

Sugar-sweetened Beverages and Obesity:

Evidence and Opportunities for Action

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Overview

- Background: Public health challenge and guidance
- Evidence from observational studies
- Opportunities for action
 - Guidance to individuals & families
 - Surveillance and intervention
 - Macro-level strategies

Sugar-sweetened beverages and obesity: Framework for Action

- **Rising prevalence of obesity and overweight in all age groups in U.S.**
- **Environmental change more probable than a genetic explanation**
- **Complex, interrelated risk behaviors lead to energy imbalance**
- **“Risky environments”: household, school, community, societal influences**

Public Health Challenge

- **Identify risk factors** for overweight & obesity: individual, environmental
- **Evidence** from well-designed studies: surveys, observational studies, intervention trials
- **Measurable:** nutrition monitoring, evaluate change
- **Preventable:** amenable to intervention

Public Health Guidance

Dietary Guidelines for Americans

- Aim for a healthy weight
- Be physically active each day
- Let Pyramid guide food choices
- Choose a variety of fruit and vegetables
- Choose a variety of grains, especially whole grains
- Choose diet low in saturated fat and cholesterol
- Choose beverages and foods to moderate sugar intake
- Choose and prepare foods with less salt

Healthy People 2010 Objectives

- Population goals for % meeting diet and activity guidelines

Added sugars and sweetened beverages:

Public health concerns

- Dental caries
- Potential role in energy imbalance and obesity
- Offset consumption of other foods: milk, fruit
- Bone health

Evidence from National Nutrition Monitoring System:

What tracks with obesity trends?

Food supply and Food Consumption

- **Fruits and Vegetables**
- **Grains and Whole Grains**
- **Total and Saturated Fat**
- **Added Sugars**

Evidence From an Observational Study

Relation between consumption of sugar- sweetened drinks and childhood obesity: a prospective, observational analysis.

Ludwig, DL, Peterson KE, Gortmaker, S. Lancet, 2001; 357-505

Soft Drinks and Energy Balance

*Adults given 3.5 servings/day regular soda for 3 weeks:

→ Increased total energy intake and body weight

*Adults given 3.5 servings/day of diet soda for 3 weeks:

→ Decreased total energy intake and body weight

Source: Tordoff & Alleva. AJCN 1990, 51:963

Hypothesis:

***Sugar-sweetened soft drink
consumption promotes weight gain in
children***

- There are few data examining the long-term relationship between soft drinks and obesity**

Soft Drink Consumption & Obesity

An Observational Study: Methods

- 2 year prospective, observational study *
- 547 subjects in grades 6 and 7
- Diet assessed by a food frequency questionnaire.
- Standardized measures of height, weight, and triceps skinfold.
- Associations between beverage intake and obesity determined by linear and logistic regression analyses, adjusted for potentially confounding variables

* Source: Gortmaker S, Peterson KE, Wiecha J et al. Arch Ped Adol Med 1999.

Estimating Beverage Consumption

- Youth Food Frequency Questionnaire (YFFQ)*
- BEVERAGES: In the past 30 days, how often did you drink (1 can or glass). . . ?
 - Soda
 - Diet Soda
 - Sweetened fruit drink (punch, lemonade, Koolaid)
 - Iced Tea--NOT Diet
 - Milk (glass or with cereal)
 - Chocolate milk

* Source: Rockett HR, et al. Validation of a youth/adolescent food frequency questionnaire. *Prev Med* 1997; 26:808-816.

Cohort Characteristics

	Baseline	Follow-up
Body Mass Index	20.7	22.2
Soda (servings/d)	1.2	1.4
Fruit juice (servings/d)	1.3	1.1
Energy from fat (%)	31.3	30.1
Total Energy (kJ)	8950	9610
Incident obesity*		37 (9.3%)

*Obesity = BMI & triceps skinfold \geq 85th percentile

Incidence = Number of 398 students NOT obese at baseline who became obese at follow-up.

Soft Drink Consumption & Obesity

An Observational Study: Results

	BMI (kg/m ²)			Odds Ratio of Obesity		
	<i>Mean</i>	<i>C.I.</i>	<i>P</i>	<i>Mean</i>	<i>C.I.</i>	<i>P</i>
Baseline Consumption (per 1 serving/d)	.18	.09 – .27	.02	1.5	.6 – 3.5	ns
Change in Consumption (per 1 serving/d increase)	.24	.1 - .39	.03	1.6	1.1 – 2.2	.02

Adjusted for baseline measures of obesity, demographics, school, physical activity, TV viewing, dietary fat, and fruit juice and total energy intake

Source: Ludwig D, Peterson KE, Gortmaker SL. Lancet 2001, 357:505

Diet Soft Drink Consumption & Obesity

	BMI (kg/m²)		Odds Ratio of Obesity		
	<i>Mean</i>	<i>P</i>	<i>Mean</i>	<i>C.I.</i>	<i>P</i>
Baseline Consumption (per 1 serving/d)	-.28	.10	.89	.4 – 1.9	.69 ns
Change in Consumption (per 1 serving/d increase)	-.15	.10	.44	.2 – .9	.03

Adjusted for baseline measures of obesity, demographics, school, physical activity, TV viewing, dietary fat, and fruit juice and total energy intake

Source: Ludwig D, Peterson KE, Gortmaker SL. Lancet 2001, 357:505

Soft Drink Consumption & Obesity

What Physiological Mechanisms Are Involved?

