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Children's Dietary Recommendations:
When Urban Myths, Opinions, Parental Perceptions & Scientific Evidence Collide

Guest Speaker
Ronald E. Kleinman, MD
Massachusetts General Hospital for Children
Boston, MA

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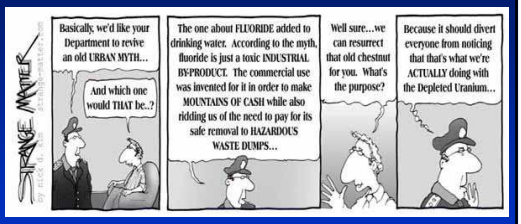
MassGeneral Hospital for Children • Harvard Medical School

Fluoride

Fluoride – the Urban Myth

- Fluoride is a toxic industrial chemical initially used by Nazis to control the minds of the population
- Almost all psychotropic drugs are fluoride products
- Even low-to-moderate doses can lead to
  - Bone cancer
  - Dental fluorosis
  - Bone fracture
  - Joint pain
  - Skin rash
  - Reduced thyroid activity
  - IQ deficits

www.fluoridealert.org



www.firstscience.com

Parental Perceptions of Fluoride

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- "I don't let my children drink tap water. I won't cook with it anymore, either, although I don't know if it's ok to do so. I don't want to chance it, since I was told that fluoride was used for mind control in WWII. I don't know if that's true, either, but I don't want to take the chance with my kids."

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- "I heard fluoride is toxic when taken internally. This is why the dentist makes sure you spit after a fluoride treatment."

- "Who funded all these studies that say it is safe? Chemical companies that furnish the chemicals? Tooth paste companies that supply the tooth paste we buy? The dental associations that make a living selling us fluoride treatments?"

Water Fluoridation: Science and Public Policy

- Considered by US Center for Disease Control and Prevention one of the top 10 public health achievements of the 20th century
- Endorsed by more than 100 national and international organizations, including
  - World Health Organization
  - US Public Health Service
  - American Dental Association
  - American Academy of Pediatrics
  - American Medical Association

Hierarchy of Study Designs*

- Level 1: *Randomized controlled trials*
- Level 2: *Non-randomized control trials* – prospective studies with pre-determined eligibility criteria and outcome measures
- Level 3: *Observational studies with controls* – Includes retrospective, interrupted times series, case-control studies, cohort studies with controls, and health services research that has adjustment for likely confounding variables
- Level 4: *Observational studies without controls*, such as cohort studies without controls and case studies

**AHRQ Evidence-based Review Methodology, www.ahrq.gov/clinics/ptsafety/chap3.htm*

Risks/Benefits of Fluoride Treatments for Children

- Marinho et al. conducted several Cochrane reviews on different types of topical fluoride treatments in children
  - Results generally positive (fewer dental caries), although more studies needed on adverse effects from excessive ingestion, such as fluorosis

Summary of Fluoride Cochrane Reviews

Fluoride Treatment Studied	# of Studies Included	Findings
1. Toothpaste	74	Benefits of fluoride toothpastes in reducing caries firmly established. Trials relatively high quality.
2. Varnishes	9	Substantial caries-inhibiting effect of fluoride varnish on both permanent and deciduous teeth based largely on trials with no treatment controls. Most of studies of poor quality with wide confidence intervals. Need for more trials.
3. Rinses	36	Supervised regular use of fluoride mouthrinse at 2 main strengths and rinsing frequencies associated with reduction in dental caries. Need for further reporting of side effects and acceptability data in trials.
4. Gels	25	Clear evidence of caries-inhibiting effect. Little information on adverse effect or acceptability of treatment.
5. Comparison of different treatments	17	Fluoride toothpastes, mouth rinses and gels appear to have a similar effect in preventing dental caries. No clear suggestion fluoride varnish is more effective them mouth washes or rinses and the evidence for comparative effectiveness for varnish and mouth washes, compared to gels, was inconclusive. No data reported about adverse effects.

