The relationship between the food environment and fruit and vegetable intake of adolescents living in Residential Children’s Homes

Alexandra Evans1*, Marsha Dowda2, Ruth Saunders3, Jacquelynn Buck3, Lauren Hastings3 and Kelli Kenison3

Abstract

The purpose of this study was to examine the relationship between food environments and fruit and vegetable (FV) consumption of adolescents (n = 246) living in Residential Children’s Homes (RCHs) in North and South Carolina, USA. Administrators of 21 RCHs completed the Physical Activity and Dietary Environmental Assessment (PADEA), an instrument assessing FV-related environmental variables of RCHs: (i) policies, (ii) availability, (iii) social environment, (iv) community collaboration and (v) administrative support. Two different approaches using mixed-effects regression models were used to compare FV consumption of adolescents living in RCHs with more conducive food environments compared with adolescents living in RCHs with less conducive environments. Using one approach, PADEA variables were analyzed as categorical data and in the second approach, PADEA variables were analyzed as continuous data. Results indicated greater FV consumption among adolescents residing in RCHs with more conducive food environments compared with adolescents living in RCHs with less conducive environments. Using one approach, PADEA variables were analyzed as categorical data and in the second approach, PADEA variables were analyzed as continuous data. Results indicated greater FV consumption among adolescents residing in RCHs with more conducive food environments compared with adolescents living in RCHs with less conducive environments. Specifically, adolescents living in RCHs with higher levels of administrative support and more FV policies reported greater FV intake compared with adolescents living in RCHs with less support and fewer policies. Food environments are related to adolescents’ dietary behaviors and interventions targeting FV consumption should include strategies to increase administrative support and the development of FV-related policies.

Introduction

The recent increase in overweight and obesity among youth is a major public health crisis [1, 2] with both immediate and long-term health consequences [3, 4]. Increased fruit and vegetable (FV) consumption has been linked to a decrease in childhood obesity and other chronic diseases such as cancer and cardiovascular disease [5, 6, 7]. However, the majority of American children and adolescents do not meet the national recommendations of at least five FV per day [8, 9], suggesting a need for interventions to increase FV consumption.

Ecological approaches [10] suggest that the food environment in which an individual lives influences dietary habits as much as individual’s personal characteristics, such as one’s attitude or self-efficacy toward healthful eating [11]. Although it is still unclear how the environment influences behavior, empirical data indicate that significant environmental influences on individuals’ dietary behaviors include factors such as availability of healthful foods, pricing of food products, media messages promoting certain foods and social influences such as role models [12–19]. A better understanding of environmental influences on dietary practices of...
adolescents could guide the development of more effective population-based interventions.

Much of the evidence suggesting a link between environmental features and dietary behavior is empirically based, as opposed to theory based. Ecological models, specifically the Structural Ecologic Model (SEM), provide a theoretically based framework for examining environmental influences on behavior. SEM identifies four distinct structural factors (i.e. availability, characteristics of the opportunities, social structures and policies and media and cultural messages) that can influence behavior directly, without mediation through change in individuals’ attitudes, beliefs, skills or knowledge [20]. SEM combines elements that have previously been targeted in environmentally focused interventions in school settings to promote nutrition [21, 22] and has guided a physical activity and nutrition intervention for children aged 10–13 in middle school settings [23].

Most research examining relationships between the food environment and child dietary behavior has been conducted in school settings [10, 12, 13, 15, 17, 19, 21] and family home settings [16, 18, 22]. Research in additional settings will deepen our understanding of environmental factors’ influence on adolescents’ behavior. Residential Children’s Homes (RCHs) provide a unique setting because RCHs are similar to family homes in that they fulfill the role of caretakers and are also similar to schools in that they are formal institutions with adult leaders and daily schedules. RCHs are located in both rural and urban communities and range from small group homes with only a few residents to large institutions with more than a 100 residents. The ethnic/racial composition of the residents in the RCHs tends to follow the demographic composition of the state in which the RCH is located.

Children and adolescents who live in RCHs are a unique population in that many of these children reside in RCHs due to abuse, neglect and/or child’s behavioral or emotional problems [24, 25]. Consequently, studies with this population related to treatment issues are readily available. However, little is known about this population in terms of health-related behaviors, including dietary intake or physical activity behaviors or other obesity-related behaviors, and to the best of our knowledge, no population-based study with this specific population has been published.

