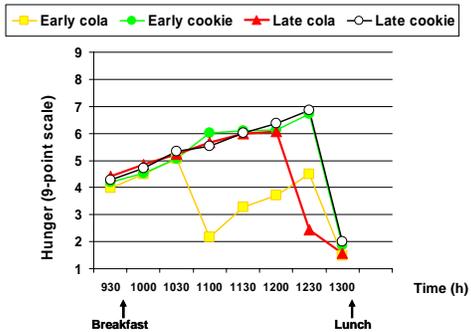
ED=0.42 kcal	Orange juice	248 kcal
ED=0.42 kcal	1% milk	248 kcal
ED=0.42 kcal	Regular cola	248 kcal
ED=0.0 kcal	Sparkling water	0 kcal



Almiron-Roig, Drewnowski *Physiol Behav* 2003;79:767

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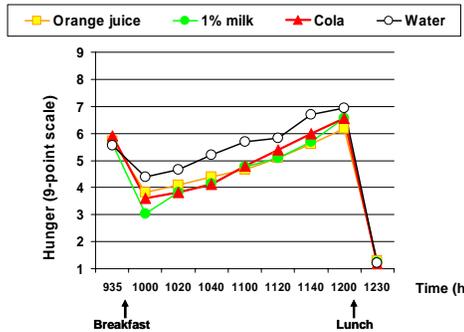
Soda Suppresses Thirst; Cookies Do Not



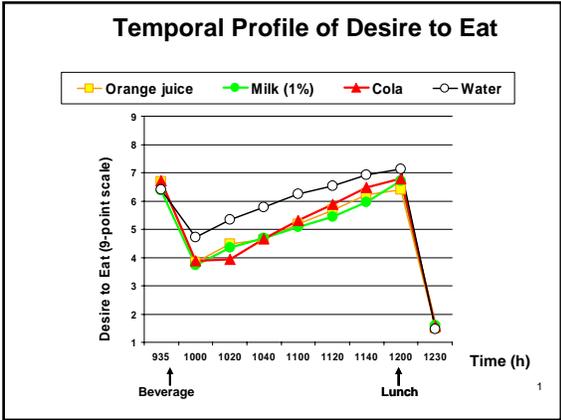
Almiron-Roig, Flores, Drewnowski, *Physiol&Behav* 2004;82:671

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Temporal Profile of Hunger Ratings



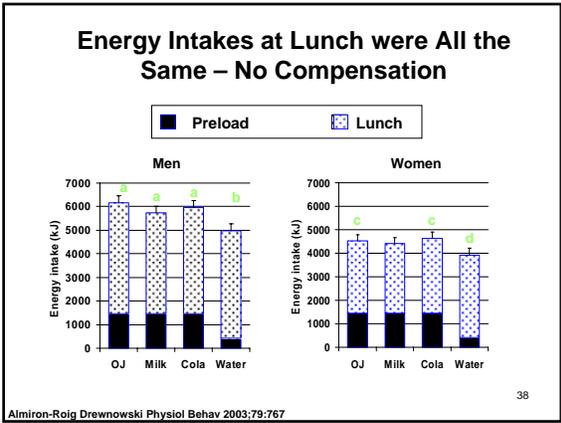
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Will telling Americans to avoid added sugars and fats improve diet quality?

Or

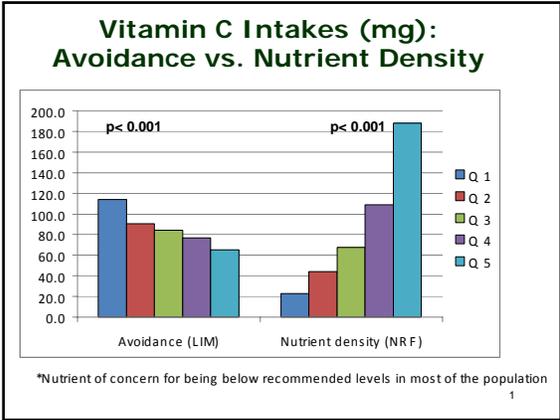
Should we help Americans build better diets by selecting affordable nutrient dense foods within each food group?



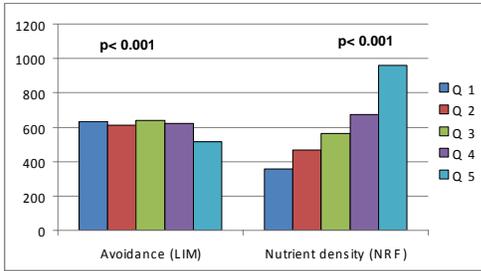
How to Build Healthier Diets

- All foods consumed by participants in NHANES 2003-2006 were scored using two approaches:
 - An “avoidance” approach based on % MRVs for saturated fat, added sugar and sodium (LIM)
 - A “nutrient density” approach based on 9 nutrients to encourage (pro, fiber, vit A, C, E, Ca, Fe, K, Mg) minus LIM
- Mean scores were calculated for each person and participants were split into 5 equal groups (quintiles) based on their scores
- Differences in diet quality by score quintiles were then examined

Are We Asking the Right Questions?