Fluoride Supplements and Fluorosis

- For children living in areas without water fluoridation, fluoride supplements may be beneficial
  - ADA, AAP and AAPD all endorse guidelines on accepted dosages
  - AAP recommends consideration of all sources of fluoride before prescribing supplements
- Fluorosis
  - A meta-analysis of cross sectional/case control studies showed an increased risk of fluorosis in children getting supplements

  Bandekar, 1999

Sugar

Sugar: the Urban Myths

Sugar contributes to:

- Hyperactivity
- Obesity
- Tooth decay
- Headaches/Migraines
- Osteoporosis
- Heart Disease
- Poor overall diet quality
- Cancer
- Sugar Addiction

Center for Science in the Public Interest

"I have mothers tell me their child can ingest something sweet, and they know to the minute when the reaction is going to occur."

-Jo Ann Hattner, RD, Stanford University School of Medicine

Parental Perceptions of Sugar

- "I look at the labels of children's products and can't help but wonder if there's a conspiracy to keep my kids addicted to sugar."

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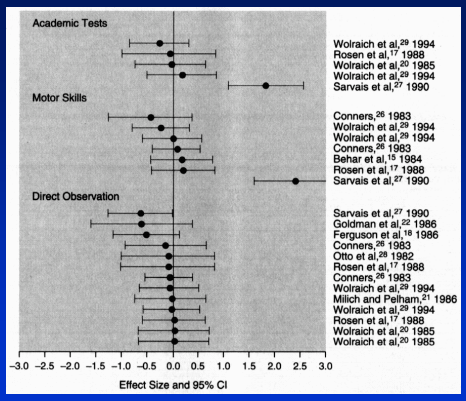
Parental Perceptions of Sugar

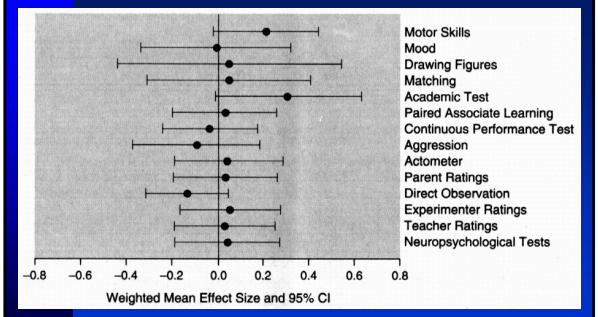
- "I look at the labels of children's products and can't help but wonder if there's a conspiracy to keep my kids addicted to sugar."
- "My kids are getting completely overloaded on sugar at school from meals and treats – it's a nightmare, my daughter comes home totally unglued and can't focus."
- "I've taught my middle child, who is the most sugar-addicted and hyperactive, to sing, 'Sugar is not my friend.' Now, she will grudgingly accept a snack of cucumber slices instead."

Evidence for Effect of Sugar on Children's Behavior

- Majority of studies so far have not found a link between sugar and behavior in children generally or children diagnosed with attention deficit hyperactivity disorder
  - Review of correlational, intervention and challenge studies found that sugar had no effect in most studies, and in those that did, the effect was as likely to be positive as negative *Milich et al, 1986*
  - Meta-analysis of blinded, placebo studies involving interventions involving sugar consumption showed no effect on behavior or cognition, although a small effect or effects on small numbers of children not ruled out *Wolraich et al. 1995*



Wolraich, JAMA 1995 1617-21



Wolraich, JAMA 1995 1617-21

Evidence for Effect of Sugar on Children's Behavior

- Despite the evidence, many parents and physicians continue to be believe that the consumption of sugar leads to behavioral problems in children
- One challenge study suggests common reporting of behavioral effect of sugar may be due to parents' perceptual biases
  Hoover, 1994

Artificial Coloring

Artificial Coloring - The Urban Myth

- Artificial coloring chemicals cause behavioral problems in all children
  - Hyperactivity/ADHD
  - Interfere with normal nervous system functions
- Coal tar, a main ingredient in artificial food coloring, is a carcinogen in large quantities, causing tumors in lab rats

www.naturalnews.com

What Parents Are Saying About Artificial Coloring

- "Just the thought of how bad they must be for us, whether or not it's proven, is disappointing. I really don't need one more thing to make sure I'm not buying!"