The first purpose of this study was to describe the adolescents living in the RCHs and their food environment using the SEM as the theoretical framework before implementation of the Environmental Interventions in Children’s Homes (ENRICH) intervention. We assessed the overall food environment of the RCHs and five specific environmental variables: (i) policies related to FV, (ii) availability and characteristics of FV, (iii) social environment related to eating FV, (iv) collaboration with community agencies and (v) administrative support for promoting FV consumption. The second purpose of the study was to determine if, at baseline, adolescents living in RCHs with food environments more conducive to eating FV consumed more servings of FV compared with adolescents living in RCHs with food environments less conducive to consuming FV. This study is unique in that no research examining the RCHs’ food environment or its influence on residents’ dietary behavior has been published.

**Methods**

**Design**

The cross-sectional data used for this study were collected as baseline data for the 5-year ENRICH intervention study with RCHs located in North and South Carolina, USA. After obtaining approval from the University of South Carolina Institutional Review Board, we collected two types of data: (i) organizational-level data regarding the food environment and administrative support from the Assistant Chief Executive Officers (CEOs) of the RCHs and (ii) individual-level data regarding adolescents’ FV consumption from the residents living in the RCHs.

**Organizational-level data collection**

**Data collection**

All 51 RCHs participating in the ENRICH study were asked to complete two surveys: (i) the
Physical Activity and Dietary Environmental Assessment (PADEA) questionnaire and (ii) the organizational assessment (OA) Survey. The OA Survey, which assessed descriptive organizational data, was completed by the CEO or designated organizational representative at a preliminary meeting before the start of the intervention or as follow-up to that meeting by mail. The PADEA, which assessed the RCH food environment, was mailed to the RCH and completed by the Assistant CEO. A modified Dillman method [26], a standardized method which uses multiple mail and phone messages to increase response rates, was used to increase the number of RCHs that returned the PADEA and the OA Survey. Forty-six PADEA questionnaires (90%) and 51 OA Surveys (100%) were completed and returned.

Description of environmental-level measures

The PADEA

The PADEA is a paper-and-pencil questionnaire which assesses the food and physical activity environments of RCHs based on the SEM (Table I). The PADEA instrument was developed specifically for this study and was pilot tested with Assistant CEOs from non-participating RCHs.

The PADEA includes five indices assessing five specific environmental variables: availability and characteristics of FV, social environment related to eating FV, policies related to FV, collaboration with outside agencies and administrative support for promoting FV consumption. Response options ranged from 0 to 3, with 0 indicating 'does not exist' or 'Never' and 3 indicating 'Fully in place' or 'Always' (see Table I for more detail). Index scores for the five specific variables were obtained by summing and averaging the scores of the corresponding items. The Total Food Environment was a measure of the overall food environment for each RCH and was a composite score of the five indices measuring the specific environmental variables and was calculated as the mean response across all the items. A higher index score indicates a food environment conducive to eating FV, whereas a low score indicates a food environment not conducive to eating FV. Test–retest (based on a 2-week interval and conducted with 21 RCHs) and internal reliability (based on 46 RCHs) statistics for the five environmental variables on the PADEA indicated acceptable to good reliability among the indices (intraclass correlation (ICC) ranging from 0.54 to 0.95 and standardized Cronbach alpha coefficients ranging from 0.55 to 0.88).

The OA Survey

Because of the great diversity of RCH, the OA Survey was used to obtain descriptive organizational information for each RCH. The OA Survey included 30 items and assessed the following information: organizational structure of the RCH (e.g. complex structure versus simple structure), location (e.g. urban versus rural) and population served (e.g. treatment versus non-treatment); information about the children’s schedule; information about ongoing programs and services available for nutrition and physical activity; information about the homes’ affiliations and information about some of the physical structures within the home environment (i.e. presence of vending machines, cafeterias, gymnasiums, etc.). We also assessed RCH participation in the federally funded School Lunch Program and dining location (i.e. whether the adolescents eat at a central location or in individual cottages). Response options to these questions include ‘yes’, ‘no’ and ‘don’t know’.

