Beyond Move More, Eat Less: Considerations in Pediatric Obesity Prevention and Treatment

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I have no relevant financial relationships or affiliations with commercial interests to disclose.
Objectives

After attending this presentation, participants will be able to:

1. Recognize the complex biological underpinnings of obesity
2. Discuss obesity within an ecological framework
3. Describe the Division of Responsibility for Feeding
4. Explain the relationship of Adverse Childhood Experiences to chronic disease
5. Identify practical therapeutic interventions which are consistent with the Tenets of Osteopathic Medicine
The body is a unit, the person is a unit of body, mind, and spirit

The body is capable of self-regulation, self-healing, and health maintenance

Structure and function are reciprocally interrelated

Rational treatment is based upon an understanding of the basic principles of body unity, self-regulation and the interrelationship of structure and function.
Objective #1

Recognize the complex biological underpinnings of obesity
Energy Homeostasis

Intake:
- Hunger
  +
- Satiety

Output:
- Metabolic rate
  +
- Activity

Hunger + Satiety = Intake
Metabolic rate + Activity = Output
Pancreas  Adipose

**Insulin**  **Amylin**  **Glucagon**  **PP**

**Adipose tissue**  **Adiponectin**  **Leptin**  **TNFα, IL-1**

**Muscle**  **IL-6, ?**

**Brain**
- Cortex
- Hypothalamus
- Medulla

**Portal vein hormones & fuels**

**Food**
- Oral cavity
- Stomach
- Duodenum
- Jejunum
- Ileum
- Colon
- Rectum

**Start/stop eating**

**Autonomic & endocrine outflow**

**Vagal/taste afferents**

**GUT**

**Liver**

**Hormone receptors**

**Glucose**

**Fat**

**Protein**

**Nutrient sensors**

2008 by American Psychological Society Zheng H and Berthoud H Physiology 2008; 23: 75-83
Peripheral signals to the CNS

Adiponectin  Leptin  PYY  Ghrelin  OXM  Insulin  CCK  GLP-1  PP  Gastric/SI distension  SI/hepatic metabolites

Hypothalamus  Brain stem  Vagus Nerve

Adapted from Stanley et al., Physiol Rev 2005
Hypothalamic Hormone Systems and Energy Homeostasis

**HPA axis**
- cort $\rightarrow$ $\uparrow$ lipolysis
- $\downarrow$ insulin sensitivity
- $\uparrow$ gluconeogenesis

**GH $\rightarrow$**
- $\uparrow$ lipolysis
- $\uparrow$ gluconeogenesis

**$T_3/T_4$ $\rightarrow$**
- $\uparrow$ metabolic rate
- $\uparrow$ thermogenesis
- $\uparrow$ lipolysis
- $\uparrow$ gluconeogenesis

**HPG axis**
- E2 $\rightarrow$ $\uparrow$ metabolic rate
- $\uparrow$ locomotor activity
- $\downarrow$ food intake
Autonomic Nervous System and Energy Homeostasis

Sympathetic
- ↑ energy usage
- ↑ availability

Parasympathetic
- ↓ energy usage
- ↑ energy storage
Adaptive Responses to Weight Loss

- ↓ leptin
- ↓ insulin
- ↓ CCK
- ↓ PYY
- ↑ ghrelin
- ↑ hunger
- ↓ satiety

→ food intake

- → SNS activity
- ↑ PNS activity
- ↓ metabolic rate

↓ energy expenditure (resting & total)

maintain body weight
Adaptive Responses to Weight Loss

Chow & Hall: Physiology and Behavior, 2014
Adaptive Responses to Weight Loss

1981 Irish Republican Army hunger strikers

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<thead>
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<th>Age</th>
<th>Name</th>
<th>Days</th>
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<tr>
<td></td>
<td>DEVINE</td>
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So, with dieting and weight loss...

Hunger goes up
Satiety goes down
Energy expenditures decrease

This effect last for years!
Osteopathic Approach
Objective #2

Discuss obesity within an ecological framework
The social ecological model recognizes multiple levels of influence and the idea that behaviors both shape and are shaped by the social environment. - NIH Bronfenbrenner, U. (1977).
The social determinants of health are the circumstances in which people are born, grow up, live, work and age, and the systems put in place to deal with illness. These circumstances are in turn shaped by a wider set of forces: economics, social policies, and politics. -WHO
Osteopathic Approach
Objective #3

Describe the *Division of Responsibility for Feeding*
Families Correlates of Child Obesity

**Family Functioning Domain**
1. Family meals
2. Family closeness/connectedness
3. Family weight teasing

**Parental Domain**
1. Parental modeling
2. Parenting styles & practices
3. Parental perceptions

**Sibling Domain**
1. Sibling weight teasing
2. Sibling relationships (intimacy & conflict)

**Obesity & Weight-Related Outcomes**
1. Weight status
2. Dietary intake
3. Physical activity
4. Weight control behaviors

