



## The baseline characteristics of parents and African American girls in an online obesity prevention program: A feasibility study

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### ABSTRACT

The objective of this paper was to identify the relationships and associations between child and parent characteristics with child fruit and vegetable (FV) consumption in an online obesity prevention program for 8–10 year old African American girls. Girls and a parent ( $n = 342$  child-parent pairs) in the southwestern US completed baseline data collection from 2012 to 2014. Girls and a parent completed self-report questionnaires online. Girls also completed two unannounced 24 hour telephone-based dietary recalls. The relationships of parent demographic characteristics, child FV intake, and psychosocial variables (child and parent) were examined by analysis of variance. Pearson correlation coefficients were calculated to determine the relationships between psychosocial variables and child FV intake. Child FV intake was significantly greater in the highest household education ( $p = 0.001$ ) and income groups ( $p = 0.004$ ). FV home availability was higher with older parents ( $p = 0.007$ ) and two-parent households ( $p = 0.033$ ). Child FV intake was positively related to child FV preferences ( $p < 0.001$ ), FV home availability ( $p = 0.022$ ), and FV home accessibility ( $p = 0.002$ ) but was negatively related to family barriers to FV consumption ( $p = 0.000$ ). The study highlighted significant findings between child FV consumption and parent psychosocial variables and demographic characteristics that may offer insights for the design of effective obesity prevention interventions for 8–10 year old African American girls.

[ClinicaTrials.gov](http://ClinicalTrials.gov) (NCT01481948).

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### 1. Introduction

African American girls have a greater risk of obesity than non-Hispanic white girls (Ogden et al., 2012). For 6 to 19 year old girls, the prevalence of obesity was higher for African American girls (26%) compared to white girls (13%) (Ogden et al., 2012). Obesity in childhood tracks into adulthood (Craigie et al., 2011). Thus, preventing obesity prior to adolescence may reduce the risk of obesity (Singh et al., 2008) and associated health issues, including hypertension and type 2 diabetes (Dietz and Robinson, 2005), during adulthood. Long term energy imbalance contributes to obesity risk, particularly when energy intake is greater than expenditure (Goran and Treuth, 2001). Diet and physical activity contribute to energy balance (Hill and Melanson, 1999; Salbe et al., 2002), and they are modifiable behaviors (Craigie et al., 2011). Thus, they are key targets for obesity prevention programs.

The diet and physical activity behaviors of African American girls contribute to their risk of obesity (Klesges et al., 2008; Ritchie et al., 2007;

Robinson et al., 2008). In studies conducted with 8–10 year old African American girls, it was found they consumed a high fat diet and did not meet fruit and vegetable (FV) recommendations (Klesges et al., 2008; Robinson et al., 2008). Consuming more FV reduces overall energy density of the diet, improves satiety, helps with weight management (Tohill, 2005), and reduces the risk for chronic diseases (Bazzano, 2006). A study also reported that physical activity in 8–10 year old African American girls averaged a total of a half hour daily of moderate to vigorous physical activity (Robinson et al., 2008) which is below the daily recommendation of at least 1 h of physical activity for children (U. S. Department of Health and Human Services - Office of Disease Prevention and Health Promotion, 2016). Because diet and physical activity behaviors track into adulthood, establishing these healthy behaviors in childhood may contribute to healthy behaviors in adulthood and reduce the risk for obesity and associated diseases (Craigie et al., 2011).

Parents are the gatekeepers of the home environment; therefore, their participation in child-focused behavior change programs and support for healthful diet and physical activity behaviors are essential (Gruber and Haldeman, 2009). Parent reported FV home availability and accessibility have been associated with child FV consumption (Cullen et al., 2004a; 2001; 2000; 2004c; Hearn et al., 1998). Family barriers to eating FV have been negatively associated with child FV

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### Abbreviations

BFG	Butterfly Girls Study
CNRC	Children's Nutrition Research Center
FV	fruit and vegetable
F	fruit
V	vegetable
SES	socioeconomic status

consumption (Cullen et al., 2000). Furthermore, parent characteristics (household income, education) are related to a child's FV consumption (Blanchette and Brug, 2005; Cullen et al., 2001; Kumanyika et al., 2014). Child FV preferences also influence child FV consumption (Domel et al., 1993; Domel et al., 1996; Kim et al., 2014; Krolner et al., 2011).