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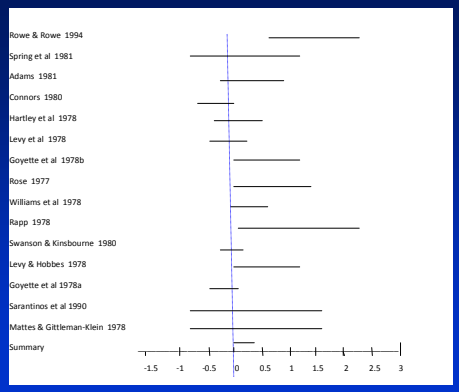
- "I know Red #40 has major side effects. Once this bad stuff was out of my 5 1/2 year old son's body, he doesn't have as many melt downs, is a lot calmer, not as many temper tantrums or refusing to do certain things we want him to do."

Evidence for Relationship Between Artificial Coloring and Children's Behavior

- Meta-analysis of double-blinded, placebo-controlled trials suggested that AFC's may cause neurobehavioral toxicity

Schab & Trinh, 2004

- Using meta-analytic modeling, the authors found
  - Overall effect of AFC's on hyperactivity to be 0.283 (95% CI, 0.079-0.488)
  - Lower effect of 0.210 (95% CI, 0.07-0.414) with exclusion of smallest and lowest quality trials



Adapted from Schab & Trinh, Figure 1. Effect sizes from 15 trials in primary analyses

Evidence for Relationship Between Artificial Coloring and Children's Behavior

- Two other studies showed mixed results

Author & Study	Type of Study	Study Goals	Results
McCann et a. Food additives and hyperactive behaviour in 3 yo and 8/9 yo children. The Lancet, 2007.	Randomized, double-blinded, placebo-controlled trial	Comparing different mixes of AFC's and additives, determine whether AFC's and additives affect children's behavior.	One mix showed negative results for both 3 yo's and 8/9 yo's; the other mix showed an effect on 8/9 yo's only. Findings suggest artificial coloring or the preservative sodium bezoate (or both) results in hyperactivity in some children in the general population.
Bateman et al. Effect of food coloring and benzoate preservative challenge on hyperactivity among preschool children. Arch Dis Child, 2004.	Randomized, double-blinded, placebo-controlled trial	Determine whether AFC's and a preservative in the diet of 3 yo children in the general population influence hyperactivity.	Adverse effect of artificial coloring and benzoate preservatives found by parents only, not detectable by a clinic assessment. Parents reported significant decreases in hyperactivity during the withdrawal phase, and greater increases in hyperactivity in the active period than in the placebo period.

Non-nutritive (Low Calorie) Sweeteners

Low-Calorie Sweeteners: Urban Myths

- Cause cancer
- Cause hyperactivity
- Cause aggression and other bad behaviors
- Impair learning
- Toxic to the body's metabolism
- Cause obesity
- Cause diabetes

Why So Popular?

- Sweeter than sugar and used in small amounts
- Provide negligible calories
- Enable consumers on restricted diet to enjoy sweet tasting foods and beverages
- Possible adjunct in weight management
- Most do not affect glycemic control and can be used safely by people with diabetes
- Generally non-cariogenic, some may be cariostatic

Aspartame Human Studies: Infants (*metabolism*)

Filer et al., 1983

Designed to understand Apm metabolism in infants

- Acute doses of Apm (34, 50 and 100 mg/kg bw) in 1-year old infants
  - Plasma Asp only rose at 100 mg/kg dose
  - Plasma Phe increased dose dependently in same manner as observed in adults.
  - Highest concentration of Phe observed in highest dose was well below high end of range of Phe observed in children with benign hyperphenylalaninemia
  - Conclusion: Infants absorb and metabolize Apm in same manner as adults

Human Studies: Children

Kruesi et al. (1987)

Evaluated effect of sugar and aspartame on aggression and activity in preschool boys identified as sensitive to sugar

- Double blind, crossover challenge with aspartame (30 mg/kg bw), sucrose, (1.75 g/kg bw), saccharin (amt. not specified and glucose (1.75 mg/kg bw)
- Administered in lemon drink once in clinic, then once 4 days later at home
- Washout periods of 5-7 days between challenges
- No significant differences in aggression scores; lower activity scores during Apm challenges
- Similar findings by Roshen and Hagen (1989), Sarvais et al. (1990), and Wolraich et al. (1994)