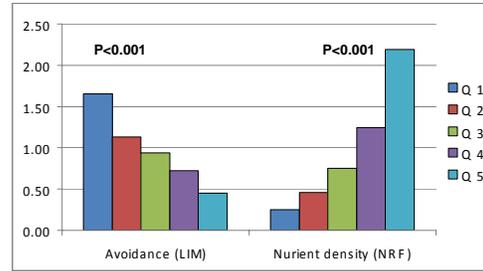
Vitamin A Intakes (µg): Avoidance vs. Nutrient Density



*Nutrient of concern for being below recommended levels in most of the population

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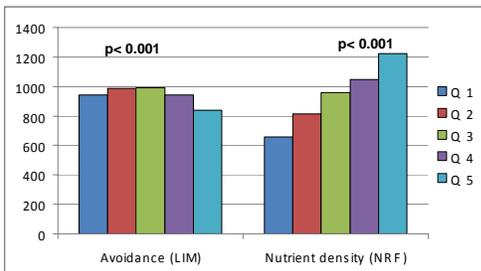
Fruit Consumption (serv): Avoidance vs. Nutrient Density



*Food group to encourage

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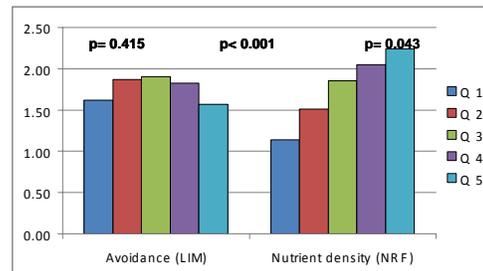
Calcium Intakes (mg): Avoidance vs. Nutrient Density



*Nutrient of concern for being below recommended levels in most of the population

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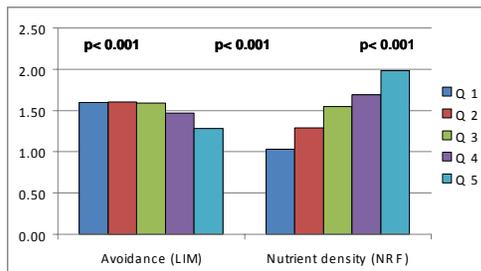
Milk Products Consumption (serv): Avoidance vs. Nutrient Density



*Low fat, fat free milk products are a food group to encourage

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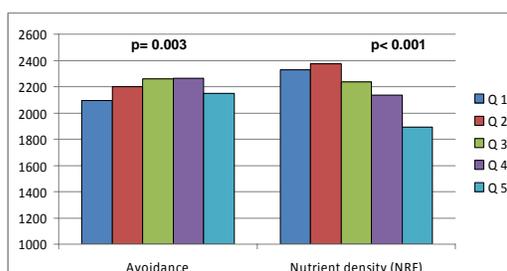
Vegetable Consumption (serv): Avoidance vs. Nutrient Density



*Food group to encourage

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Total Energy Consumption (kcal): Avoidance vs. Nutrient Density



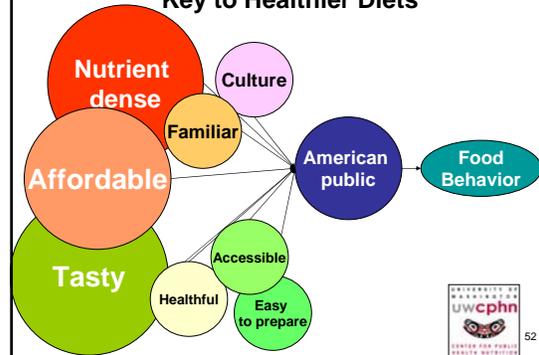
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A Balanced Approach is Better

- Nutrient density provides a better indicator of diet quality than do approaches based on added sugars, sodium and saturated fat only
- The avoidance approach (LIM score and its variants) tells Americans what *not* to eat without helping them to build healthier diets
- We cannot assume that limiting low cost sugar and fat will automatically lead to healthier diets
- Data show that nutrient dense diets were higher in nutrients of concern and higher in food groups to encourage
- Nutrient dense diets were lower in calories!

49

Affordable Nutrient-Dense Foods are the Key to Healthier Diets



52

The Answer

- Is it possible to improve diet quality while maintaining or lowering diet cost?
 - Yes, but only if we help the public identify foods within each food group that are nutrient dense, affordable, accessible, and appealing
- Limiting low-cost foods may not help diet quality or reduce obesity rates
- We need a positive approach to dietary guidance

50

Appealing, Affordable Nutrient Dense Foods