The literature, however, is limited regarding how these factors and others influence FV intake in African American girls. Exploring the relationships between parent behaviors, the home environment, child FV preferences, and child FV consumption may provide important insights that can inform the development of effective obesity prevention interventions for African American children.

Programs may be well designed and target appropriate behaviors, but if they are not available at convenient times, participation will suffer. Systematic reviews have shown some increases in child FV consumption (Ammerman et al., 2002; Knai et al., 2006), but the changes are not large enough to help children meet national recommendations for FV consumption (Krebs-Smith et al., 2010). Therefore, novel intervention approaches are needed to promote FV intake. Online programs may offer an alternative to traditional approaches. They are both convenient and appealing (Thompson et al., 2015) and have achieved dietary behavior change in children (Cullen et al., 2013; Ezendam et al., 2012; Hamel and Robbins, 2013; Kattelman et al., 2014; Thompson et al., 2009; Thompson et al., 2012a; Thompson et al., 2015; Whittemore et al., 2013). An online video game for fourth and fifth grade children increased FV consumption (Thompson et al., 2012a; Thompson et al., 2015) and similarly an online program for African American girls was developed to promote healthy lifestyle behaviors (Thompson et al., 2008). Furthermore, an online program for teens was successful in increasing V intake (Cullen et al., 2013). It is also important that interventions be culturally sensitive and appropriate to enhance likelihood of success (Kumanyika et al., 2005). African Americans are heavy users of the Internet (Smith, 2014), and Internet usage is prevalent among children (Rideout et al., 2010). Thus, a culturally appropriate online obesity prevention program would enable healthy behaviors to be presented to African American girls in a familiar and convenient format (Thompson et al., 2012a; Thompson et al., 2015; Thompson et al., 2012b).

Recognizing that African American girls are at a greater risk for becoming obese than their non-Hispanic white peers (Ogden et al., 2012), obesity interventions are needed specifically for African American girls. *The Butterfly Girls Study and the Quest for Founder's Rock (BFG)* is an online obesity prevention program created for 8–10 year old African American girls and parents (Thompson et al., 2013). The purpose of this paper is to identify relationships and associations between child and parent characteristics with child FV consumption.

## 2. Methods

### 2.1. Study design

This cross-sectional research is a secondary data analysis of the baseline data from a randomized control trial with African American girls. The study protocol was approved by the institutional review boards at Baylor

College of Medicine (H-27505) and Texas Woman's University. The protocol for the randomized control trial is registered with [ClinicaTrials.gov](http://ClinicaTrials.gov) (NCT01481948) (Thompson et al., 2013).

### 2.2. Intervention

The BFG study was an 8 episode online program promoting healthy diet and physical activity behaviors to 8–10 year old African American girls (Thompson et al., 2013). A three-group randomized design with three data collection periods tested the efficacy of this approach at changing and maintaining changes in diet and physical activity behaviors. For more detailed description of the intervention, please refer to the methods paper (Thompson et al., 2013). The research reported here uses the baseline data from that study.

### 2.3. Participants

Child inclusionary criteria included an African American girl, 8 to 10 years old, with Internet access, a personal email address, and a parent or legal guardian willing to participate in data collection; exclusionary criteria included having mental, physical, or medical conditions that limited their ability to participate in data collection activities or taking medications that impact appetite, dietary behaviors, and physical activity. Parent inclusionary criteria included having a child participating in the program, willingness to participate in data collection, and having Internet access and a personal email address; exclusionary criteria included physical restrictions that limited their ability to participate in data collection activities.

### 2.4. Recruitment

Families were recruited in several ways including the volunteer database at the Children's Nutrition Research Center (CNRC), recruitment announcements on websites (i.e., CNRC, Baylor College of Medicine, and Texas Children's Hospital) and in newsletters, posting flyers in community locations, mailing flyers out to community members and organizations, and community events. The rolling recruitment method was utilized for the study. Recruitment began in November 2012 and ended in October 2014. Written informed parental consent and child assent were received prior to participation in the study.

### 2.5. Baseline data collection

Data were collected from both parents and girls (Table 1). Parents completed self-report questionnaires online, while girls completed self-report questionnaires online and two dietitian-assisted telephone interviews.

The online questionnaires were hosted on a secure, password protected website. Parents and girls were received separate links and private passwords to complete the online surveys. After completion of baseline data collection, both parent and child each received a \$40 check from Baylor College of Medicine.

