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Fruit and Vegetable Exposure in Children is Linked to the Selection of a
Wider Variety of Healthy Foods at School

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Esbelle M. Jowers
Fruit and Vegetable Exposure in Children is Linked to the Selection of a
Wider Variety of Healthy Foods at School

by

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Abstract

Fruit and Vegetable Exposure in Children is Linked to the Selection of a Wider Variety of Healthy Foods at School

Elizabeth Victoria Korinek, M.S.Kin.
The University of Texas at Austin, 2011

Supervisor: John B. Bartholomew

Background: The relationship between fruit and vegetable (FV) exposure, preference, and consumption among children has been a targeted topic of study due to the increasing prevalence of childhood obesity. The purpose of this study was to examine FV home exposure in elementary children and the selection of both fruits and vegetables and less familiar lunch entrées at school.

Design: Cross-sectional data on 3rd, 4th, and 5th grade students (N=59) from an elementary school in central Texas.

Methods: Home and school FV exposure was collected via self-report using a six-item questionnaire. Students were placed into high and low groups for 1) the variety of FV offered at home, and 2) the variety of FV eaten at home. Absolute and relative ratings of eight lunch entrées were collected through taste-tests conducted at school.

Results: Differences in the consumption of FV at school and the selection of lunch entrées between high and low groups were analyzed using Mann-Whitney U independent non-parametric tests. Results indicated that the distribution of consumption at school differed across high and low groups for parental offering of FV for: oranges (z=2.16, p<0.05), cucumber (z=2.44, p<0.05), pineapple (z=3.41, p=0.001), mandarin oranges (z=2.93, p<0.01), tomato (z=3.14, p<0.01), and broccoli (z=3.26, p=0.001). The distribution of consumption at school across high and low groups for the eating FV at home was significant for 10 out of the 11 FV items: oranges (z=2.24, p<0.05), cucumber (z=2.64, p<0.01), pineapple (z=4.19, p<.001), mandarin oranges (z=3.06, p<0.01), tomatoes (z=3.47, p=0.001), bell pepper (z=2.25, p<0.05), broccoli (z=4.00, p<0.001), melon (z=3.06, p<0.01), apples (z=2.79, p<0.01), and zucchini (z=2.27, p<0.05)

Likewise, significant differences between high and low groups for parental offering of
FV were found for the selection of the chef salad ($z=2.546, p<0.05$), the Greek salad ($z=2.091, p<0.05$), and the veggie humus plate ($z=2.104, p<0.05$). Absolute and relative ratings of eight lunch entrées are also reported.

**Conclusions:** Children who are more frequently exposed to FV at home consume a wider variety FV at school and are more likely to select healthy, less familiar entrées at school lunch.
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Introduction and Background

Childhood obesity is a nationwide epidemic. Results from the National Health and Nutrition Examination Survey (NHANES) indicate that obesity increased from 6.5% to 19.6% in children aged 6-11 between 1976-1980 and 2007-2008, and from 5.0% to 18.1% in adolescents aged 12-19 during this same period (Ogden & Carroll, 2010). Obese and overweight children are at an increased risk for numerous adverse health conditions, including: high blood pressure, hyperlipidemia, elevated insulin levels, elevated low-density lipoprotein (LDL) cholesterol levels, type 2 diabetes, orthopedic complications, and psychological and behavioral problems (depression, low self-esteem, anxiety) (Deckelbaum & Williams, 2001; Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007; Weiss et al., 2004). Children with a BMI in the 85th to 95th percentile are at risk for being overweight or obese later in life, and this risk increases with increasing age (Deckelbaum & Williams, 2001; Guo, Wu, Chumlea, & Roche, 2002; Morrison, Friedman, Wang, & Glueck, 2008). Thus, it is important to intervene early in order to establish lasting, long-term health behavior patterns.

