A Compelling Case for Obesity Prevention
Building an Arsenal for Action

GreenTown: Pioneering Healthy and Sustainable Communities

Helen J. Binns, MD, MPH
Professor of Pediatrics
Children’s Memorial Hospital and Northwestern University

Sponsor: Pediatric Environmental Health Specialty Unit, Region 5
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- I have no relevant financial relationships with the manufacturer(s) of any commercial products and/or provider of commercial services.
- I do not intend to discuss commercial products or services.
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Main Points

- **Exposures at very young ages** can increase risk for obesity.
- **Physiologic responses** promote persistence of obesity.
- **Parents and peer** healthy habits promote child adoption of healthy habits.
Fetal Environment Changes Biologic Risks for Obesity

- In-utero factors:
  - Glucose exposure
    - Fetal response to glucose exposure *in utero*
      - Influences fetal development of insulin sensitivity
      - ↑ risk of type 2 diabetes
  - Malnutrition
  - Stress
  - Environmental toxins
    - PCBs, hexachlorobenzene
    - Possibly: Bisphenol A, phthalates, organotins (in PVC)

Gillman MW, et al. *Pediatrics* 2003;111:e221-6
Environmental Exposures May Change Biologic Risk: How It Works

- Methylation, acetylation, phosphorylation
- Changes how tightly DNA is coiled
- Alterations of gene expression

Child Overweight by Maternal BMI During Early Pregnancy

Whitaker RC. *Pediatrics* 2004; 114;e29-e36.
Rapid Weight Gain → Obesity at 3 Years

- Project Viva
  - 559 children, 72% white, 74% college-educated mothers
- Weight at 6 months predicts obesity at 3 years

Early Obesity and Parental Obesity

Beyond Genes: Response to “It runs in the family.”

- 12 pair of adult monozygotic twins
  - Overeating 1000 Kcal/day for ~ 3 months
  - Twins were more similar to each other in weight gain than to others – but not always!
  - Twin status explained 55% of gain pattern

COUNSELING TIPS: Genetics

- A healthy start is the right start!
- Healthy habits can overcome genetic risks.
Main Points

Exposures at very young ages can increase risk for obesity. **Physiologic responses** promote persistence of obesity. Parents and peer healthy habits promote child adoption of healthy habits.
Child Factors Associated with Higher Weight

- Rapid rate of eating
  - High heritability of eating rate
  - Inherited trait, not just learned
- High food-cue responsiveness
- More focused on food
- More impulsive when making food choices
- More motivated for immediate rewards, such as good taste
- Low satiety responsiveness
- Presence of these traits does not guarantee expression
  - Environmental influences, such as parenting practices, turn these behaviors on or off

Regulation of Eating

Sensory factors:
- Taste
- Smell
- Texture
- Sight

Effects of:
- Variety
- Sensory-specific satiety
- Palatability
- Food concentration
- Ready availability

Brain mechanisms:
Modulate sensory factors by satiety signals to produce reward value and appetite

Cognitive factors:
- Conscious rational control
- Beliefs about the food
- Advertising

Satiety/hunger signals:
- Adipose tissue signals
- Gut hormones
- Gastric distension

Weight Status

Food Content

from Rolls ET. Obes Rev 2007;8(suppl 1):67-72
Satiety/Hunger Signals: Adipose Tissue Hormones

- **Leptin**
  - Signals to the brain the fat storage reserves in the body
  - Mediates long-term appetite control
    - Tells body to decrease nutrient storage “stop eating” & use stored nutrients “burn fat”
  - **Obese people have HIGH leptin, but are insensitive to its effects**
    - Levels in obese about 3 x higher
    - Keeps energy balance restored at ↑ weight and ↑ leptin
  - **Underweight people have LOW leptin**
    - Increases appetite and decreases energy expenditure
Satiety/Hunger Signals: Gut Hormones

- **Ghrelin**
  - Made in stomach
  - *Highest before meals; falls rapidly on refeeding*
  - *Stimulates hunger*
    - Prompts eating when the stomach is empty

- **Peptide YY (PYY)**
  - Made in small and large bowel
  - *Highest 30-60 minutes after meals*
  - *Enhances feeling of satiety*
Gut Peptide Response to Meals: Prepubertal