**Table 1**  
Baseline data collection for the Butterfly Girls Study.

Who	How	What
Girl	Phone	Dietary intake (2 recalls, NDSR 2012)
	Online	FV preferences
Parent	Online	FV intake brief screener
		FV home availability
		FV home accessibility
		Family barriers

## 2.6. Self-report data

1. **Child self-report data.** In the online survey, the girls completed a survey measuring the following child psychosocial characteristic: 37-item questionnaire reporting fruit, juice, and vegetable preferences (Domel et al., 1993) with a 3-item response format (0 = I do not like this one, 1 = I like this a little, and 2 = I like this a lot). Possible scores ranged from 0 to 74, with a higher score indicating greater preference. For the purpose of controlling potential bias in the self-report data, social desirability was also collected in a 9-item questionnaire (Dadds et al., 1998; Reynolds and Paget, 1983) with the response options yes or no.
2. **Parent self-report data.** In the online survey, parents provided demographic information which included age, highest level of education, household income, household size, and marital status. Parents also completed self-report data measuring parent psychosocial characteristics:
  - a. **Parent FV Intake brief screener.** Parents identified how often (i.e., times per week, times per day) they ate or drank servings of fruits, juices, and vegetables in the past month on a 7-item questionnaire (Thompson et al., 2000) with a 10-item response format (i.e., (0 = never, 1 = 1–3 times/month, 2 = 1–2 times/week, 3 = 3–4 times/week, 4 = 5–6 times/week, 5 = 1 time/day, 6 = 2 times/day, 7 = 3 times/day, 8 = 4 times/day, 9 = 5 or more times/day). Possible scores ranged from 0 to 63, with higher scores indicating greater consumption.
  - b. **FV Home Availability.** Parents were asked to identify which of the 3 juices, 17 fruits, and 20 vegetables (40-item questionnaire in total) were available within the home environment in the last two weeks (Cullen et al., 2004c) with a 3-item response format (0 = no, 1 = not sure, 2 = yes). Possible scores ranged from 0 to 80, with higher scores representing greater availability.
  - c. **FV Home Accessibility.** Parents were asked to identify whether fruit, juices, and vegetables were at the front of the refrigerator and whether FV were visible on a surface in the home and cut up or ready to eat in a 6-item questionnaire (Hearn et al., 1998; Thompson et al., 2015) with a 3-item response format (0 = no, 1 = not sure, 2 = yes). Possible scores ranged from 0 to 12, with higher scores representing greater accessibility.
  - d. **Family Barriers to Eating FV.** Parents completed a 14-item questionnaire about barriers to buying, preparing, serving, and eating FV in the home environment (Cullen et al., 2000) with a 3-item response format (0 = disagree, 1 = agree a little, 2 = agree a lot). Possible scores ranged from 0 to 28, with higher scores indicating greater barriers.

## 2.7. Child dietary intake

Food and beverage intakes were measured from two unannounced 24 hour dietary recalls (1 weekday, 1 weekend) (Table 1). Trained staff members conducted recalls directly with the child over the phone, using the Nutrient Data System for Research (NDSR-2012, University of Minnesota) and food amount booklets displaying 2-dimensional food and measurement models. The families were provided with a paper copy of the food amount booklet for use in the dietary recalls. The girls were asked where they ate, what they were doing while eating, and who was present when they ate. The dietary data collection team was blinded to participant group assignments in the online intervention program. FV servings were analyzed from the two dietary recalls to determine average servings of FV (Cullen et al., 2004b). The definition of FV intake included F, excluding 100% juice, and V, excluding high fat and fried vegetables (Thompson et al., 2015). Juice and high fat and fried V were excluded because these are not the types of FV promoted in the intervention. In order to fully assess intervention effects, this more conservative definition of FV was used.

## 2.8. Statistics

Descriptive statistics were calculated for demographic, psychosocial, and dietary intake variables of the baseline data. Means and standard deviations were calculated for child FV intake and parent and child psychosocial variables. Frequencies and percentages were calculated for the demographic characteristics. Analysis of variance (ANOVA) was conducted to examine relationships in baseline parent demographic characteristics, child FV intake, and psychosocial variables (child and parent). Pearson correlation coefficients were calculated to examine the relationships between psychosocial variables (child and parent) and child FV intake. Statistical significance was set at  $p < 0.05$ . All statistical analysis was conducted using SAS (version 9.4, SAS Institute Inc., Cary, NC, 2010–12).