Individual-level data collection

Data collection

Of the 46 RCHs who completed the PADEA, 30 were eligible for individual behavior data collection. The initial eligibility criterion was to have at least 10 residents in the 11–18 age group living full time at the RCH. Of the 30 RCHs that were eligible, 23 RCHs agreed to participate and allowed for individual data collection with their residents. Due to the geographic distribution of the RCHs across the two states and the nature of this population, we relied on RCH staff to assess adolescents’ eligibility and to recruit adolescents for the study. A total of 277 adolescents living in the eligible RCHs were enrolled in the study at baseline. Inclusion criteria for adolescents’ participation assessed at the home level by staff were as follows: being between the ages of 11 and 18, a full-time resident of a participating RCH and ability to complete the
demographic survey and 24-hour dietary recalls with minimal assistance. The age-eligible population (children 11–18) living in the 23 RCHs was 713. However, it was not possible to determine how many of these children were ineligible to participate in the study due to their inability to provide reliable data on the demographic survey and the 24-hour dietary recalls.

Each of the RCHs had its own protocol for obtaining informed consent for study participation. At some RCHs, a counselor or the RCH’s CEO was able to consent for eligible adolescents, whereas at

<table>
<thead>
<tr>
<th>Table I. Summary information for the PADEA (n = 21 RCHs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PADEA environmental variables</td>
</tr>
<tr>
<td>Availability and characteristics of FV</td>
</tr>
<tr>
<td>Social environment related to eating FV</td>
</tr>
<tr>
<td>Policy related to FV</td>
</tr>
<tr>
<td>Collaboration with outside agencies</td>
</tr>
<tr>
<td>Administrative support for promoting FV consumption</td>
</tr>
<tr>
<td>Total food environment</td>
</tr>
</tbody>
</table>
other RCHs, the child’s parent or a Department of Social Service caseworker provided consent. Due to the challenges of obtaining informed consent, as well as the need to rely on RCH staff to identify and recruit adolescents, our strategy goal was to recruit at least between 10 and 20 children at each eligible RCH.

Description of individual-level measures
At the individual level, we collected dietary, anthropometric and demographic data from adolescents living in the RCHs. The anthropometric and demographic data were collected from each participating child by two trained data collectors who visited each RCH.

Demographic variables
The demographic variables collected from the adolescents included gender, age and race/ethnicity. This information was obtained using a paper-and-pencil questionnaire administered by research staff while they were at the RCHs. In addition, the RCH staff recorded the date of each child’s entry into the RCH on the consent form and ‘Length of stay’ for each child was then calculated accordingly.

Anthropometric variables
Height and weight of adolescents were measured with adolescents dressed in street clothing. Height was measured to the nearest 0.1 cm with a portable stadiometer (Shorr Productions, Olney, MD, USA) and weight was measured to the nearest 0.1 kg with a calibrated digital scale (Seca 880/881, Seca Corporation, Hanover, MD, USA). Body mass index (BMI) was calculated as weight in kilograms divided by height in square meter (kg m\(^{-2}\)). Adolescents were classified as normal weight (<85th percentile), overweight (≥85th and <95th percentile) or obese (≥95th percentile) according to the Centers for Disease Control and Prevention’s growth charts for BMI for age and sex [27, 28].

Child FV consumption
Within 2 weeks following the visit by the data collectors, each participating child was randomly called twice by a registered dietitian to complete two 24-hour dietary recalls over the phone using the multi-pass approach [29, 30] to assess FV consumption.

Recalls were conducted randomly so that the participants would not change their dietary behavior in preparation for the call (for example, some children may eat more healthfully the day before the call if they know they are going to be called). Portion estimation was facilitated with the use of a validated, two-dimensional, food portion visual, which was provided to the adolescents by the data collectors who visited the RCH to collect the demographic data prior to the 24-hour recalls. Because of the variance in dietary intake between week and weekend days, both week and weekend day data were collected; for adolescents who went home for the weekend, we collected weekday information only because the study’s research question was to determine the relationship between the RCH environment and FV intake. Analyses indicated no significant differences in FV intake between week and weekend days. This protocol was pilot tested in two RCHs before it was finalized. The Nutrient Data System for Research (version 2005) software was used to calculate average daily servings of FV.