Although the causes of childhood obesity are complex, an overall pattern of consumption emphasizing high fat foods and sugary beverages, and a decreased intake of fruits and vegetables (FV) has been identified as primary contributors (Nicklas, Baranowski, Cullen, & Berenson, 2001). In fact, pizza, snacks, and desserts may account for one-third of the daily intake of a child’s diet (Van Horn, Obarzanek, Friedman, Gernhofer, & Barton, 2005), with 30% of adolescents consuming fast food up to three or
more times per week (Bauer, Larson, Nelson, Story, & Neumark-Sztainer, 2009). In
contrast, FV consumption is known to aid in weight management due to its low-energy
density and high water and fiber content (Ledikwe et al., 2006; Rolls, Ello Martin, &
Tohill, 2004; Vioque, Weinbrenner, Castello, Asensio, & de la Hera, 2008). Several
researchers have demonstrated a link between an increased FV intake and a lower body
weight (He et al., 2004; Kahn et al., 1997; Lin & Morrison, 2002; Trudeau, Kristal, Li, &
Patterson, 1998), as well as a reduced risk for chronic disease, including: cardiovascular
disease, diabetes, certain types of cancers, and metabolic syndrome (Esmailzadeh et al.,
2006; Riboli & Norat, 2003; Yeh et al., 2008). Additionally, dietary patterns and eating
behaviors developed during childhood have been shown to track into adolescence and
adulthood (Cutler, Flood, Hannan, & Neumark-Sztainer, 2009; Kelder, Perry, Klepp, &
Lytle, 1994; Ritchie et al., 2007).

Despite the increased awareness of the importance of FV intake and initiatives
such as Healthy People 2010, FV consumption among children in the United States falls
well below recommendations. It is estimated that only 10-14% of girls and boys aged 4-8
and 18-20% of children 9-13 consume the USDA MyPyramid recommendations of 5 or
more servings of FV per day (Guenther, Dodd, Reedy, & Krebs-Smith, 2006). A recent
analysis of the 2003-2004 NHANES data by Kimmons and colleagues (2009), indicates
that this may actually be an overestimation. When data was analyzed in the form of two
non-consecutive 24-hour recalls, instead of a single day, results indicated that a shocking
0.9% of adolescents aged 12-18 met the MyPyramid recommendations.
This lack of FV consumption may derive from an absence of early and consistent exposure to a variety of FV. An early study by Birch and colleagues (1987) demonstrated that “taste” exposures are more effective than merely “look” exposures in increasing a child’s preference for seven novel fruits. Likewise, Wardle, Herrera, Cooke, & Gibson (2003) found that daily exposure to sweet red pepper strips for two weeks, or 8 tasting sessions, significantly increased both the liking and consumption in children aged 5-7 years, compared to a no treatment control. This effect is generalizable to parent intervention. Wardle and colleagues (2003) demonstrated that a 14-day parent-led exposure to an initially disliked vegetable increased liking, ranking, and consumption of the target vegetable in children 2-6 years of age.

The evidence supporting the link between exposure, preference, and intake of FV has led to the implementation of numerous school-based nutrition intervention programs to prevent weight gain. With 50% of youth eating at least one meal at school and 10% consuming two (Hendy, Williams, & CAMISE, 2005; Howerton et al., 2007), the school setting is an ideal environment for targeting food behavior change in youth. In February of 2010, Michelle Obama introduced a nationwide initiative, Let’s Move, and incorporated the HealthierUS School Challenge (HUSSC) into her campaign. HUSSC was established in 2004, and awards schools that participate in the National School Lunch Program (NSLP) with a monetary incentive for meeting a distinguished standard of food quality, nutrition education, and physical activity opportunities. Four levels of performance are awarded based on criteria set forth by the USDA: Bronze, Silver, Gold, and Gold of Distinction. For example, an elementary school awarded the Gold Standard
must offer a different vegetable every day of the week, with dark green or orange vegetables offered three or more days per week and cooked dry beans or peas at least once per week.

The relative newness of the HUSSC awards provides a novel area of research for scientists in the health domain. Attempts to implement this program will necessitate change in menu construction – often for foods that are unfamiliar to most children. For example, wrap and pita sandwiches, main-dish salads, and novel vegetables (e.g. sweet potatoes) are being offered at a greater frequency (http://www.pflugervilleisd.net/schools/menus/). Given the relationship between exposure and taste ratings (Birch, et al., 1987), one would expect these foods to be bypassed by children. This prevents sufficient exposure to develop a positive opinion of their taste and, potentially, undermines the effort to modify eating behavior through the school lunch menu.