## 3. Results

### 3.1. Demographic characteristics

Three hundred and forty-two families completed baseline data collection. The majority of parents were African American (92.1%), female (98.8%), <40 years old (59.7%), and married (62%). Highest level of household education was fairly equally distributed, with 34.8% having less than a college education, 33.9% having a college degree, and 31.3% having a post graduate education. The majority of families (57.0%) had a household income greater than \$42,000 (Table 2). All girls recruited for the study met the inclusionary criteria for an African American girl, 8–10 years of age.

### 3.2. Child dietary and psychosocial characteristics

Child dietary intake and psychosocial variables are presented in Table 3. Mean daily child FV intake was 1.89 servings. FV servings were comprised of a mean of  $0.74 \pm 0.95$  servings of F and  $1.15 \pm 0.85$  servings of V. Internal consistencies for the child FV preference ( $\alpha = 0.86$ ) and parent FV home availability questionnaires ( $\alpha = 0.80$ ) were high (Table 3). Cronbach's alpha above 0.70 indicates a highly reliable or internally consistent measure.

### 3.3. Parent demographic characteristics, parent psychosocial variables, and child FV intake

Significant differences in child FV intake were found for highest household education ( $p = 0.001$ ) and household income ( $p = 0.004$ ) (Table 4). Girls living in households with post graduate study had higher

**Table 2**  
Descriptive statistics of parent characteristics<sup>a</sup> for the Butterfly Girls Study.

	n	Percentage
Race/ethnicity		
African American	315	92.11
Non-African American	27	7.89
Gender		
Male	4	1.17
Female	338	98.83
Age (yr)		
≤39 yr	204	59.65
≥40 to 59 yr	138	40.35
Parent marital status		
Non-married	130	38.01
Married	212	61.99
Highest household education		
Less college	119	34.8
College graduate	116	33.92
Post graduate study	107	31.29
Household income		
<\$42,000	147	42.98
>\$42,000	195	57.02

<sup>a</sup> n = 342.

**Table 3**  
Baseline measures of the girls and their parent<sup>f</sup> for the Butterfly Girls Study.

	Mean ± SD	Min-max	Cronbach a
FV intake (servings/day)	1.89 ± 1.31	0, 9.50	–
Fruit (servings/day)	0.74 ± 0.95	0, 9.50	
Vegetable (servings/day)	1.15 ± 0.85	0, 4.30	
Child FV preference <sup>a</sup>	47.28 ± 11.27	12, 73	0.86
Parent FV intake (servings/day) <sup>b</sup>	3.83 ± 2.29	0.13, 11	0.60
Parent FV home availability <sup>c</sup>	45.37 ± 12.05	12, 78	0.80
Parent FV home accessibility <sup>d</sup>	8.52 ± 2.78	0, 12	0.57
Parent family barriers to eating FV <sup>e</sup>	6.10 ± 3.00	0, 17	0.61

<sup>a</sup> Child FV preference = 0 to 74; greater preference with higher scores.

<sup>b</sup> Parent FV intake = 0 to 63; greater consumption with higher scores.

<sup>c</sup> FV home availability = 0 to 80; greater availability with higher scores.

<sup>d</sup> FV home accessibility = 0 to 12; greater accessibility with higher scores.

<sup>e</sup> Family barriers to eating FV = 0 to 28; greater barriers with higher scores.

<sup>f</sup> n = 342.

FV intakes than girls living in households with or without a college degree. Girls living in households with annual household incomes above \$42,000 had higher FV intakes than those living in households with incomes \$42,000 or less each year.

Significant differences in home FV availability were found for parent age ( $p = 0.007$ ) and marital status ( $p = 0.033$ ) (Table 4). Home FV availability was higher in household with parents 40 to 59 years old compared to younger parents. Home FV availability was also higher in homes where parents were married compared to those who reported not being married.

#### 3.4. Relationships between child FV consumption and psychosocial variables

Child FV intake was positively related to child FV preferences ( $p < 0.001$ ), home availability ( $p = 0.022$ ), and home accessibility ( $p = 0.002$ ), but child FV intake was negatively related to barriers to FV consumption ( $p = 0.000$ ) (Table 5).

## 4. Discussion

This study examined the differences in child FV intake and parent psychosocial variables by parent demographic characteristics, and the relationships between child FV intake, child FV preferences, and parent psychosocial variables. Several significant differences and relationships were found, contributing to the body of evidence regarding factors to consider when designing dietary interventions for African American girls.