Human Studies: Children

Shaywitz et al. (1994)

Effect of aspartame on behavior and cognitive function of children with ADD

- Randomized, double blind, placebo-controlled crossover design
- *n* = 15, ages 5-13
- 34 mg/kg bw/day, capsules administered daily for two-week period
- No effect on cognitive, attentive or behavioral testing or on urinary levels of neurotransmitters

Safety of Low-calorie Sweeteners: Science

- Numerous peer-reviewed studies support the safety of low-calorie sweeteners
- History of safe use of low-calorie sweeteners in all population group (children, pregnant mothers, diabetics, individuals on weight maintenance, etc.)
- Reviewed by major regulatory agencies in the U.S., Canada, Europe, Australia/New Zealand, Japan, and the Joint Food and Agriculture Organization/World Health Organization Expert Committee on Food Additives
- Low-calorie sweeteners may be useful in the approach to common major public health threats

Low Calorie Sweeteners

Weight Management

Human Trials on Weight Management: Neutral to Positive Impact on BMI and/or Related Indicators

- 2006 meta-analysis of human clinical trials concludes: Apm contributes to weight loss
  British Nutrition Foundation *Nutrition Bulletin 2006. 31:115-128, 2006*
- America on the Move: benefits of exercise + replacing sucrose with sucralose
  Rodearmel, et al. *Pediatrics*, 2007
- Other studies:
  - Blackburn et al. (*Am J Clin Nutr*, 1997)
  - Palmer et al. (*Arch Int Med*, 2008)
  - Astrup et al. (*Am J Clin Nutr,* 2002)
  - Ludwig et al. (*The Lancet,* 2001)
  - Fantino et al. (*Appetite,* 1998)
  - Tordoff and Alleva (*Am J Clin Nutr*, 1990)

Low Calorie Sweeteners

Dental Caries

Dietary Sweeteners and Etiology of Dental Caries

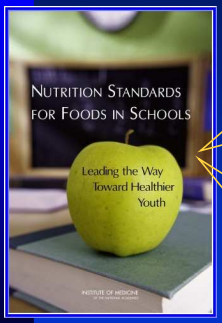
- Dental caries (tooth decay) is a complex disease process impacted by oral bacteria, dietary carbohydrate and host enamel
- Cariogenicity is also likely influenced by food/beverage vehicle and nature of exposure (frequency and length of eating events) to dietary carbohydrates
- Fermentable carbohydrates serve as substrate for the synthesis of polysaccharide in dental plaque
- Fermentation of dietary carbohydrates by oral bacteria which acts to dissolve tooth enamel
- Low calorie sweeteners are generally considered non-cariogenic because they have lower rates of acid production than fermentable carbohydrates
- FDA has approved dental health claims for some of the low-calorie sweeteners

Low Calorie Sweeteners: Policy

Focus on Childhood Obesity

2004	2004	2005	2006	2007
Kids are getting fat; prevention key	Focus on physical environment	Marketing is making kids fat	Government is not doing enough	Get "junk food" out of schools

IOM Urges Restrictive School Food & Beverage Standards



Nonnutritive Sweeteners

Standard 5: Beverages containing nonnutritive sweeteners are only allowed in high schools after the end of the school day.

Four related topics were evaluated:

- **Safety;**
- **Displacement effect of intake of foods and beverages;**
- **Efficacy of intake to contribute to maintaining a healthy weight in children; and**
- **The role of choice and necessity in the use.**

Stated Rationale on Low-Cal Sweeteners

- **Safety –** "Nonnutritive sweeteners have been evaluated and meet the safety standards set by FDA. However, there is no long-term evidence on the safety of nonnutritive sweeteners when consumption begins in early childhood and in relation to a broader range of health and developmental outcomes. The committee considered this in light of the limitations in testing and the lack of evidence concerning the benefits or necessity for use of nonnutritive sweeteners in foods."
  - *Committee seemed to ignore fact that FDA ingredient reviews take into account lifetime use and special population groups such as pregnant females and young children.*

Stated Rationale on Low Cal Sweeteners

- **Efficacy –** "Based on the energy balance principle, nonnutritive sweeteners in foods might provide a tool for weight management; however, studies to test this concept have not been conducted in children . . ."
  - *Beverage substitution unlikely basis for clinical trial in children*
- **Necessity –** "Although nonnutritive sweeteners may increase palatability, thereby increasing the consumption of healthful foods, the potential increase in consumption may not be sufficient reason to include nonnutritive sweeteners in foods."
- **Displacement –** "Displacement was not an important issue for nonnutritive sweeteners in foods that otherwise meet the recommended standards."