Parental Styles

Expectations and Control

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<tr>
<td>High</td>
<td>Authoritative</td>
</tr>
<tr>
<td></td>
<td>Respects child's opinions but maintains boundaries. “Firm but flexible.”</td>
</tr>
<tr>
<td>Low</td>
<td>Authoritarian</td>
</tr>
<tr>
<td></td>
<td>“Strict disciplinarian”</td>
</tr>
<tr>
<td>Low</td>
<td>Permissive</td>
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<tr>
<td></td>
<td>Indulgent without discipline</td>
</tr>
<tr>
<td>Low</td>
<td>Neglectful</td>
</tr>
<tr>
<td></td>
<td>Emotionally uninvolved and does not set rules</td>
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Parental Feeding Practices

• Parental modeling of health behaviors
  – Associated with lower BMI & healthy dietary intake
  – Contributes to children’s increased liking of novel foods.

• Parental feeding practices related to weight gain:
  – Restriction/control
    • Regulation of when, what and how much children eat
  – Pressure/prompting to eat
    • Pushing to eat
  – Instrumental/emotional feeding
    • Food for reward or emotion regulation
Sibling Domain

- Sibling weight teasing
  - Positively associated with female weight status, body dissatisfaction, disordered eating behaviors, low self-esteem, and depression

- Sibling relationships
  - Intimacy related to healthy attitudes and exercise behaviors
  - Conflict associated with an increased risk of overweight
    - Strongest in sibling pairs with older brothers

Senguttuvan, et al 2014
Family Functioning Domain

• Family emotional closeness/connection
  – Associated with lower BMI, breakfast consumption, frequent family meals, & lower eating related parent-child conflict

• Family weight teasing
  – Associated with higher BMI, disordered eating, low body satisfaction, low self-esteem, high depressive symptoms, & suicide ideation
Division of Responsibility for Feeding

• Parents take the lead on the WHAT, WHEN, AND WHERE of feeding

• Child determines how much and if they are going to eat what is provided

• Encourage and model family, structured, sit-down meals and snacks
Osteopathic Approach
Objective #4

Explain the relationship of Adverse Childhood Experiences to chronic disease
The Adverse Childhood Experiences (ACE) Study examined the impact of abuse, neglect, exposure to intimate partner violence and other household dysfunction during childhood on adult health risk behaviors and chronic disease development.

Over half of respondents had at least one adverse childhood experiences with over 6% having at least 4.

The study found that “the impact of adverse childhood experiences on adult health status is strong and cumulative”

Felitti, et al 1998
Adverse Childhood Experiences

Mechanisms by Which Adverse Childhood Experiences Influence Health and Well-being Throughout the Lifespan

Felitti, et al 1998
Compared with an ACE score of 0, individuals with an ACE score of 4 are nearly twice as likely to be severely obese (BMI $\geq 35$)

- Overeating is a means of coping
- Food has psychoactive benefits
- Obesity is protective socially, sexually, and physically

<table>
<thead>
<tr>
<th>Relationships and connections</th>
<th>Environmental conditions and resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you have someone who loved you unconditionally (you did not doubt that they cared about you)?</td>
<td>Did you have an engaging hobby -- an artistic or intellectual pastime either alone or in a group?</td>
</tr>
<tr>
<td>Did you have at least one best friend (someone you could trust, had fun with)?</td>
<td>Did you have an adult (not a parent) you trusted and could count on when you needed help or advice?</td>
</tr>
<tr>
<td>Did you do anything regularly to help others or do special projects in the community to help others?</td>
<td>Did you live in a home that was typically clean and safe with enough food to eat?</td>
</tr>
<tr>
<td>Were you regularly involved in organized sports groups or other physical activity?</td>
<td>Did your school provide the resources and experiences you needed to learn?</td>
</tr>
<tr>
<td>Were you active in at least one social or civic (non-sport) group with peers?</td>
<td>Were there routines and rules in your home that were clear and fairly administered?</td>
</tr>
</tbody>
</table>

Osteopathic Approach
Consider all causes of weight gain, weight regain, or failed weight loss attempts

Consider obesity from an ecology prospective

Take an osteopathic approach to obesity prevention and treatment
Resources

- Project Implicit [https://implicit.harvard.edu/implicit/](https://implicit.harvard.edu/implicit/)
- Ellyn Satter Institute [https://www.ellynsatterinstitute.org/](https://www.ellynsatterinstitute.org/)
References

- Zheng, H, Berthoud, H. Neural Systems Controlling the Drive to Eat: Mind Versus Metabolism. Physiology Apr 2008, 23(2) 75-83; DOI:10.1152/physiol.00047.2007
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