The significant differences found in child FV intake for varying levels of household education are consistent with previous studies. European schoolchildren living in households with higher levels of education reported higher consumption of low fat and low sugar foods, including F and V, compared to children living in households with medium and low levels of education (Fernandez-Alvira et al., 2013). Among Canadian adolescents, the frequency of FV intake increased as level of household education increased (Riediger et al., 2007). Furthermore, for 9 and 10 year old girls in the NHLBI Growth and Health Study, higher education was related to higher diet quality, including lower dietary fat and higher intakes of vitamin C, calcium, and potassium (Crawford et al., 1995).

Consistent with the literature, children living in higher income households reported eating more F and V. For toddler and pre-school aged children in Malaysia, mean F intake was lower for children from lower income households and higher for children from higher income households (Mohd Shariff et al., 2015). The frequency of FV intake among Canadian adolescents increased as household income increased (Riediger et al., 2007). F intake differed significantly for Norwegian children by socioeconomic status (SES) group; F intake was higher for the high SES group compared to the medium and low SES group (Sandvik et al., 2010). Crawford et al. found that higher income was related to higher intakes of vitamin C and lower intakes of dietary fat in 9 and 10 year old girls in the United States (Crawford et al., 1995).

New findings from this study regarding FV availability were that home FV availability was higher in households with older parents and in two-parent households. Perhaps older parents have more knowledge and experience (i.e., purchasing FV) and more FV available in the home than younger parents. The second new finding suggests that single parents may have limited time and resources for planning, shopping and preparation in order to have FV available in the home compared to two-parent households.

The significant relationship between child FV consumption and FV preferences is supported by previous findings. Domel et al. found that FV preferences were consistently related to FV consumption in fourth and fifth grade children (Domel et al., 1993; Domel et al., 1996). Similarly, Gross et al. found that students who reported higher FV preferences had higher daily average FV consumption (Gross et al., 2010). For 11 year old European children, FV preferences were significantly correlated with FV intake (Wind et al., 2006). Furthermore, in the Project EAT study with adolescents, FV preferences were significantly correlated with FV intake (Neumark-Sztainer et al., 2003). Taken together, these studies suggested that child FV preferences positively influenced FV consumption.

**Table 4**  
Differences in child FV intake, FV home availability, FV home accessibility, & family barriers by parent characteristics for the Butterfly Girls Study.

	Child FV intake <sup>a</sup>		FV home availability <sup>b</sup>		FV home accessibility <sup>c</sup>		Family barriers to eating FV <sup>d</sup>	
	Mean ± SE	p-Value	Mean ± SE	p-Value	Mean ± SE	p-Value	Mean ± SE	p-Value
Age (yr)		0.051		0.007		0.137		0.176
<39 yr	3.63 ± 0.16		43.93 ± 0.84		8.33 ± 0.19		5.92 ± 0.21	
≥40 to 59 yr	4.12 ± 0.19		47.50 ± 1.02		8.79 ± 0.24		6.37 ± 0.26	
Education level <sup>e</sup>		0.001		0.840		0.564		0.131
Less college	3.47 ± 0.21 <sup>e</sup>		45.74 ± 1.11		8.31 ± 0.26		5.94 ± 0.27	
College graduate	3.56 ± 0.21 <sup>e</sup>		44.84 ± 1.12		8.56 ± 0.26		6.55 ± 0.28	
Post Graduate study	4.53 ± 0.22 <sup>f</sup>		45.53 ± 1.17		8.70 ± 0.27		5.79 ± 0.29	
Income		0.004		0.641		0.998		0.344
<\$42,000	3.42 ± 0.19		45.02 ± 1.00		8.52 ± 0.23		5.93 ± 0.25	
>\$42,000	4.14 ± 0.16		45.64 ± 0.86		8.52 ± 0.20		6.24 ± 0.22	
Marriage		0.104		0.033		0.771		0.122
Non-married	3.57 ± 0.20		43.60 ± 1.05		8.46 ± 0.24		6.42 ± 0.26	
Married	3.99 ± 0.16		46.46 ± 0.82		8.55 ± 0.19		5.91 ± 0.21	

<sup>a</sup> Child FV intake = servings per day.

<sup>b</sup> FV home availability = 0 to 80; greater availability with higher scores.

<sup>c</sup> FV home accessibility = 0 to 12; greater accessibility with higher scores.

<sup>d</sup> Family barriers to eating FV = 0 to 28; greater barriers with higher scores.

<sup>e</sup> Differences in child FV intake for the low and medium education levels.