Statistical analysis
For the final analysis, data from two RCHs were not included in the analysis because at each of these homes data from fewer than five adolescents were collected; therefore, the final number of RCHs included for analyses was 21. Within the 21 RCHs, 246 children provided reliable data and were included in the final analyses. Trained dietitians who completed the 24-hour recalls determined whether data were ‘reliable’ using a standardized protocol.

For the first aim of the study, describing the food environment of RCHs and the adolescents living in the RCHs, we computed index scores and means [standard deviation (SD)] for the five specific environmental indices and the Total Food Environment index as assessed by the PADEA (Table I). We also calculated frequencies for child demographics and means (SD) for child age, child BMI and FV servings (Table II).
The second aim of the study was to determine if adolescents living in RCHs with food environments more conducive to eating FV consumed more FV than adolescents living in RCHs with food environments less conducive to consuming FV (Table III).

Two different approaches were used to complete this aim. For the first approach, the PADEA variables were categorized so that approximately one-third of the adolescents would be in the one category (high group) and two-thirds of the sample into the other category (the low group). Specifically, for each of the six indices measured by the PADEA (i.e. the total index and five specific indices), the RCHs were divided into two groups for the analyses: a ‘high’ group and a ‘low’ group. RCHs in the high group received a more favorable score on the indices measuring the environmental variables, while the ‘low group’ received a less favorable score on these indices. A separate high group and low group were identified for each of the six variables. The number of RCHs in the high group was decided by adding the homes with the highest scores for each specific variable until approximately a third of the adolescents were in the high group. The remaining RCHs for that variable were included in the low group. For example, for the variable ‘availability’, seven RCHs were included in the high group because this would allow ~38% of the adolescents to fall into the high group.

Mixed-effects regression models were then used to compare the average number of daily servings of FV consumed by the adolescents living in the high group of RCHs versus those living in the low group of RCHs. Six regression models were run, specific to each of the six indices measured by the PADEA. This type of regression models is appropriate for these analyses since adolescents were nested inside the homes [31].

In the second approach, the PADEA variables were used as continuous variables. Similar to the analyses described above, six regression models were run, specific to each of the six indices measured by the PADEA.

SAS Proc MIXED (version 8.2) was used for all analyses, with home specified as a nested random effect. All analyses were adjusted for the child’s age, gender, BMI and years of stay in the home. Participation in the federally funded School Meal program and Dining Location was originally considered as potential covariates, as well. However, analyses indicated that they were not significantly related to FV consumption. Therefore, they were not considered as potential confounders of the effect examined here. For all analyses, the alpha level of significance was set at 0.05.

### Results

#### Descriptive data

**RCHs (n = 21)**

Thirteen RCHs were located in North Carolina and eight in South Carolina. Seventeen of the RCHs participated in the School Lunch Program, while four did not. In 9 of the RCHs, adolescents ate meals in central dining facilities, while in the other 12 RCHs, adolescents ate meals in ‘family or cottage’ settings.

---

**Table II. Characteristics of children in RCHs (n = 246)**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>126</td>
<td>51.2</td>
</tr>
<tr>
<td>Females</td>
<td>120</td>
<td>48.8</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>118</td>
<td>48.0</td>
</tr>
<tr>
<td>Black</td>
<td>83</td>
<td>33.7</td>
</tr>
<tr>
<td>Othera</td>
<td>45</td>
<td>18.3</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11–14</td>
<td>98</td>
<td>39.8</td>
</tr>
<tr>
<td>15–18</td>
<td>148</td>
<td>60.2</td>
</tr>
<tr>
<td>Weight group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>142</td>
<td>57.7</td>
</tr>
<tr>
<td>Overweight</td>
<td>50</td>
<td>20.3</td>
</tr>
<tr>
<td>Obese</td>
<td>54</td>
<td>22.0</td>
</tr>
<tr>
<td>Years of stay in RCH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year or less</td>
<td>139</td>
<td>68.8</td>
</tr>
<tr>
<td>&gt;1 year</td>
<td>63</td>
<td>31.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean (SD)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total FV (servings)</td>
<td>2.5 (1.7) 0–11</td>
</tr>
<tr>
<td>Age, years</td>
<td>14.9 (1.8) 11–18</td>
</tr>
<tr>
<td>BMI</td>
<td>24.8 (6.2) 16.3–45.4</td>
</tr>
</tbody>
</table>

*aHispanic, mixed race, other or unknown.*
Adolescents

The participants for this study were 49% female, had a mean age of 14.9 (SD = 1.8) and were mixed racially. Using the Centers for Disease Control and Prevention growth charts, 57.7% were considered normal weight, 20% were overweight and 22% were obese (Table II) [29]. The adolescents consumed an average of 2.5 servings of FV per day. In total, 8.5% of the adolescents (n = 21) met the recommended 5 servings of FV per day. There were no significant differences in FV consumption by race, gender, age, weight group and years living in the Children’s Home.

