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The Evidence Base for the Satter Eating Competence Model

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Webinar Objectives

• Define and describe the Satter Eating Competence model

• Identify the evidence base for the Satter Eating Competence model

• Frame public health goals with eating competence
Eating Competence is an intra-individual approach to eating and food-related attitudes and behaviors that entrains positive bio-psychosocial outcomes.

Competent Eaters are . . .

✓ matter-of-fact and reliable about getting enough to eat of enjoyable and nourishing food

✓ positive, comfortable and flexible with eating

✓ trusting of being able to eat satisfying amounts of rewarding food to maintain a stable body weight
ecSatter Inventory

**Eating Attitudes and Behaviors**

- I am relaxed about eating.
- I am comfortable about eating enough.
- I enjoy food and eating.
- I am comfortable with my enjoyment of food and eating.
- I feel it is okay to eat food that I like.

**Internal Regulation of Intake**

- I trust myself to eat enough for me.
- I eat as much as I am hungry for.
- I eat until I feel satisfied.
**Food Acceptance**

I experiment with new food and learn to like it. If the situation demands, I can “make do” by eating food I don’t much care for. I eat a wide variety of foods.

**Eating Context**

I tune into food and pay attention to eating. I make time to eat. I have regular meals. I consider what is good for me when I eat. I plan for feeding myself.
Measuring Eating Competence
Satter Eating Competence Inventory (ecSI)

Always → 3
Often → 2
Sometimes → 1
Rarely → 0
Never → 0

16 items
Possible Scores: 0 to 48
≥ 32 = Eating Competent

n=507; α = 0.90; 4 SUBSCALES

Eating Attitudes 5 items α = 0.85
Internal Regulation 3 items α = 0.79
Food Acceptance 3 items α = 0.64
Contextual Skills 5 items α = 0.82

Test-Retest Reliability (n= 259)
Spearman Rho=.68;

**ecSI**

- I assume I will get enough to eat.
- I tune in to food and pay attention to myself when I eat.
- I think about nutrition when I choose what to eat.
- I generally plan for feeding myself. I don’t just grab food when I get hungry.

**ecSI-Low Income**

- I trust myself to eat enough for me.
- I tune in to food and pay attention to eating.
- I consider what is good for me when I eat.
- I plan for feeding myself.

Cognitive interviews with select parents (n=14)

4 unique ecSI items compared with 4 corresponding unique ecSI/LI items

20 items administered to parents not categorized as low-income (n=99)

ecSI – 16 items validated in general population

ecSI/LI – 16 items validated for low-income

ecSI & ecSI/LI congruent. Use of ecSI/LI for general audience approved

Renamed

ecSI 2.0

Lohse B. *Appetite* 2015;87:223-228.
Studies: Sample Characteristics

- **Gender**
  - Male only
  - Female only
  - Both

- **Participant Age**
  - College Student
  - Elderly
  - General

- **Targeted Income**
  - Low-income
  - All incomes

- **Health Status**
  - No chronic dx
  - Chronic dx

- **Children’s Age**
  - Preschool
  - Elementary Age
  - General

- **Location**
  - Pennsylvania
  - Colorado
  - New Mexico
  - California
  - Utah
  - Ohio
  - USA
  - Spain
<table>
<thead>
<tr>
<th>Parameters Examined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Activity</td>
</tr>
<tr>
<td>Cardiovascular Risk</td>
</tr>
<tr>
<td>Dietary Intake</td>
</tr>
<tr>
<td>Sleep Behavior</td>
</tr>
<tr>
<td>Parenting Behaviors</td>
</tr>
<tr>
<td>Eating Behaviors</td>
</tr>
<tr>
<td>BMI</td>
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<tr>
<td>Food Security</td>
</tr>
<tr>
<td>Demographics</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Intervention Outcomes</td>
</tr>
</tbody>
</table>
References

Lohse B. Appetite. 2015;223-228.
References

Age, by itself, does not appear to be associated with eating competence.
## Age

Telephone dietary assessment; all female (n=149) recruited from 63 EFNEP and SNAP-Ed classes in Pennsylvania; 56% white, 42% black, 61% some post HS education, 60% SNAP

<table>
<thead>
<tr>
<th>Age Range</th>
<th>EC score$^1$</th>
<th>% EC$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 – 30 y</td>
<td>29.6 ± 7.3 $^a$</td>
<td>49</td>
</tr>
<tr>
<td>31 – 50 y</td>
<td>28.3 ± 8.2 $^a$</td>
<td>32</td>
</tr>
<tr>
<td>&gt; 50 y</td>
<td>34.2 ± 6.4 $^b$</td>
<td>71</td>
</tr>
</tbody>
</table>