<sup>f</sup> Differences in child FV intake for the high education level.

<sup>g</sup> Different superscripts between education levels differ significantly with Tukey-Kramer adjustment.



**Table 5**  
Correlations of girls' FV intake with girls' FV preferences and parent psychosocial variables for the Butterfly Girls Study.

	Corr	p-Value
Child FV preference	0.24	<0.0001
Parent FV intake	0.09	0.112
Parent home availability FV	0.12	0.022
Parent home accessibility FV	0.17	0.002
Parent family barriers to eating FV	−0.20	0.000

Corr = Pearson correlation.

A significant relationship between child FV intake and parent FV intake was not observed. However, the measures for child FV intake (24 hour dietary recalls) and parent FV intake (a brief screener) were different. The parent screener had low reliability. Perhaps the parent screener was not sensitive enough to detect differences in daily FV consumption. The relationships could have been masked because the time periods covered by these measures differed, or that the two days of the child dietary recalls were not enough to capture the variety of the children's diets. Future research is needed to further explore these issues that use common measurement methods and similar time periods.

FV home availability and home accessibility were positively related to the girls' FV consumption. Previous studies support this finding in Michigan (Hearn et al., 1998) and Texas (Cullen et al., 2001). Furthermore, parent FV accessibility was significantly correlated with FV consumption among fourth to sixth grade children (Cullen et al., 2003). These findings suggest that FV home availability and home accessibility are key factors in improving child FV consumption.

Family barriers to eating FV were negatively related to the girls' FV consumption. This finding is supported by previous research. Among fourth to sixth grade students and their parents, family barriers to eating FV were negatively related with child FV intake (Cullen et al., 2000). Perceived barriers to healthy eating were also negatively correlated with FV consumption in high school students (Bruening et al., 2010). The questionnaire for family barriers to eating FV was not highly reliable in this sample. Future research is needed to identify ways to enhance the reliability of this measure with African Americans families or to develop a new measure to capture this information.

FV home availability and accessibility were not related to household income and parent educational level. There are several possible explanations for the reason our results differ. First, the low income girls may have been enrolled in the National School Lunch Program and School Breakfast Program and therefore had access to FV in those meals (Cullen et al., 2015). The girls on non-free reduced price meals might have brought more meals from home instead; a school-based study demonstrated that FV in meals brought from home were low compared to meals purchased at school (Caruso and Cullen, 2015). Second, Houston has one of the largest food banks in the United States (Houston Food Bank, 2017), and they have programs that provide nutritious meals and snacks which include FV to low income children (Houston Food Bank - BB, 2017; Houston Food Bank - KC, 2017). Further, not all children in the sample were low income (see demographic profile), which may partially explain why our results differed from those published by others.

The average F intake for the girls participating at baseline did not meet total daily F recommendations of 1–1.5 cups for girls, ages 4 to 8, and 1.5 cups for girls, ages 9–13 (U. S. Department of Agriculture, 2016a). The average V intake did not meet total daily V recommendations of 1.5 cups for girls, 4 to 8, and 2 cups for girls, ages 9–13 (U. S. Department of Agriculture, 2016b). This supports the need to explore the factors that influence FV consumption in African American girls.

Strengths of the study include a large sample size, a range of parental education and household income levels, and a strong measure of child FV intake by excluding 100% juice and high fat and fried V. Limitations include conducting the study in one geographic location, which could potentially limit generalizability; the age of the girls, which may have impacted the accuracy of the dietary data (Thompson et al., 2016) and

answers provided in the online survey; and self-report data from the parents and girls have potential memory and recording errors. For dietary intake, different response periods between parent (screener) and child (dietary recalls) are also a limitation. Also, several parent questionnaires, including the parent FV intake screener and family barriers to eating FV, had low internal consistency, which could reduce the ability to identify significant relationships. Despite these limitations, the findings provide important information on the relationships between psychosocial variables related to the home food environment and parental characteristics that influence the FV intake of 8–10 year old African American girls.

## 5. Conclusion

In conclusion, this secondary data analysis highlighted significant findings between child FV consumption and parent psychosocial variables and demographic characteristics that may offer insight in how to design effective, accessible, and appealing obesity prevention programs for 8–10 year old African American girls and their families.

## Conflict of interest

The authors declare that there are no conflicts of interest.