- 7-11 yrs
- High CHO, Protein, or Fat meals
- Measures obtained 6 times over 4 hrs
  - Ghrelin & PYY
  - Hunger/satiety rated on 100 mm scale (higher = more)
- AUC (area under curve) analysis over 3 hrs
  - assess changes from baseline
- Obese children less full than normal weight children after CHO and fat meals

Gut Peptide Responses to Meals: Adolescents

- Girls 12-18 y
- Changes in ghrelin and PYY after breakfast
- Obese: Rise in Ghrelin after CHO (↑ hunger)
- Obese: No rise in PYY after Fat (not full)
- Similar responses to Protein
- Lunch intake

COUNSELING TIPS: Hormones

- Hormonal responses to types of foods differ by food type and obesity status
  - Similar response to high protein meals
- Serve well-balanced meals and include protein
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Parental Modeling

Parent Behaviors

Health Habits
- Dietary Choices
- Exercise
- Verbal prompts to child

Parenting Skills
- Parental leadership
- Parent-child communication
- Problem-solving skills

Home Environment

Support for Eating Choices
Support for Activity & Inactivity

Modeling

Child Health Behaviors

Child Weight Status

Adapted from Golan & Weizman JNE 2001
Parental Modeling and Pressure to Eat

- 191 families; Girls age 5 yrs

- Measures:
  - F&V servings/day
    - Girls: 3/day
    - Parents 2/day
  - Parental pressure to eat scale

- Parents with high F&V intake
  - had girls with higher levels of F&V intake (about 1 more/day)

- Parents with lower F&V intake
  - had higher levels of pressure to eat

- High pressure decreased F&V intake
  - about 1 less/day, after controlling for parental intake

Positive Messages: Increasing Healthy Eating vs. Reducing High Energy-Dense Foods

- Family-based obesity intervention
  - 13 groups sessions over 5 months
  - 2 groups
    - Healthy Eating = more fruit, vegetables, and low-fat dairy
    - Reducing High Energy-Dense Foods = less high-fat, high-sugar foods
- BMI reduction sustained only in Healthy Eating group
  - BMI of parents in Healthy Eating group improved more, too!

Changing Food Preferences

- Intervention study
  - Children 2-6 yrs
  - “Tasting” method:
    - Taste vegetable for 14 consecutive days
    - Parent taste & provide positive verbal cues
    - No forcing
  - Significant increase in liking and consumption after using the method (compared to controls)

- Repeated “tasting” can transform dislike into like

Children’s Activity and Their PERCEPTION of Parental Physical Activity

- 2379 girls
- Followed from ages 9-18 yrs
- Evaluated how well child perceptions predicted child activity 2 years later
- Girls reporting that their parents exercised $\geq 3x \text{ /week}$ were:
  - $\sim 50\%$ more active than girls perceiving sedentary parents
- Relationship to parent measured activity not nearly as strong
- Social support by parents for activity is very important for adolescent activity

Parents and Children have Similar Inactivity Levels

- 271 children
- 7-12 years
- 3-day activity diary

Correlations between Parent-Child Activity

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<th>Activity</th>
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<td>0.28**</td>
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<td>Mother - Son</td>
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Influence of Peers

- Peers can promote healthier food choices
  - The best predictor of selection of healthy snack foods is other peers consuming healthy snack foods
  - True for both overweight and lean children
- When overweight children are alone
  - Eat more (than if with their peers)
  - Eat more (than lean children who are alone)
- Peer influences become stronger as children age

Peers Influence Snacking

- 22 girls, ages 8-12 yrs
- Subjects
  - assigned a picture sorting task while watching a video & offered a snack
  - Small serving video:
    - girl doing the sorting task
    - eating 10 mini oreos (about 2.5 cookies)
  - Large serving video:
    - girl doing the sorting task
    - eating 77 mini oreos (about 20 cookies)
- Children exposed to large serving on video ate more
  - Overweight children more strongly influenced than non-overweight

COUNSELING TIPS: Family

- Praise, not pressure. Be positive!
- Patience, persistence and modeling will pay off.
- Repeated exposures to a new food are needed to see increased preference.
- Incorporate activity into your family events
- Young children need play partners – that is the parent!
- Support your child’s activities.
- Plan to be active yourself.
Summary: Critical Steps in Child Healthy Weight

- Start Early!
  - Promote prenatal and infant healthy nutrition
- Be positive about healthy habits
- Model healthy habits
- Provide social support for healthy choices
- It will take families, schools, & society working together!