These novel entrées do, however, provide an opportunity to assess how exposure to FV might generalize to other food items. The existing research has centered on the match between exposure and later food selection of the target item – e.g. exposure to celery increases liking and consumption of celery (Wardle, Cooke, et al., 2003). However, might exposure to celery also increase children’s willingness to select and enjoy a Thai salad and other novel entrées? There are reasons to expect this to be the case. Children who are exposed to an array of less familiar FV may be more willing to experiment with other less familiar foods. Falciglia et al. (2000) found that neophobic children (unwilling to try new foods) had less overall diet quality, as assessed by the
USDA Healthy Eating Index, than both “average” and “neophilic” children. In addition, exposure to more bitter FV might also create less reactance to other, less sweet foods. Prior to testing these potential mediators it would be reasonable to ascertain if exposure to a variety of FV is associated with taste ratings of less familiar lunch entrées. This study is designed to achieve this aim.
Materials and Methods

Participants
The participants were 59 ethnically diverse (59.3% Hispanic white, 8.5% non-Hispanic white, 11.9% non-Hispanic black, 5.1% Hispanic black, 8.5% American Indian, 5.1% Asian, 1.7% Native Hawaiian), children (30 girls and 29 boys) enrolled in 3rd, 4th, and 5th grades in a Central Texas elementary school. Gender and race/ethnicity were based on self-report at the distribution of the first survey. This study was approved by The University Institutional Review Board and both parental consent and student assent were obtained prior to data collection.

Instrumentation
Fruit and Vegetable Questionnaire
The fruit and vegetable questionnaire was developed to test home and school exposure for: five fruits (orange, pineapple, mandarin orange, melon, apple) and seven vegetables (salad greens, cucumber, carrots, bell pepper, broccoli, zucchini, and tomato) offered as a part of school lunch. Previous studies have provided evidence that children will reliably report FV exposure. Domel and colleagues (1993) measured FV exposure and preference to fruits, vegetables, and snacks in 4th and 5th graders, and found internal consistencies to range from 0.65 to 0.95 and test-retest reliabilities from 0.65 to 0.84. A more recent study by Economos and colleagues (2008) assessed FV exposure in 6-9 year old children, and found that over 90% of the children reported valid intake recall, (as was confirmed through direct observation), with test-retest reliabilities for recall ranging from
93-94% (fruits) and 76-90% (vegetables). For the present study, we applied this methodology with a 13-page packet, including a page for student identification and demographics. Each page presented two photos of a single fruit or a single vegetable. One was a photo of how it was offered at school and the second was a generic photo. To assess exposure, each page contained two identical columns, one in English and one in Spanish, with six multiple-choice questions that referred to the specific fruit or vegetable pictured at the top of the page (e.g. “My parent’s have never offered this to me, sometimes offer this to me, always offer this to me”). These questions were similar in language and format as those found in previous research (Economos et al., 2008). Items were coded as 0 (never offered) and 1 (sometimes or always offered) and summed across all food items for each child. A median split was used to categorize students into high and low groups for parent offering of the FV at home and into high and low groups for the actual consumption of the FV at home.

**Taste-test Evaluation**

The taste-test evaluation form used in this study was developed by Jowers, Bartholomew, and Callen (2009) for absolute and relative taste ratings for the school lunch in elementary children (test-retest reliability coefficient = 0.87). Children were asked to provide an absolute rating of the entrée on a 5-point Likert-type scale (0 = disliked a lot, 4 = liked a lot). Relative rating was assessed for each food by asking children if they would a) select the food for lunch with no comparison, and b) select the food instead of several comparison foods: fruit and cheese platter, whole grain chicken nuggets, and whole grain pizza that were a part of the Gold Standard menu changes. For
each question, children circled a “yes” or a “no,” coded as 1 and 0, respectively. Selection against pizza, chicken nuggets, and the fruit and cheese platter were analyzed using binomial tests to indicate the child’s preference for the specific entrée. These items were selected because they reflect the range of entrée popularity.

