Developmental aspects of young children’s food acceptance patterns

Susan L. Johnson
General overview

• Children’s development
  ▪ Taste, neophobia, learning & developmental readiness

• Key issues/opportunities
  • Exposure vs. Consumption
  • Early variety
  • Developmentally appropriate strategies & expectations
  ▪ Education opportunities

• Linkages to Criteria from report**
Innate Likes and Dislikes


We are born liking sweet

We are born disliking bitter and sour
Food preference 4 - 16 years

Cooke, Wardle, British J Nutr, 2005

Sweetness and energy density trump
Energy density & preference for F & V

Gibson, Wardle, Appetite, 2003
Children’s vegetable intakes

• Vegetables intakes from infancy to preschool
  – 30% toddlers & preschoolers do not eat any veg/d
  – Vegetable acceptance “falls off in variety” after 1 y

• Dark green vegetables listed in top 5

• In 1 – 3 y vegetable consumption, irrespective of race/ethnicity & which vegetables are examined, is below the DGA

Deming, Reidy, Breifel, Fox, Condon, 2012
Grimm, 2014
Feeding Infant and Toddler Studies FITS, 2006 & 2010
The Biology of Taste

• Evolution has shaped initial food acceptance patterns. That doesn’t mean children will only eat sweet or salt but it explains the attraction Steiner et al. 2001

• CHILDREN LEARN. Chemical senses interact with early life experiences Mennella, 2007 **

• Early experiences in utero, via breast feeding and in introduction of tables foods are associated with children’s vegetable preference/consumption Pepino & Mennella, 2005; Stein et al. 2012 **
Early feeding practices (BF) and preschoolers’ intake of vegetables**

• **Quebec Longitudinal Study of Child Development**  Burnier, 2011  
  – Maternal education positive predictor of child FV intake  
  – Exclusive BF for >3 m

• **4 European birth cohorts**  Lauzon-Guillan, 2013  
  – Avon, French, Portuguese, Greek  
  – Longer BF => greater veg acceptance

• **Infant Feeding Practices Study II at Y6FU**  Perrine, 2014  
  – Longer BF => greater fruit& veg intake @ 6 y
A step-by-step introduction to vegetables: The effects of early & repeated exposure
Hetherington et al. 2014

• Vegetable flavoring to add to milk**
• Vegetable added to rice cereal **
• “Pure” vegetable

1. Gradual introduction would increase intake and liking
2. Exposure effect would generalize to an unfamiliar vegetable
A step-by-step introduction to vegetables:
The effects of early & repeated exposure
Hetherington et al. 2014

Mean veg intake recorded daily in both lab setting (D25,26,33 – 35) & at home (Day 27 – 32)

* p < 0.05;  ** p < 0.01

Age day 1 = 4.9 mo
4 – 6 mo range

Artichoke
Tofu
Daikon Radish
Lentils

Early**
Often
Variety
Texture preferences of 12 mo olds**

Blossfeld et al., 2006

Infant responses to pureed and chopped foods

Positive associations w/ intake:
- Children with more teeth
- Early experience w/ veg & chopped foods**
- More experience w/ texture**
- BF duration
- Dietary variety (reported regularly consuming 13 – 87 foods; M=53) **
Fx of age of introduction of lumpy solids on food eaten & feeding difficulties at 6 & 15 mo

Northstone, Emmett & Nethersole, 2001

• ALSPAC (n=9360)
• Retrospective questionnaire (@15 mo)
  – 11% before 6 mo
  – 72% between 6 – 9 mo
  – 17% >10 mo
• Infants introduced at earliest ages consumed a greater variety of family foods at 6 mo**
• Children introduced to lumps after 10 mo more difficult to feed**
Delayed introduction of lumpy foods affects children’s food acceptance at 7 y
Coulthard, Harris, Emmett (2008)

• ALSPAC study n=7821
• All 10 categories of f&v eaten by fewer children introduced to lumps after 9 mo
• Cause or effect?

Sensitive window for introducing lumpy/textured foods?**
Positive experiences facilitate acceptance

Johnson et al., 2007

Children learn about new foods by gradual sensory experiences**
Longitudinal shifts in children’s sensory behaviors when tasting foods (4 – 6 y)

Preschoolers’ preferences aren’t intractable

Most mothers reported giving up by 3-5 tries**
Early exposure effects—
If you get exposed to it...you eat it

Also sets an early social norm for intake
Meat as a first CF for BF infants

- To determine feasibility of introducing meat to impact micronutrient status, growth and development
- Randomized to Gerber beef or fortified cereal
- Infants (by maternal ratings) had equal acceptance of the two foods
  - On 5 point scale, average ratings were 3.9 ± 1.0 for each
Summary Points

• Repeated exposure is most important & consistent
• Sensitive periods for introduction of CF and for variety (by 6 mo)
• Rotation of foods (variety) during the CF period may help generalization
• Lumpy best introduced before 10 mo
• Early introduction related to > preschooler intake
• Best acceptance if it is a family food
• Exploratory behaviors = children’s learning
• BF may help child eat better as a preschooler
How do parent beliefs/expectations relate to *how* they feed their children?