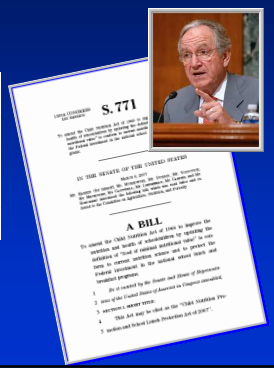
Nutrition Standards Can Have Unintended Consequences

The New York Times

Metro Briefing | New York: Manhattan: Milk Consumption Drops In Schools

By DAVID M. HERSZENHORN; COMPILED BY JOHN SULLIVAN
Published: December 13, 2006

Milk consumption by city schoolchildren has dropped by about 10 percent after officials removed whole milk from cafeteria menus in February as part of an effort to reduce childhood obesity, the City Education Department said yesterday. The city, which serves about a half-million half pints of milk a day, continues to serve 1 percent milk and skim milk. The city released the information in advance of a City Council hearing on the subject today. DAVID M. HERSZENHORN



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Alliance for a Healthier Generation

Alliance School Beverage Guidelines

Download the Guidelines

CATEGORY	Qualify for the Alliance for a Healthier Generation's School Beverage Guidelines		
	ELEMENTARY	MIDDLE	HIGH*
BOTTLED WATER	any size	any size	any size
PLAIN FAT-FREE OR LOW FAT MILK 150 calories/8oz	8oz (150 cal)	10oz (188 cal)	12oz (225 cal)
FLAVORED FAT-FREE OR LOW FAT MILK 150 calories/8oz	8oz (150 cal)	10oz (188 cal)	12oz (225 cal)
100% JUICE WITH NO ADDED SWEETENERS 120 calories/8oz + 10% DV for at least 3 vitamins and nutrients**	8oz (120 cal)	10oz (150 cal)	12oz (180 cal)
NO OR LOW CALORIE BEVERAGES 10 calories/8oz	No	No	any size
OTHER DRINKS No more than 66 calories/8oz	No	No	12oz (99 cal)

*At least 50% of beverages must be water and no- or low- calorie beverages
** Must contain at least 10% Daily Value of 3 vitamins and nutrients as such as Vitamin A, C, D and calcium

Low Calorie Sweeteners

- **Opinions/Myths**
  - Dangerous by-products
  - Cause hyperactivity
  - Cause attention deficit
  - Cause seizures
  - Not natural
  - `Cause cancer
  - Not tested in children
- **Science**
  - FDA approved low calorie sweeteners are safe and can be consumed by children
  - Low calorie sweeteners have been useful in the dietary management of diabetes in children
  - Low calorie sweeteners may be useful in the dietary approach to weight management in obese children
  - Low calorie sweeteners may be useful to improve dental health

Childrens' Dietary Recommendations: Why Do Some Parents Disregard the Science?

- Parents' intuition
  - They see a clear connection between the substance and the negative behavior
- A belief that it's a parent's responsibility to take care of their children's health, not the government's
- New studies raising doubts on substances previously found to be safe sound credible
- Complicated Issues with poorly developed evidence base for some aspects
- Groups leading the charge against the science are no longer fringe organizations
  - They maintain websites, distribute press releases and publish their own reports

Diet Myths and Misperceptions: How Do We Approach This?

- **Reproducible and consistent high level evidence base**
- **Well-educated health care professional**
- **Clear understanding of risks and how they relate to other risks to child health and development**
- **Effective communication to targeted audiences**
  - **Parents**
  - **Policy makers**
  - **Children**
  - **Others?**

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Question & Answer

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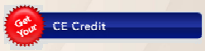

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