**Procedure**

Administration of the fruit and vegetable questionnaire took place in the school gym during a physical education (P.E.) class. Children entered the gym during their assigned class time and those that had provided parental consent and written assent to participate in the study were pulled aside. The number of students taking the questionnaire at any one time ranged from 5-17. The questionnaires, clipboards, and pencils were distributed to the students and verbal directions for completion of the first page only (identification and demographics) were given by the researcher. Upon completion of the first page by the full group, verbal instructions pertaining to each question of the survey were given to ensure understanding and clarity. Students proceeded question by question following the instructions, and were encouraged to ask questions at any time during the assessment. The questionnaire took approximately 10-15 minutes to complete, after which students joined the rest of the class for the remainder of P.E.

Three entrées were tested on each of the four days of data collection for a total of 12 taste-tests, and included: whole grain cheese pizza, Thai chicken salad, chicken ranch pita, chef salad, whole grain chicken nuggets, ham and cheese sub, Greek salad, sunbutter and apple sandwich, veggie hummus plate, turkey cheese pocket, chicken patty, and
cheeseburger. The pizza, chicken nuggets, chicken patty, and hamburger were not included in the analyses because of their high popularity among the students. All samples were prepared by the food service staff the morning of the testing, and were one-fourth the size of a normal lunch entrée. Prior to student arrival, cups with water, eating utensils, and the taste-test forms for the first entrée were placed at every other seat on the cafeteria tables by the researchers. Children entered the cafeteria as a class and were instructed to sit down and fill out the identification and demographic information. Food samples were then distributed and the children were told to taste the food and then fill out the evaluation. Members of the research team monitored the completion of the forms to ensure that students followed the protocol and understood all items on the evaluation. Students were instructed to raise their hand when they had finished, and a staff member collected the form. After collection of the forms for the first entrée by all students in a particular class, the same procedure was repeated for the subsequent entrées for that day. Students tasted no more than three entrées in each tasting session.
Results

Fruit and Vegetable Items

Descriptives
Mean scores ± standard deviations for each FV for the four variables of interest (“parents offer,” “eat at home,” “school offers,” and “eat at school”) are reported in Table 1. There was a range of 0-2 for each variable (0=never offered, 1=sometimes offered, 2=always offered), with N=59 students.

Table 1 – Descriptive Statistics on FV Items

<table>
<thead>
<tr>
<th>Fruit/Item</th>
<th>Parents Offer</th>
<th>Eat at Home</th>
<th>School Offers</th>
<th>Eat at School</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Orange</td>
<td>1.19</td>
<td>0.57</td>
<td>1.19</td>
<td>0.57</td>
</tr>
<tr>
<td>Cucumber</td>
<td>0.98</td>
<td>0.63</td>
<td>0.95</td>
<td>0.75</td>
</tr>
<tr>
<td>Carrots</td>
<td>1.14</td>
<td>0.60</td>
<td>1.25</td>
<td>0.66</td>
</tr>
<tr>
<td>Pineapple</td>
<td>1.10</td>
<td>0.61</td>
<td>1.32</td>
<td>0.71</td>
</tr>
<tr>
<td>Mandarin Oranges</td>
<td>1.14</td>
<td>0.78</td>
<td>1.25</td>
<td>0.85</td>
</tr>
<tr>
<td>Tomato</td>
<td>0.78</td>
<td>0.77</td>
<td>0.51</td>
<td>0.65</td>
</tr>
<tr>
<td>Bell Pepper</td>
<td>0.42</td>
<td>0.59</td>
<td>0.34</td>
<td>0.58</td>
</tr>
<tr>
<td>Broccoli</td>
<td>1.19</td>
<td>0.71</td>
<td>0.98</td>
<td>0.78</td>
</tr>
<tr>
<td>Melon</td>
<td>1.19</td>
<td>0.68</td>
<td>1.25</td>
<td>0.71</td>
</tr>
<tr>
<td>Apple</td>
<td>1.47</td>
<td>0.68</td>
<td>1.51</td>
<td>0.69</td>
</tr>
<tr>
<td>Zucchini</td>
<td>0.46</td>
<td>0.60</td>
<td>0.36</td>
<td>0.61</td>
</tr>
</tbody>
</table>