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## References

- Ammerman, A.S., Lindquist, C.H., Lohr, K.N., Hersey, J., 2002. The efficacy of behavioral interventions to modify dietary fat and fruit and vegetable intake: a review of the evidence. *Prev. Med.* 35:25–41. <http://dx.doi.org/10.1006/pmed.2002.1028>.
- Bazzano, L.A., 2006. The high cost of not consuming fruits and vegetables. *J. Am. Diet. Assoc.* 106:1364–1368. <http://dx.doi.org/10.1016/j.jada.2006.06.021>.
- Blanchette, L., Brug, J., 2005. Determinants of fruit and vegetable consumption among 6–12-year-old children and effective interventions to increase consumption. *J. Hum. Nutr. Diet.* 18:431–443. <http://dx.doi.org/10.1111/j.1365-277X.2005.00648.x>.
- Bruening, M., Kubik, M.Y., Kenyon, D., Davey, C., Story, M., 2010. Perceived barriers mediate the association between self-efficacy and fruit and vegetable consumption among students attending alternative high schools. *J. Am. Diet. Assoc.* 110:1542–1546. <http://dx.doi.org/10.1016/j.jada.2010.07.001>.
- Caruso, M.L., Cullen, K.W., 2015. Quality and cost of student lunches brought from home. *JAMA Pediatr.* 169:86–90. <http://dx.doi.org/10.1001/jamapediatrics.2014.2220>.
- Craigie, A.M., Lake, A.A., Kelly, S.A., Adamson, A.J., Mathers, J.C., 2011. Tracking of obesity-related behaviours from childhood to adulthood: a systematic review. *Maturitas* 70: 266–284. <http://dx.doi.org/10.1016/j.maturitas.2011.08.005>.
- Crawford, P.B., Obarzanek, E., Schreiber, G.B., et al., 1995. The effects of race, household income, and parental education on nutrient intakes of 9- and 10-year-old girls. *NHLBI Growth and Health Study. Ann. Epidemiol.* 5:360–368. [http://dx.doi.org/10.1016/1047-2797\(95\)00033-4](http://dx.doi.org/10.1016/1047-2797(95)00033-4).
- Cullen, K.W., Baranowski, T., Rittenberry, L., et al., 2000. Socioenvironmental influences on children's fruit, juice and vegetable consumption as reported by parents: reliability and validity of measures. *Public Health Nutr.* 3:345–356. <http://dx.doi.org/10.1017/S136898000000392>.
- Cullen, K.W., Baranowski, T., Rittenberry, L., Cosart, C., Hebert, D., de Moor, C., 2001. Child-reported family and peer influences on fruit, juice and vegetable consumption: reliability and validity of measures. *Health Educ. Res.* 16:187–200. <http://dx.doi.org/10.1093/her/16.2.187>.