Food environment of RCHs

The mean score for the index measuring the Total Food Environment was 2.10 (SD = 0.50). Means for the indices measuring the individual environmental variables ranged from 1.66 (Administrative Support) to 2.47 (availability and characteristics). Higher scores on the indices indicate a more favorable food environment for eating FV (Table I).

Relationship between the food environment and FV consumption using the PADEA variables as categorical data:

FV consumption was significantly higher for adolescents living in RCHs that scored high on the index measuring the Total Food Environment compared with adolescents who lived in RCHs that scored lower on the index measuring the Total Food Environment (P = 0.03) (Table III). In addition, adolescents living in RCHs which scored high on the index measuring Administrative Support consumed more FV than adolescents living in RCHs which scored lower on the same index (P = 0.01), and adolescents living in RCHs which scored higher on the index measuring FV Policy consumed more FV than adolescents living in RCHs which scored lower on the same index (P = 0.03). For the three remaining variables (availability, collaboration and the social environment), FV consumption was higher among adolescents living in the RCHs that scored higher on these three indices, but these differences were not statistically significant.

Relationship between the food environment and FV consumption using the PADEA variables as continuous data:

Mixed regression model analyses, when controlling for gender, age, BMI and years in the RCH, indicated that when the PADEA variables were analyzed as continuous variables, significant differences were found for the Total Food Environment (P = 0.01) and the FV policy (P = 0.02) variables. Thus, adolescents living in RCHs with

Table III. Relationship between environmental variables and child FV consumption (n of RCHs = 21; n of children = 246) using mixed-effects regression models and PADEA variables as categorical variables

<table>
<thead>
<tr>
<th>PADEA environmental variables</th>
<th>Number of RCH in high category</th>
<th>% (n) in high category of children living in RCHs</th>
<th>Mean (SD) score high category</th>
<th>Mean (SD) score low category</th>
<th>Mean (SE) servings of FV consumption in high category of children living in RCHs</th>
<th>Mean (SE) servings of FV consumption in low category of children living in RCHs</th>
<th>P-valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability and characteristics</td>
<td>7</td>
<td>38.2 (94)</td>
<td>2.90 (0.10)</td>
<td>2.20 (0.36)</td>
<td>2.5 (0.2)</td>
<td>2.5 (0.2)</td>
<td>0.21</td>
</tr>
<tr>
<td>Social environment related to eating FV</td>
<td>7</td>
<td>37.8 (93)</td>
<td>2.49 (0.13)</td>
<td>1.50 (0.60)</td>
<td>2.4 (0.2)</td>
<td>2.4 (0.2)</td>
<td>0.15</td>
</tr>
<tr>
<td>FV policy related to FVb</td>
<td>6</td>
<td>35.7 (82)</td>
<td>3.00 (0)</td>
<td>1.77 (1.18)</td>
<td>2.3 (0.2)</td>
<td>2.3 (0.2)</td>
<td>0.03</td>
</tr>
<tr>
<td>Collaboration with outside agencies</td>
<td>10</td>
<td>50.8 (125)</td>
<td>3.00 (0)</td>
<td>1.04 (0.99)</td>
<td>2.4 (0.2)</td>
<td>2.4 (0.2)</td>
<td>0.29</td>
</tr>
<tr>
<td>Administrative support for promoting FV</td>
<td>5</td>
<td>32.9 (81)</td>
<td>2.57 (0.11)</td>
<td>1.21 (0.69)</td>
<td>2.4 (0.1)</td>
<td>2.4 (0.1)</td>
<td>0.01</td>
</tr>
<tr>
<td>Total food environmentb</td>
<td>5</td>
<td>33.3 (82)</td>
<td>2.48 (0.33)</td>
<td>1.86 (0.43)</td>
<td>2.4 (0.1)</td>
<td>2.4 (0.1)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

aP-values are after adjustment for age, years of stay in home, gender and child BMI.
bNo. of children = 230.
a food environment more conducive to eating FV and with more policies related to FV eat significantly more FV. Administrative support, which was a significant variable in the analysis described above, was significant at the 0.10 level. For the other three variables, no significant differences were found. *P* values for availability, collaboration and the social environment were 0.12, 0.18 and 0.97, respectively.