Prediction of fruit and vegetable consumption at school
Mann-Whitney U independent non-parametric tests were conducted between the categorized high and low groups for each home exposure item (“parents offer” and “at
home I eat”) and the consumption of FV at school. Results indicated that the distribution of consumption at school differed across **high and low groups for parental offering** of FV for: oranges (z=2.16, p<0.05), cucumber (z=2.44, p<0.05), pineapple (z=3.41, p=0.001), mandarin oranges (z=2.93, p<0.01), tomato (z=3.14, p<0.01), and broccoli (z=3.26, p=0.001). The distribution of consumption at school across **high and low groups for the eating FV at home** was significant for 10 out of the 11 FV items: oranges (z=2.24, p<0.05), cucumber (z=2.64, p<0.01), pineapple (z=4.19, p<.001), mandarin oranges (z=3.06, p<0.01), tomatoes (z=3.47, p=0.001), bell pepper (z=2.25, p<0.05), broccoli (z=4.00, p<0.001), melon (z=3.06, p<0.01), apples (z=2.79, p<0.01), and zucchini (z=2.27, p<0.05).

**Taste Tests**

**Descriptives: Absolute Ratings**

Mean scores ± standard deviations for the absolute ratings of each entrée are reported in Table 2. Paired t-tests were conducted between the means for the absolute ratings and a significance level of 0.05 was used for all comparisons. Results are summarized in Table 2 and indicated that the entrées fell into three, distinct groupings (indicated by superscripts a, b, and c). Entrées within each group are not different from one another, but are significantly (p<0.05) different from the entrées in the other two groups: a) ham and cheese sub and sunbutter and apple sandwich, b) chef salad, chicken ranch pita, turkey cheese pocket, and Thai salad, and c) Greek salad, and veggie hummus plate. Furthermore, the absolute ratings of the entrées in group (a) are greater than those in group (b), which are greater than those in group (c).
Additionally, the mean scores ± standard deviations and effect sizes for the absolute ratings by group (high and low for parental offering of FV and high and low for the consumption of FV at home) were calculated and are reported in Table 2. Differences between means were analyzed using a one-way analysis of variance (ANOVA). A significant difference between the absolute ratings of the chef salad (F=7.65, p<0.01) and the Greek salad (F=11.04, p<0.01) were found between high and low groups of parental offering of FV. No significant differences were found between the high and low groups for the consumption of FV at home.

**Descriptives: Relative Ratings**

The relative ratings of the eight entrées of interest were analyzed using binomial tests of significance, and tested relative to the 50% distribution (Ho: p=0.50). Results are reported as the percent of students that would pick the entrée of interest over the comparison item and are shown in Table 3. The results of the binomial tests further support the findings of the absolute ratings, in that there is a natural grouping of entrées, with the highest comparison values found for the ham and cheese sub and the sunbutter and apple sandwich. This is followed by the chef salad, chicken ranch pita, Thai salad, and the turkey cheese pocket. The lowest comparison values were found in the Greek salad and the veggie hummus plate. Additionally, it can be seen that intention to select was highest when the entrées were compared to the fruit and cheese platter.
### Table 2 – Descriptive Statistics on Absolute Ratings of Entrées

<table>
<thead>
<tr>
<th>Entrée</th>
<th>Overall</th>
<th>Parents Offer Low</th>
<th>Parents Offer High</th>
<th>Eat at Home Low</th>
<th>Eat at Home high</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Effect Size</td>
</tr>
<tr>
<td>Ham and Cheese Sub</td>
<td>53</td>
<td>3.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.90</td>
<td>2.87</td>
<td>1.01</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.10</td>
<td>0.80</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.75</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
<td></td>
<td>0.52</td>
</tr>
<tr>
<td>Sunbutter and Apple Sandwich</td>
<td>52</td>
<td>2.63&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.36</td>
<td>2.73</td>
<td>1.25</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.52</td>
<td>1.47</td>
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<td></td>
<td></td>
<td></td>
<td>0.08</td>
<td></td>
<td>0.08</td>
</tr>
<tr>
<td>Chef Salad</td>
<td>55</td>
<td>1.98&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.51</td>
<td>1.40*</td>
<td>1.47</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.47*</td>
<td>1.38</td>
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<td>0.37</td>
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<td>0.37</td>
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<tr>
<td>Chicken Ranch Pita</td>
<td>50</td>
<td>1.94&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.25</td>
<td>1.82</td>
<td>1.40</td>
<td>0.17</td>
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<tr>
<td></td>
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<td>0.08</td>
<td></td>
<td>0.08</td>
</tr>
<tr>
<td>Turkey and Cheese Pocket</td>
<td>25</td>
<td>1.70&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.10</td>
<td>1.61</td>
<td>1.15</td>
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<td>1.03</td>
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<tr>
<td>Thai salad</td>
<td>48</td>
<td>1.52&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.30</td>
<td>1.17</td>
<td>1.03</td>
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<tr>
<td>Greek Salad</td>
<td>52</td>
<td>1.05&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>0.56*</td>
<td>0.85</td>
<td>0.94</td>
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<td>0.38</td>
<td></td>
<td>1.20</td>
</tr>
<tr>
<td>Veggie and Hummus Plate</td>
<td>52</td>
<td>0.86&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.01</td>
<td>0.60</td>
<td>0.90</td>
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<td>0.54</td>
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<td>1.11</td>
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<td></td>
<td></td>
<td>0.54</td>
<td></td>
<td>1.05</td>
</tr>
</tbody>
</table>