$^1$ F=4.8, P=0.01;  $^2$ Chi Square 10.6, P=0.005

Lohse et al., *Appetite*. 2012;58:645-650
**ecSI validation**

<table>
<thead>
<tr>
<th>Age ranged 18 – 71</th>
<th>Age (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low tertile (n=296)</td>
<td>33.7 ± 12.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Middle tertile (n=266)</td>
<td>35.6 ± 13.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>High tertile (n=257)</td>
<td>39.8 ± 13.6&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>P ≤ 0.001</td>
<td></td>
</tr>
<tr>
<td>EC (n=375)</td>
<td>34.1 ± 13.0</td>
</tr>
<tr>
<td>Not EC (n=444)</td>
<td>38.8 ± 13.5</td>
</tr>
<tr>
<td>P ≤ 0.001</td>
<td></td>
</tr>
</tbody>
</table>


**ecSI/LI validation**

<table>
<thead>
<tr>
<th>Age ranged 18 - 45</th>
<th>Age (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low tertile (n=175)</td>
<td>31.6 ± 6.7</td>
</tr>
<tr>
<td>Middle tertile (n=163)</td>
<td>32.1 ± 7.0</td>
</tr>
<tr>
<td>High tertile (n=169)</td>
<td>31.7 ± 7.3</td>
</tr>
<tr>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>EC (n=148)</td>
<td>31.8 ± 7.1</td>
</tr>
<tr>
<td>Not EC (n=444)</td>
<td>31.8 ± 7.0</td>
</tr>
<tr>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

## Age

<table>
<thead>
<tr>
<th>Study</th>
<th>age (n)</th>
<th>Age (y)</th>
<th>EC score</th>
<th>% EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1689</td>
<td>All 18 – 19</td>
<td>31.0 ± 7.0</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>343</td>
<td>All 18 – 20</td>
<td>28.2 ± 0.9</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>1708</td>
<td>23.8 ± 7.1</td>
<td>29.6 ± 8.4</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>259</td>
<td>26.9 ± 10.4</td>
<td>31.3 ± 6.4</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>27.7</td>
<td>28.8 ± 8.0</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>512</td>
<td>30.7 ± 7.5</td>
<td>28.9 ± 8.5</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>31.5 ± 9.3</td>
<td>25.4 ± 9.6</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>507</td>
<td>31.8 ± 7.0</td>
<td>26.3 ± 9.7</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>832</td>
<td>36.2 ± 13.4</td>
<td>31.1 ± 7.0</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>339</td>
<td>37.2 ± 7.7</td>
<td>33.6 ± 8.5</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>638</td>
<td>66.7 ±6.4/67.7±5.7</td>
<td>30.9 ± 6.3</td>
<td>46</td>
<td></td>
</tr>
</tbody>
</table>
Gender

Males are more eating competent than women.

Men have higher scores on the eating attitudes subscale; contextual scale scores contribute the most and eating attitudes scores the least to female eating competence scores.
Eating competent persons more frequently perceive being physically active.

$\text{VO}_2\text{max}$ is lower in persons who are not eating competent.
**Physical Activity**

**Women (n=512); 93% white; 58% some college; 60% SNAP**
**61% O/O; 39% EC; mean age 30.7 ± 7.5 y**

<table>
<thead>
<tr>
<th></th>
<th>Physically Active</th>
<th>Not Physically Active</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating Competent</td>
<td>44%</td>
<td>22%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>High Eating Competence tertile</td>
<td>40%</td>
<td>21%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Eating Competence score</td>
<td>30.1 ± 8.3</td>
<td>24.9 ± 8.1</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

* controlling for age, weight satisfaction, and BMI

Do you consider yourself a physically active person?

- no (n=116)
- yes (n=376)

ecSI/LI scores compared by amt. of physical activity and BMI category

- Physically active ≥ 30 min/d (n=351)
- Physically active < 30 min/d (n=141)

BMI categories:
- Undwt/Normal
- Overweight
- Obese

Error Bars: +/- 1 SE

amt phys act P=.002
BMI cat P=.002

Physical Activity

n=506 Penn women; 78% white; 68% O/O; 61% food insecure; 46% no post-hs education; mean age 31.8 ± 7.0 y

