The Influence of Snacking on Energy Intake in Young Children

Chelsi C. Cardoso, MS, RD, LDN
Research Associate, III
Healthy Eating and Activity Laboratory
Department of Nutrition

THE UNIVERSITY OF TENNESSEE
KNOXVILLE
Presentation Objectives

• Describe the concept of energy self-regulation

• Review research regarding energy self-regulation capabilities in young children

• Discuss implications of how energy self-regulation capabilities in young children influence the ability to achieve a healthy weight

• Review the role of snacks within young children’s diets

• Describe what is needed to develop an evidence-base for developing participatory guidance regarding the role of snacks in young children’s diets
Energy Self-Regulation
Energy Self-Regulation

• Energy self-regulation is the idea that a person can modify his/her energy intake based upon the energy content of the overall diet (1)

“Eating like a bird”   “Eating like a horse”
Research on Energy Self-Regulation in Young Children

• Initial studies (1,2) demonstrated young children can modify food intake based upon overall energy content of the diet, suggesting “self-regulation”

• This self-regulation was demonstrated:
  • Within one eating occasion
    • i.e. children adjusted intake after consuming a low calorie or high calorie preload, such that they consumed more or less calories at a meal following the preload
  • Over several eating occasions
    • i.e. children’s individual meal consumption is highly variable throughout the course of the day, but overall energy intake over the course of the day was relatively constant
Research on Energy Self-Regulation in Young Children

• Newer studies (3-9) demonstrated that environmental cues can impact energy intake in young children, suggesting a lack of “self-regulation”

  • Cues that impact energy intake include:

    • Portion size (3-5, 9)
      • i.e. increasing portion size resulted in an increase in energy consumed in young children

    • Energy density (6-9)
      • i.e. increasing energy density of an entrée or beverage by ~30% resulted in a 25% increase in energy consumed in young children
Research on Energy Self-Regulation in Young Children

• Inconsistencies and changes in results could be due to:
  • Study design differences
  • Changes in the environment over time
  • Children’s changes in responsiveness to the environment over time
Energy Self-Regulation in Young Children and Weight Status

• Children are often provided
  • Large portion sizes
  • Snacks
  • High-energy-dense foods

• If children are able to self-regulate intake this would suggest that children would remain at a healthy weight, even if energy is offered to children outside of what daily needs are.

• Disruption of self-regulation of intake could lead to excess energy consumption, especially if energy is offered to children outside of what daily needs are.
Snacking in Young Children

Percentage who snack over a 2-day period

- Ages 2-6
- Ages 7-12
- Ages 13-18
- Ages 2-18

<table>
<thead>
<tr>
<th>Year</th>
<th>Ages 2-6</th>
<th>Ages 7-12</th>
<th>Ages 13-18</th>
<th>Ages 2-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>76</td>
<td>74</td>
<td>73</td>
<td>74</td>
</tr>
<tr>
<td>1989</td>
<td>84</td>
<td>76</td>
<td>78</td>
<td>79</td>
</tr>
<tr>
<td>1994</td>
<td>95</td>
<td>93</td>
<td>90</td>
<td>93</td>
</tr>
<tr>
<td>2006</td>
<td>99</td>
<td>99</td>
<td>97</td>
<td>98</td>
</tr>
</tbody>
</table>
Snacking in Young Children

- Snacking appears to be a major contribution to overall intake in young children
  - National survey data shows increases in the number and size (i.e. calories) of snacks consumed by US children from 1977-1978 to 2003-2006 (10)
  - In 2006, 2 to 6 year-old children consumed 500 kcal from snacks daily across 2-3 snacking occasions (10)
Snacking in Young Children

**View One**
• Snacking helps young children consume appropriate amounts of nutrients and energy needed for healthy growth

**View Two**
• Snacking promotes excessive intake of nutrient-poor foods and energy, increasing obesity risk
Snacking in Young Children

• The National Health and Nutrition Examination Study (NHANES) indicate that US preschoolers consume close to one-third of their daily energy intakes from snacks (10-12)
  
  • These data could suggest snacks may help some young children meet energy needs
Snacking in Young Children

• Snacks have been observed to provide >25% of calcium, potassium, and Vitamin D intakes among US children aged 2 to 5 years in 2009-2010 (11)

• These data could suggest that snacks enhance young children’s diet quality by contributing important nutrients
Snacking in Young Children

• Along with increases in snacking frequency and size, increases in total daily energy intake among US preschoolers from 1989-1991 to 2009-2010 have been observed (13)

• These data could suggest snacks could be problematic and contribute to excessive energy intake
Snacking in Young Children

• The top snack foods consumed by US children aged 2 to 18 years were observed as desserts, sweetened beverages, and salty snacks (10,14)

• These data could suggest that snacks are not as nutrient-dense as meals (14) and contain high levels of solid fats and added sugars, (10,14) which are thought to promote excessive energy intake (11,14)
Snacking in Young Children

• Descriptive and observational studies have produced unclear findings as to whether snacking has helpful or harmful effects on energy intake among young children.
Summary of Snacking in Young Children

• Snacks are a fixture in the diets of most young children

• Evidence regarding snacking is limited and lacking due to reliance on observational designs and caretaker-reported dietary data that do not permit causal inference

• It is currently unknown whether snacking has helpful, harmful, or negligible effects on young children’s energy intake

• Consequently, current recommendations and policies on child snacking are without appreciable scientific basis
Our Pilot Data
Our Pilot Data

- We collected preliminary data in collaboration with the Early Learning Center to obtain initial estimates of snacking frequency effects on daily energy intake among 10 preschool-aged children
  - 4.0 ± 0.4 years old
  - -0.30 ± 0.81 body mass index z-score [zBMI]
  - 70% male
  - 70% white
  - 90% non-Hispanic
Our Pilot Data