<sup>a</sup> sunbutter and apple sandwich and ham and cheese sub

<sup>b</sup> chef salad, chicken ranch pita, turkey cheese pocket, and Thai salad

<sup>c</sup> Greek salad and veggie hummus plate

*significant difference between groups (p<0.01)
Table 3 – Comparison of Relative Ratings of Entrées

<table>
<thead>
<tr>
<th>Entrée</th>
<th>Pizza</th>
<th>Chicken Nuggets</th>
<th>Fruit and Cheese Platter</th>
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</thead>
<tbody>
<tr>
<td>Ham and Cheese Sub</td>
<td>21%</td>
<td>38%</td>
<td>57%</td>
</tr>
<tr>
<td>Sunbutter and Apple Sandwich</td>
<td>27%</td>
<td>29%</td>
<td>58%</td>
</tr>
<tr>
<td>Chef Salad</td>
<td>24%</td>
<td>22%</td>
<td>25%</td>
</tr>
<tr>
<td>Chicken Ranch Pita</td>
<td>21%</td>
<td>17%</td>
<td>38%</td>
</tr>
<tr>
<td>Thai Salad</td>
<td>25%</td>
<td>18%</td>
<td>45%</td>
</tr>
<tr>
<td>Turkey and Cheese Pocket</td>
<td>12%</td>
<td>20%</td>
<td>28%</td>
</tr>
<tr>
<td>Greek Salad</td>
<td>15%</td>
<td>17%</td>
<td>14%</td>
</tr>
<tr>
<td>Veggie and Hummus Plate</td>
<td>6%</td>
<td>4%</td>
<td>10%</td>
</tr>
</tbody>
</table>

**Prediction of entrée selection**

Mann-Whitney U independent non-parametric tests of significance were performed between the categorized high and low groups for each home exposure item ("parents offer" and "at home I eat") and the selection of each entrée. Results indicated that the distribution of selection differed across **high and low groups for parental offering of FV** for the chef salad (z=2.55, p<0.05), the Greek salad (z=2.09, p<0.05), and the veggie humus plate (z=2.10, p<0.05). The distribution of selection across **high and low groups for the consumption of FV at home** was only significant for the veggie and hummus plate (z=2.02, p<0.05), although there was a trend for the chef salad and the Thai salad.
Discussion

The first aim of this study was to examine the relationship between exposure to a variety of FV in children and the consumption of FV at school lunch. Results indicated that the self-report of both being offered a range of FV at home and of actually eating a range of FV at home predicted children’s reports of consumption of FV that are offered at school lunch. This finding supports existing literature that home availability and accessibility of FV is associated with child intakes of those foods (Pearson, Biddle, & Gorely, 2009; Spence, Campbell, & Hesketh, 2011; Van Der Horst et al., 2007), as well as confirming the theory that exposure drives preference and consumption of foods in children (Cooke, 2007; Wardle, Cooke, et al., 2003; Wardle, Herrera, et al., 2003). In this study, children who were highly exposed to FV at home were willing to eat more of the FV offered at school lunch, including typically “disliked” items, such as broccoli and zucchini.