<table>
<thead>
<tr>
<th></th>
<th>Not EC</th>
<th>EC</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physically Active</td>
<td>44%</td>
<td>66%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Low EC tertile</th>
<th>Middle EC tertile</th>
<th>High EC tertile</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physically Active</td>
<td>39%</td>
<td>47%</td>
<td>66%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Physical Activity

\[ n=832; \text{from 33 states; 79\% female; 92\% white; 55\% college degree; mean age } 36.2 \pm 13.4 \text{ y} \]

Physically active 43\% less likely to be in lowest EC tertile
OR \(0.57 (CI \ 0.34 - 0.96)\)  \(P<0.05\)

Physically active 1.67 times more likely to be EC
OR \(1.67 (CI 1.12 - 2.51)\)  \(P < 0.05\)

# Physical Activity

N=1689; from colleges in 8 states; 62% female; 79% white; 69% 18 – 19 y

<table>
<thead>
<tr>
<th></th>
<th>Psychosocially Secure n=183</th>
<th>Behaviorally Competent n=178</th>
<th>High Risk n=179</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>ecSI</td>
<td>32.1 ± 5.8 x</td>
<td>37.7 ± 4.5 y</td>
<td>28.4 ± 5.0 z</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>IPAQ Vig MET min/wk</td>
<td>1032.8 ± 961.1 x</td>
<td>3088 ± 1936.8 y</td>
<td>1616.2 ± 1581.1 z</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Estimated VO₂ max</td>
<td>49.7 ± 3.8 x</td>
<td>48.6 ± 4.1 x</td>
<td>46.1 ± 5.4 y</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

BMI

Strange, but true. . . BMI is not very related to eating competence, even when controlling for gender; coefficients are in the range of .16 to .23 and are negative in direction.

When related though, eating competent persons have a lower BMI, for BMIs from self-report or measured height and weight.

Clifford et al., in her study with college students, noted that weight satisfaction and not desiring to lose weight were more predictive of EC than BMI.

PREDIMED Study: Likelihood of EC decreased by 5% per unit increase in BMI (P=.013).
Early studies revealed fewer competent eaters in Pre-Action Stages of Change. Validation studies show competent eaters report enjoying cooking more often, spend more time cooking, and have stronger food resource management skills (e.g., using a shopping list, preparing a budget, reading labels).

Subsequent studies support these findings.

- A study of low-income adults (mean age 31.5 ± 9.3 y) recruited using Facebook showed that EC persons tended to make more healthy/lowfat foods compared to those not EC (62% vs. 31%, P=0.06).

- Clifford et al., showed that perceived diet quality was important in a regression model predicting EC score in college students (n=1,708); those who perceived having a higher diet quality had a higher EC score (P<0.001). [Clifford D, et al., *Fam Con Sci Res Jl.* 2010;39(2):184-193]
## Diet Quality

Parents of 4th graders; (n=309); 78% Hispanic; 89% female

<table>
<thead>
<tr>
<th></th>
<th>Fruit &amp; Veg Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating Competent (n=182)</td>
<td>12.7 ± 3.0</td>
</tr>
<tr>
<td>Not Eating Competent (n=127)</td>
<td>11.9 ± 3.2</td>
</tr>
<tr>
<td></td>
<td>P=.024</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>EC Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; median FV availability (n=152)</td>
<td>32.4 ± 8.2</td>
</tr>
<tr>
<td>≥ median FV availability (n=157)</td>
<td>34.8 ± 8.7</td>
</tr>
<tr>
<td></td>
<td>P=.014</td>
</tr>
</tbody>
</table>

Diet Quality

Females recruited from EFNEP/SNAP (n=149); 86% were 18 – 50 y; White-56%; Black 42%; 60% SNAP participants; Intake 1620 ± 595 kcal; 32.3% kcal from fat

Compared to non-EC, EC women had > Kcal-adjusted intake of:

- Dietary fiber
- Vitamin A
- Vitamin E
- Vitamin C
- Most B vitamins
- Mg ++
- Fe ++
- Zinc ++
- K +
- HEI score

Lohse et al., *Appetite*. 2012;58:645-650
Pattern 1
- Lower HEI score
- Refined grains
- Added fat
- Sweetened beverages
- Fried vegetables
- Added salts
- Whole fat dairy
- Less low-fat dairy
- Less unsweetened bev.
- No correlation with EC

Pattern 2
- Higher HEI score
- Dark green, yellow veg
- Other Vegetables
- Fruits
- Whole grains
- Reduced fat
- Fruit Juices
- Tomatoes
- Correlation with EC
  - $R = .21$ ($P < .01$)

Lohse et al., *Appetite*. 2012;58:645-650
Diet Quality

Dietary Comparisons (n=638)

After adjusting for energy and gender, eating competent had > intake of:

- Fruits (P=.013)
- Fish (P=.076)
- n-3 fatty acids (P=.094)

- > adherence to the Mediterranean diet (P=.034)
Cross-sectional data show having 8 or more hours of sleep a night is associated with greater eating competence.
Slide(s) not shown.