**Discussion**

Our first aim was to describe adolescents living in the RCHs and the food environment of RCHs. Second, we wanted to explore the relationship between the food environment of the RCHs and the adolescents’ FV consumption; specifically, we wanted to examine whether adolescents who lived in RCHs with more favorable food environments ate more FV compared with adolescents who lived in RCHs with less favorable food environments.

Descriptive statistics indicate that the demographic variables of adolescents who live in RCHs in North and South Carolina are comparable to other adolescents living in these states. About 50% of our participants were female and about half were White. An additional 33% of the adolescents were African-American and a smaller percent were ‘other’, mostly Hispanic. This ethnic distribution is very similar to the ethnic distribution of the adolescents living in South Carolina and somewhat similar to adolescents in North Carolina (in North Carolina, the African-American population constitutes 22% of the overall population) [32]. The overall prevalence rates of overweight and obesity among the adolescents living in the RCHs were higher compared with adolescents nationwide. Compared with national child obesity prevalence rates of 17% [2], 22% of participants in our study were obese. Residents’ FV consumption was similar to the FV intake of adolescents nationwide in that only a minority of our participants met the 5 servings per day recommendation [33, 34]. However, the mean intake of 2.5 servings of FV among our participants was lower compared with the national mean FV intake of 3.9 servings of adolescents [33] indicating a need for interventions targeting dietary patterns among this specific population.

The Assistant CEOs of the RCHs reported home environments that were generally conducive to healthful eating. The availability index received the highest score of 2.47 (on a scale ranging from 0–3), indicating that FV were almost always available to the adolescents during meals and snacks. ‘Administrative support for promoting FV consumption’ received the lowest mean score (1.66), indicating ‘medium’ support from the RCHs’ administration.

The second aim of this paper was to determine if adolescents living in RCHs with food environments more conducive to eating FV consumed more servings of FV compared with adolescents living in RCHs with food environments less conducive to consuming FV. Two different approaches were used to examine these relationships, and the two approaches provided similar results. Our results suggest that adolescents living in RCHs with healthful food environments consumed more servings of FV than adolescents living in RCHs with less healthful food environments. This result is consistent with results from studies in different populations and settings. Past research in school and family home settings indicates that social and physical environments can have a significant effect of students’ food choices, including FV consumption [12–19, 35]. Kubik *et al.* [35] conducted a focus group study with adolescents attending alternative high schools, a population that may be similar to the population of our study. Results from Kubik’s study suggested that interventions targeting physical and social environmental factors including social norms, role models, social support and opportunities to practice a health behavior can potentially affect the dietary behaviors of this specific population [35].

Our study indicates that adolescents who live in RCHs with greater administrative support for healthy eating consumed more FV than adolescents who lived in RCHs with less administrative support. This finding is supported by studies targeting adolescents’ behavior in school settings [36]. In a review of environmental factors that shape health behavior, Weschler *et al.* [37] suggest that
administrative commitment by the school can help facilitate students’ behavior change. In a study examining implementation quality in a school-based delinquency prevention program, adequate support from school principals was one of two factors that contributed to the success of the intervention [37]. In another school-based study, specific aspects of the school climate, including the principal’s support, were associated with better implementation and institutionalization of the curriculum, which can be linked to greater behavior change [38]. However, our study showed an association between the environment and behavior pre-intervention. Possible mechanisms for the association between administrative support at the organizational level and FV consumption at the individual level include administrative support resulting in supportive organizational policies, increased availability and reinforcement of social norms [39].