- **Responsive feeding**
  - Respond to the child’s internal cues and developmental stage
  - Child centered

- **Goal driven feeding**
  - Need child to eat
  - Adult centered and constrained by environment and SES
Positive influences on preschoolers’ vegetable intake

Positive parenting practices

– Encouragement, praise, monitoring
– Child centered feeding practices
– Feeding style of high demand and expectations
– Modeling
– Structure & rules
– Appropriate reward

Vereecken & Maes, 2010
Patrick & Nicklas, 2005
Goldman, 2012
Gregory, 2011
Coulthard, 2009
Baranowski 2013
Wyse, 2011
Pearson, 2009
Effective ways to decrease children’s vegetable consumption

– Offering foods as rewards—relates to consumption of poorer quality foods  Kiefner-Burmeister et al., 2014
– Pressure to eat  Gregory, 2011; Galloway 2006; Fisher 2002
– Permissive feeding style—lowest FV intake**  Murashima, 2012
– Catering **  Blissett, 2011
Food neophobia & food preferences

• Early food preferences predict preferences later in childhood
  – Related modestly to child neophobia & maternal preferences (Skinner, 2002)
  – Neophobias related to preferences for all food groups, number of foods tried, variety, healthful food preferences (Russell et al, 2008)
Parent beliefs of preschoolers’ veg preferences
Russell & Worsley, 2013

- Child characteristics
  - stubbornness, need for sameness

- Children inherit food preferences

- Children’s preferences are affected by social circumstances
  - peers, parents, child care, marketing

- Children just don’t like certain things
  - texture, strong taste, color

Miller, et al. 2008
Parent-Child Concordance in Food Preferences (by Food Groups)
Kaar, Shapiro, Fell & Johnson, 2016

Percent Agreement

Food Group

Sweetened Beverage 39
Other Vegetables 43
Dark Green Vegetables 47
Red & Orange Vegetables 50
Beans or Peas Vegetables 56
High Fat or High Sugar Foods 58
Entrees 66
Protein 67
Condiments 71
Enriched Grains 72
Dairy 75
Starchy Vegetables 76
Fruit 77
Whole Grains 79

n=210
Variables associated with # vegetables children like and eat
Kaar, Shapiro & Johnson, 2016

<table>
<thead>
<tr>
<th>Variable</th>
<th># of vegetables child likes and eats</th>
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<tbody>
<tr>
<td></td>
<td>B (95% CI)</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td>Race</td>
<td>NS</td>
</tr>
<tr>
<td>Education</td>
<td></td>
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<tr>
<td>Income</td>
<td></td>
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<tr>
<td>Employment Status (yes)</td>
<td></td>
</tr>
<tr>
<td>Parent BMI</td>
<td></td>
</tr>
<tr>
<td>Parent Food Neophobia</td>
<td>NS</td>
</tr>
<tr>
<td>Parent Eating History</td>
<td></td>
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<tr>
<td>Pressure to Eat</td>
<td>0.59 (0.21, 0.97)** (girls only)</td>
</tr>
<tr>
<td>Child Age (months)</td>
<td>0.04 (0.01, 0.06)**</td>
</tr>
<tr>
<td>Child Weight Status</td>
<td>NS</td>
</tr>
<tr>
<td>Child Food Neophobia</td>
<td>-0.17 (-0.21, -0.13)**</td>
</tr>
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**p<0.01; ***p<0.001

R² = 0.41, Effect Size = 0.38
Influences on children’s food preferences
Kaar, Shapiro, Fell & Johnson, 2016

Parent eating history

Parent food neophobia

Parent trait

Parent feeding practices

Child trait

Child food acceptance

Child food preferences

Correlations; p<0.05*, p<0.01** and p<0.001***

R²=.45
Model of children’s acquisition of vegetable preference and ingestion

**Child traits**
- Neophobia
- Sensory sensitivities
- Age
- Temperament
- Genes

**Environmental inputs**
- Early learning experiences
- Parent neophobia
- Home environment
- Vegetable availability
- SES factors
- Parenting practices

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**LEARNING**

1. Mere exposure
2. Reward
3. Affective valence of experience

**CONSUMPTION**
As much about the feeding as it is about the food

• Breastfeeding & flavors (maternal knowledge)
• Early introduction of variety and texture
• Repeated exposure
• Lower the bar for what is considered “success;” trying counts
• Examine existing materials to ensure developmental appropriateness
• Focus on dietary variety for mothers and children
Thank You!
Television viewing & vegetable consumption

• **Food cues in programs** (Radnitz, et al. 2009)
  – PBS (10 programs for 1 – 4 y olds); 245 episodes
  – 2 x the airtime and positive endorsement for unhealthy foods;

• **TV viewing & diet quality** (Miller, et al. 2008)
  – Project Viva; 3 y olds (n=1203)
  – Lower intakes of F&V (\(\downarrow\)~0.5 serv/day; reports of 4.5 servings???)
  – -0.18 serv/hr TV

• Similar findings from GENESIS and Quebec LSCD
Positive influences on preschoolers’ vegetable intake

**Positive parenting practices**

– Encouragement, praise, monitoring

– Child centered feeding practices
  (Vereecken & Maes, 2010; Vereecken, Rovner & Maes, 2010)

– Feeding style of high demand and expectations (Patrick & Hughes)

– Modelling (Goldman, 2012; Gregory, 2011; Coulthard, 2009)

– Structure & rules (Baranowski 2013; Wyse, 2011; Pearson, 2009)