This data has not yet been published.
### Sleep - College Students

1252 college students; 80% white; 59% female; mean age 19 y mean BMI 23.6 ± 3.7.

<table>
<thead>
<tr>
<th>Item</th>
<th>&lt; 7 h (n=344)</th>
<th>7 – 8 h (n=449)</th>
<th>≥ 8 h (n=459)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total EC (0-48)</td>
<td>30.6 ± 0.4</td>
<td>30.5 ± 0.5</td>
<td>31.7 ± 0.3</td>
<td>.03</td>
</tr>
<tr>
<td>Eating Attitudes (0-15)</td>
<td>10.9 ± 0.2</td>
<td>10.6 ± 0.1</td>
<td>11.1 ± 0.1</td>
<td>.04</td>
</tr>
<tr>
<td>Internal Regulation (0-9)</td>
<td>6.6 ± 0.1</td>
<td>6.5 ± 0.1</td>
<td>6.9 ± 0.1</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Binge Eating (0 - 100)</td>
<td>43.6 ± 1.5</td>
<td>41.5 ± 1.3</td>
<td>38.5 ± 1.3</td>
<td>.03</td>
</tr>
</tbody>
</table>

Controlled for gender, race/ethnicity, negative affect, sleep disturbance

CVD Risk

Eating competence has been associated with biomarkers of reduced cardiovascular disease risk, but not consistently. Additional research is needed.

Suggest providing the Satter Eating Competence Inventory in clinically related studies and including the survey in NHANES.

Differences in SBP Response to Stress by EC group

Main effect P=.01

n=67, 21-70 y; Hypercholesterolemia; BMI < 35; No chronic Dz

Differences in DBP Response to Stress by EC group

Main effect $P = .05$

Differences in DBP Response to Stress by EC group

$n=67$, 21-70 y; Hypercholesterolemia; BMI $< 35$; No chronic Dz

Parenting

Parents who are eating competent demonstrate reliable mealtime structure, self-efficacy for serving fruits and vegetables, and have more fruits and vegetables available in the home.
Parent eating competence proportion mapped to response options for selected modeling items

Chi Square 9.13, P=0.028

Chi Square 5.24, P=0.07

Lohse B. *J Nutr.* 2012;142(10):1904-1909
Parent eating competence proportion mapped to response options for selected modeling items

Chi Square 13.5, P=0.001

Lohse B. *J Nutr.* 2012;142(10):1904-1909
Parent eating competence proportion mapped to response options for selected modeling items

Chi Square 8.8, P=0.012

Chi Square 8.36, P=0.04

How often do you eat vegetables at dinner with your child?

How often do you eat fruit at dinner with your child?

Lohse B. *J Nutr.* 2012;142(10):1904-1909
Slide(s) not shown.
This data has not yet been published.
Cluster Analyses - 78% Hispanic

<table>
<thead>
<tr>
<th></th>
<th>Achievers (n=167)</th>
<th>Strivers (n=107)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eats dinner w/child***</td>
<td>3.0 ± 0.0</td>
<td>1.8 ± 0.5</td>
</tr>
<tr>
<td>Eats breakfast w/child***</td>
<td>1.4 ± 0.7</td>
<td>1.0 ± 0.7</td>
</tr>
<tr>
<td>Modeling Scale***</td>
<td>17.3 ± 4.5</td>
<td>12.3 ± 3.5</td>
</tr>
<tr>
<td>Self-efficacy/OE Scale**</td>
<td>54.3 ± 8.5</td>
<td>51.5 ± 8.0</td>
</tr>
<tr>
<td>F&amp;V Available**</td>
<td>13.1 ± 2.9</td>
<td>11.1 ± 3.4</td>
</tr>
<tr>
<td>Eating Competence***</td>
<td>34.9 ± 7.8</td>
<td>30.3 ± 8.9</td>
</tr>
<tr>
<td></td>
<td>(n=153)</td>
<td>(n=98)</td>
</tr>
</tbody>
</table>

** P < 0.01; ***P < .001

Slide(s) not shown.
This data has not yet been published.
Future Directions

- Population level assessment of eating competence
  - Plans for online access to ecSI 2.0
  - NHANES or other population-based survey
- Consideration in developing the Dietary Guidelines for Americans
- Intervention design, development and testing
  - Application of dissemination and implementation science principles
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