• A within-subjects design was used where each child was seen in 3 conditions using a single menu that varied in:
  • the number of snacks and
  • total energy provided during an 11-hour period
# Our Pilot Data

<table>
<thead>
<tr>
<th>Eating Occasion</th>
<th>Calories Provided</th>
<th>Eating Occasion</th>
<th>Calories Provided</th>
<th>Eating Occasion</th>
<th>Calories Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>500</td>
<td>Breakfast</td>
<td>400</td>
<td>Breakfast</td>
<td>500</td>
</tr>
<tr>
<td>Morning Snack</td>
<td></td>
<td>260</td>
<td>Morning Snack</td>
<td>260</td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td>750</td>
<td>Lunch</td>
<td>540</td>
<td>Lunch</td>
<td>750</td>
</tr>
<tr>
<td>Afternoon Snack</td>
<td></td>
<td>260</td>
<td>Afternoon Snack</td>
<td>260</td>
<td></td>
</tr>
<tr>
<td>Dinner</td>
<td>750</td>
<td>Dinner</td>
<td>540</td>
<td>Dinner</td>
<td>750</td>
</tr>
<tr>
<td><strong>Day Total:</strong></td>
<td><strong>2000</strong></td>
<td></td>
<td><strong>2000</strong></td>
<td></td>
<td><strong>2520</strong></td>
</tr>
</tbody>
</table>
## Our Pilot Data

### Food at Breakfast
- Yoplait® Light Yogurt, Strawberry
- Kellog’s® Nutrigrain Cereal Bars, Blueberry
- Strawberries, Fresh (sliced in halves)
- Water

### Food at Morning Snack
- Nature’s Own® Cinnamon Raisin Bagel
- Water

### Food at Lunch
- I.M. Healthy SoyNut Butter, Creamy
- Smuckers® Concord Grape Jelly
- Arnold® Whole Wheat
- Baby Carrots, Fresh, Medium
- Mott’s® Natural No Sugar Added Applesauce
- Mayfield® Nurture 1% Milk

### Food at Afternoon Snack
- Nabisco® Triscuit Reduced Fat Crackers
- Kraft® Natural Cheese cubes, Mild Cheddar
- Water

### Food at Dinner
- Tyson® Grilled and Ready Fully Cooked Frozen Chicken Breast Fillets
- MorningStar Farms® Garden Veggie Patties
- OreIda® Steam n’ Mash® Cut Russet Potatoes
- Minute® White Rice
- Pictsweet® Steamables® Broccoli Florets
- Baby Carrots, Fresh, Medium
- Dole® Mandarin Oranges in Syrup
- Dole® Tropical Fruit in Syrup
- Mayfield® Nurture 1% Milk
Our Pilot Data

REFERENCE: 3M (2000 KCAL PROVIDED)

3M+2S:ME (2000 KCAL PROVIDED)

3M+2S:EE (2520 KCAL PROVIDED)

Kcal

Session

Meals Snacks

p = 0.001*

p = 0.051
Our Pilot Data

• These findings provide initial evidence that
  • Preschool-aged children do not appear to compensate for energy consumed from snacks at later meals; and
  • Reducing meal size may offset additional energy consumed from snacks
Our Pilot Data

• Dietary quality of the three conditions was assessed using the Healthy Eating Index-2010 (HEI-2010)
  • The HEI was developed to measure compliance of diets to the Dietary Guidelines, with the HEI-2010 reflecting compliance to the 2010 Dietary Guidelines
  • HEI-2010 controls for the size and amount of food consumed by having all components reported in functions of 1,000 kcal
Our Pilot Data

<table>
<thead>
<tr>
<th>Condition</th>
<th>HEI-2010 score</th>
</tr>
</thead>
<tbody>
<tr>
<td>REFERENCE: 3M</td>
<td>80.0 ± 10.0</td>
</tr>
<tr>
<td>3M+2S: ME</td>
<td>77.3 ± 7.9</td>
</tr>
<tr>
<td>3M+2S: EE</td>
<td>74.9 ± 3.9</td>
</tr>
</tbody>
</table>

- These results suggest that snacks do not appear to improve overall dietary quality, especially if they are providing extra energy beyond that provided by meals.
Future Research Considerations for the Development of an Evidence Base
Future Research

• Scientific understanding of snacking among young children needs to be broadened in a number of important ways
  • we need experimental evidence of the effects of snacking on daily energy intake
Future Research

• Scientific understanding of snacking among young children needs to be broadened in a number of important ways
  • we need to consider the frequency and size of snacks as well as the size of accompanying meals
Future Research

• Scientific understanding of snacking among young children needs to be broadened in a number of important ways
  • we need to determine if the effects of snacking are moderated by weight status, food motivation, and satiety responsiveness
Future Research

• Scientific understanding of snacking among young children needs to be broadened in a number of important ways
  • we need to evaluate snacking within the context of existing policies and guidelines (i.e., CACFP)
References


QUESTIONS?
Save the Date!

Promoting Healthy Weight 2.0

Friday, September 30, 2016
12:30pm – 5:00pm EDST (onsite)
12:45pm – 5:00pm EDST (online)

This Project is supported by the Health Resources and Services Administration (HRSA) of the U.S Department of Health and Human Services (HHS) under grant number T79MC09805, Leadership Education in Maternal and Child Health Nutrition, $176,795, 50% funded by the University of Tennessee, Department of Nutrition. This information or content and conclusions are those of the author and should not be construed as the official position or policy of, nor should any endorsements be inferred by HRSA, HHS or the U.S. Government.