The second aim of this study was to quantify the preference for several novel lunch entrées, recently introduced to the Gold Standard lunch menu. The absolute and relative taste-test ratings indicated that children liked the ham and cheese sub on whole-grain bread and the sunbutter and apple sandwich most out of the eight entrées taste-tested. This may be due to a resemblance of these foods to familiar items – e.g. the typical deli sandwich and a peanut-butter and jelly sandwich. Indeed, Pliner and Stallberg-White (2000) demonstrated that children were more willing to try novel foods when it was paired with a familiar flavor, than when it was served alone. The chef salad,
chicken ranch pita, turkey and cheese pocket, and Thai salad were moderately liked by children, and may be a viable option for schools to offer with greater frequency in the future. The relative ratings of these entrees showed a reasonably high intention to select (near 20%) even when paired against popular items, such as pizza and chicken nuggets. This value increased when the comparison item was the fruit and cheese platter, strengthening the argument that reducing the number of high-fat competing entrees offered in conjunction with low-fat items will increase the likelihood of the selection of these items. Bartholomew and Jowers (2006) showed that low-fat entrees were selected more than twice as often when they were paired with one rather than two alternative, higher-fat entrees at elementary school lunch.

Finally, the third aim of this study was to examine the relationship between FV exposure at home and selection of several unfamiliar lunch entrees at school. To our knowledge, this is the first study to generalize FV exposure to other types of food. Our results indicated that children who were offered a greater variety of FV at home were more likely to select the chef salad, the Greek salad, and the veggie hummus plate than those who were not frequently offered FV at home. This was also supported by the significant difference between high and low groups of parental offering of FV between the absolute ratings of the chef salad and the Greek salad. This is a novel finding and suggests that merely offering children a variety of FV may lead to willingness to try new foods. This may be especially true for those items that are typically avoided, as the Greek salad and the veggie hummus plate were rated the lowest in both absolute and
relative terms, but were both more likely to be selected by those with higher exposure to FV at home.

These findings highlight the importance of continuing to increase the amount and variety of FV offered to children in the school environment, as it is apparent that not all children are regularly exposed to these foods at home. It is encouraging that the addition of a simple fruit or vegetable side dish can improve the overall quality of child’s diet. Secondly, by decreasing the number of higher-fat or “popular” items, children may select these unfamiliar and more healthful lunch entrées at a greater frequency. This would result in an increased number of exposures to these foods and thus the potential to enhance preference. Taste-test data has been used to describe the absolute rating and relative preference of low-fat entrees in elementary school children (Jowers et al., 2009). Results found numerous instances in which a high absolute rating for the entrées, was paired with a low intention to select when presented as an alternative to popular, high fat entrées (e.g. cheeseburger). The distinction between the absolute and relative ratings of the entrées demonstrates that low-fat foods can be palatable to children but not selected for lunch at school.
Limitations

There are several limitations in this study. First, this study measured absolute and relative preference for the entrees, not actual selection and consumption of the items during school lunch. Although it would have been ideal to support the intention scores with actual purchases, several studies have utilized similar measurements to predict health behavior (Nader et al., 1999; Saba & Di Natale, 1998). Second, this study utilized self-report of children’s exposure to and consumption of FV without parent verification. However, as previously stated, researchers have demonstrated children’s ability to accurately report FV exposure and intake (Domel et al., 1993; Economos et al., 2008). Third, the participants in this study were of a narrow range of ethnicity (predominately Hispanic), thus we do not know if the high and low groupings used in the analyses would generalize across other schools of a more varied population. Finally, we did not assess the history of children’s exposure to the “less familiar” entrées, and thus we do not know if children were being offered items such as hummus or salads at home; nor, do we know how often they had selected these entrées at school. However, this was the first year that these entrées appeared on the school lunch menu, and thus all children had the same school exposure to each entrée. A check of the menu in the months in which data collection took place indicated that children were exposed, on average, to each of the eight entrées two and a half times per month; the maximum number of times any one entrée was offered in a single month was four.
Conclusions

The present study found that children who are more frequently exposed to FV at home consume more FV at school and are more likely to select healthy, less familiar entrées at school lunch. Future interventions should focus on ways to increase the exposure to and accessibility of FV in both the home and school environment, as well as decrease the number of competing foods, particularly those that engender low relative preferences, offered in conjunction with these lower-fat, novel entrées.
References