- **There is no clear evidence that sugar consumption *per se* promotes food intake or obesity in a unique manner**
 - **Ecological & epidemiological studies do not show a relationship between sucrose consumption and obesity**
 - **Sucrose appears to be as satiating as fat or starchy food**

Source: Hill & Prentice, Am J Clin Nutr 1995, 62:264S

Soft Drink Consumption & Obesity

What Physiological Mechanisms Are Involved?

Possibility #1:

- **Compensation for calories in liquid form is less accurate and complete than for calories in solid form**
 - **Energy from beverages added to, and did not displace, energy consumed in other forms among free feeding adults (De Castro, Physiol Behav 1993, 53:1133)**
 - **Total energy intake was greatest on days when an energy-containing beverage was consumed at lunch. (Mattes, Physiol Behav 1996, 59:179)**

Soft Drink Consumption & Obesity

What Physiological Mechanisms Are Involved?

Possibility #2:

- **High glycemic index/load of soft drinks promotes hunger and food intake**
 - **Beverages sweetened with fructose (a low GI sugar) decreased subsequent *ad libitum* calorie and fat intake relative to water or aspartame.**
 - **Beverages sweetened with glucose (high GI) increased subsequent *ad libitum* calorie intake relative to water or aspartame.**

Summary

- **Excessive dietary fat is unlikely to be the primary cause of the obesity epidemic**
- **The decrease in calories from fat has been matched, in large part, by an increase in calories from soft drinks**
- **Soft drink consumption may promote excessive weight gain**
- **Soft drinks may affect body weight regulation due to incomplete compensation for calories in liquid form**
- **High glycemic index/load**

Sugar Sweetened Beverages and Obesity: Opportunities for Action

- Guidance for individuals
- Surveillance and intervention
- Macro-level strategies

Opportunities for Action: Guidance for Individuals

- **Quantify ‘use sparingly’ in Dietary Guideline**
 - Added sugars
 - Sugar-sweetened beverages
- **Substitute fruit and vegetables for sugar-sw beverages**
 - Link message to ‘5-a-Day’ campaigns
- **Educate re: added sugars in ‘low-fat’ products**
- **Food labels**
 - Provide household units (4 g = 1 tsp)
 - List true weights (baked goods 20-25% underest)

Opportunities for Action: Surveillance and Intervention

- **Add items on beverages and milk intake on YRBS, PedNSS***

- **‘In past 30 days, how often did you drink. . .’**
- **Milk, chocolate milk, diet soda, soda, ice tea, punch**

- **Consider environmental indicators**

- **Availability of sugar sweetened and alternative beverages**
- **Vending, markets**

- **Develop and evaluate interventions**

- **Clinical guidance to parents and youth**
- **School and community-based education**

*Youth Risk Behavior Surveillance System; Pediatric Nutrition Surveillance System

Massachusetts Partnership for a Healthy Weight : *Using Surveillance Methods to Evaluate an Intervention*

GOALS

- Assess the effectiveness of Planet Health intervention in middle schools
- Enable Massachusetts DPH to conduct obesity surveillance: detect & describe problem; monitor trends

Wiecha J, Peterson K, Bettencourt M, Salkeld S, Metallinos-Katsaras E. APHA Annual Meetings, October 2001, Atlanta, GA

Morris V, Roberts J, Bettencourt M et al. Building Comprehensive Obesity Surveillance Workgroup Case Conference, December 2002.

Massachusetts Partnership for a Healthy Weight : *Using Surveillance Methods to Evaluate an Intervention*

INSTRUMENT DEVELOPMENT:

- Key indices desirable in both systems
 - Height, weight(measured, self-report)**
 - Weight control behaviors**
 - Physical activity& inactivity**
 - Dietary intake (frt/veg, beverages)**
- Self-administered frequency questionnaire
- Format and items comparable with YRBS

Opportunities for Action: Macro-level Strategies

- **Tax soft drinks and snack foods**
- **Limit availability in schools**
- **Limit direct advertising to children and youth**
- **Prompt fast food/restaurant industry to reduce portions**
- **Shift agricultural production from sugar beets to fruit and vegetables**

Sources: Adapted from Krebs-Smith S. J Nutr 2001; Harnack L et al, Am J Clin Nutr 2000.

Sugar-sweetened Beverages and Obesity: Conclusions

Evidence from Surveillance:

- **Increased supply and consumption of added sugars.**
- **Sugar sweetened beverages as a major food source.**
- **Largest increase in consumption for adolescents, 12-17.**

Evidence from Observational Research:

- **Sugar sweetened beverages associated with adolescent obesity, controlling for other risk factors.**

Opportunities for Action:

- **Research, surveillance and intervention at multiple levels of influence.**