Our study found trends suggesting that adolescents living in RCHs with greater FV availability, a more favorable social environment and greater collaboration with community agencies consumed more FV than adolescents living in RCHs with lower scores on these three indices; however, these trends were not found to be significantly different. These results are not consistent with results from other studies which suggest that these specific environmental variables, especially availability, are influential in adolescents’ dietary behaviors [40, 41]. Possible reasons for the finding specific to availability include (i) lack of variability in availability index scores, (ii) small sample size in terms of the RCHs and (iii) a high mean rating, which indicated widespread FV availability for meals and snacks. It may be difficult to examine the role of availability if availability is consistently high across all organizational settings.

**Limitations**

As in any study, several limitations must be considered. First, all data were self-reported and subject to bias and social desirability when a respondent answers a question the way he/she believes that the surveyor wants him or her to answer. For example, the Assistant CEO may misrepresent the environment at their RCH to make the RCH ‘look’ better. Furthermore, the Assistant CEOs may not have been the best respondents to answer the questions about availability of FV during meals and snacks; perhaps, the direct care staff could have provided more accurate information. However, the Assistant CEOs were selected as organizational respondents because they were able to provide an overall accurate picture of the food environment including organizational policy. A second limitation is that a significant number of RCH’s and children living within the RCHs did not elect to be part of the study. We did not collect information from these RCH and can therefore not determine whether these RCHs or children were different from the participating RCHs and children. A third limitation of the study was the use of RCH staff to recruit the children to participate in the study. Depending on the level of motivation of the staff to recruit, we ended up with more or less participants. However, because the RCH staff knew the children so much better than our research staff did, we had to rely on the RCH staff to decide which of the children were able to reliably complete our instruments. Another consideration is that this study has a cross-sectional study design and thus causal relationship cannot be inferred. Fifth, the small sample size of the RCHs decreased power to find statistically significant differences in the analyses. More RCHs in our sample would have allowed for the analyses to be more adequately powered. In addition, if the number of RCHs in our sample had been larger, we would have been able to use a more ‘high-risk’ approach for our data analysis in which we compared the adolescents in the lowest third group with those in the higher two-thirds group. We were unable to use this approach because of our small sample size and the distribution of the adolescents within the RCHs. Another limitation is the fact that some children completed the 24-hour dietary recall for two week days while others reported the 24-hour dietary recall for a week and weekend day. Because the purpose of our study was to determine the influence of the RCH environments on the children’s FV intake,
it did not make sense to have children complete a dietary recall while they were not in the RCH environment. In addition, although differences in weekend versus week day eating have been noted, these differences tend to be very minimal for children in the 2–18 age group [42]. Analyses conducted for this study showed no significant differences in FV consumption between week and weekend days. Lastly, this study was conducted in RCHs in North Carolina and South Carolina and results are not generalizable to residents of RCHs in other parts of the country. However, even though this study has limited generalizability, it is an important first step and provides important information about an under-studied population.

Conclusions

Although public health researchers and practitioners are interested in the role of the food environment and individuals’ behaviors, there is a paucity of studies that have used a comprehensive model to examine specific environmental characteristics and dietary behavior. There are also very few studies examining health behaviors among adolescents living in RCHs, even though this population is relatively large and may benefit from health promotion programs. Our results indicate that the RCH’s overall food environment, including policies related to FV and organizational support, is related to FV consumption among adolescents living in RCHs. Although no research has been done to determine the minimum length of time a person needs to be in a certain environment before the environment actually has an influence on that individual, it seems logical that some environmental factors (such as availability of specific foods) will have immediate impact while others (such as social environmental factors) make take longer to have an impact. Therefore, even though our study showed that many children live in an RCH <1 year, any time spent in a ‘healthy’ food environment can have some impact on a child, especially during the years that a child is becoming more independent and is learning independent living skills. Therefore, changing the RCHs environments is one effective intervention strategy to change dietary behavior of children who live in the RCHs.

Funding

The Duke Endowment. (1292-SP).

Acknowledgements

The authors wish to thank all the children, adolescents and the RCHs who are participating in the ENRICH study. The authors would also like to acknowledge the contributions of Lauren Workman and Chris Stewart for individual behavior data collection and Drs Melissa Stigler and Andrew Springer for providing feedback to drafts of the manuscript. Lastly, we want to thank our anonymous reviewers for their insightful comments. Any opinions, findings, conclusions or recommendations contained herein are those of the authors and do not necessarily reflect the views of The Duke Endowment.

Conflict of interest statement

None declared.

References


Received on January 27, 2008; accepted on October 1, 2008.