- Cullen, K.W., Baranowski, T., Owens, E., Marsh, T., Rittenberry, L., de Moor, C., 2003. Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Educ. Behav.* 30:615–626. <http://dx.doi.org/10.1177/1090198103257254>.
- Cullen, K.W., Baranowski, T., Klesges, L.M., et al., 2004a. Anthropometric, parental, and psychosocial correlates of dietary intake of African-American girls. *Obes. Res.* 12 (Suppl:205–315). <http://dx.doi.org/10.1038/oby.2004.265>.
- Cullen, K.W., Himes, J.H., Baranowski, T., et al., 2004b. Validity and reliability of a behavior-based food coding system for measuring fruit, 100% fruit juice, vegetable, and sweetened beverage consumption: results from the Girls Health Enrichment Multi-site Studies. *Prev. Med.* 38:S24–S33. <http://dx.doi.org/10.1016/j.ypmed.2003.05.001>.
- Cullen, K.W., Klesges, L.M., Sherwood, N.E., et al., 2004c. Measurement characteristics of diet-related psychosocial questionnaires among African-American parents and their 8–10 year old daughters: results from the Girls health Enrichment Multi-site Studies (GEMS). *Prev. Med.* 38 (Suppl:S34–42). <http://dx.doi.org/10.1016/j.ypmed.2003.05.002>.
- Cullen, K.W., Thompson, D., Boushey, C., Konzelmann, K., Chen, T.A., 2013. Evaluation of a web-based program promoting healthy eating and physical activity for adolescents: teen choice: food and fitness. *Health Educ. Res.* 28:704–714. <http://dx.doi.org/10.1093/her/cyt059>.
- Cullen, K.W., Chen, T.A., Dave, J.M., 2015. Changes in foods selected and consumed after implementation of the new National School Lunch Program meal patterns in southeast Texas. *Prev. Med. Rep.* 2:440–443. <http://dx.doi.org/10.1016/j.pmedr.2015.05.007>.
- Dadds, M.R., Perrin, S., Yule, W., 1998. Social desirability and self-reported anxiety in children: an analysis of the RCMAS lie scale. *J. Abnorm. Child Psychol.* 26:311–317. <http://dx.doi.org/10.1023/A:1022610702439>.
- Dietz, W.H., Robinson, T.N., 2005. Clinical practice. Overweight children and adolescents. *N. Engl. J. Med.* 352:2100–2109. <http://dx.doi.org/10.1056/NEJMcP043052>.
- Domel, S.B., Baranowski, T., Davis, H., Leonard, S.B., Riley, P., Baranowski, J., 1993. Measuring fruit and vegetable preferences among 4th- and 5th-grade students. *Prev. Med.* 22:866–879. <http://dx.doi.org/10.1006/pmed.1993.1078>.
- Domel, S.B., Baranowski, T., Thompson, W.O., Davis, H.C., Leonard, S.B., Baranowski, J., 1996. Psychosocial predictors of fruit and vegetable consumption among elementary school children. *Health Educ. Res.* 11:299–308. <http://dx.doi.org/10.1093/her/11.3.299>.
- Ezendam, N.P., Brug, J., Oenema, A., 2012. Evaluation of the web-based computer-tailored FATaintPHAT intervention to promote energy balance among adolescents: results from a school cluster randomized trial. *Arch. Pediatr. Adolesc. Med.* 166:248–255. <http://dx.doi.org/10.1001/archpediatrics.2011.204>.
- Fernandez-Alvira, J.M., Mouratidou, T., Bammann, K., et al., 2013. Parental education and frequency of food consumption in European children: the IDEFICS study. *Public Health Nutr.* 16:487–498. <http://dx.doi.org/10.1017/s136989001200290x>.
- Goran, M.L., Treuth, M.S., 2001. Energy expenditure, physical activity, and obesity in children. *Pediatr. Clin. N. Am.* 48:931–953. [http://dx.doi.org/10.1016/S0031-3955\(05\)70349-7](http://dx.doi.org/10.1016/S0031-3955(05)70349-7).
- Gross, S.M., Pollock, E.D., Braun, B., 2010. Family influence: key to fruit and vegetable consumption among fourth- and fifth-grade students. *J. Nutr. Educ. Behav.* 42:235–241. <http://dx.doi.org/10.1016/j.jneb.2009.05.007>.
- Gruber, K.J., Haldeman, L.A., 2009. Using the family to combat childhood and adult obesity. *Prev. Chronic Dis.* 6, A106.
- Hamel, L.M., Robbins, L.B., 2013. Computer- and web-based interventions to promote healthy eating among children and adolescents: a systematic review. *J. Adv. Nurs.* 69:16–30. <http://dx.doi.org/10.1111/j.1365-2648.2012.06086.x>.
- Hearn, M.D., Baranowski, T., Baranowski, J., et al., 1998. Environmental influences on dietary behavior among children: availability and accessibility of fruits and vegetables enable consumption. *J. Health. Educ.* 29:26–32. <http://dx.doi.org/10.1080/10556699.1998.10603294>.
- Hill, J.O., Melanson, E.L., 1999. Overview of the determinants of overweight and obesity: current evidence and research issues. *Med. Sci. Sports Exerc.* 31:S515–S521. <http://dx.doi.org/10.1097/00005768-199911001-00005>.
- Houston Food Bank, 2017. Houston Food Bank - more about us. Houston, TX. ([Accessed March 9, 2017]; Available from:). <http://www.houstonfoodbank.org/aboutus/more-about-us/>.
- Houston Food Bank - BB, 2017. Houston Food Bank - backpack buddy. ([Accessed March 9, 2017]; Available from:). <http://www.houstonfoodbank.org/programs/backpack-buddy/>.
- Houston Food Bank - KC, 2017. Houston Food Bank - kids cafe. ([Accessed March 9, 2017]; Available from:). <http://www.houstonfoodbank.org/programs/kids-cafe/>.
- Kattelmann, K.K., Bredbenner, C.B., White, A.A., et al., 2014. The effects of Young Adults Eating and Active for Health (YEAH): a theory-based web-delivered intervention. *J. Nutr. Educ. Behav.* 46:S27–S41. <http://dx.doi.org/10.1016/j.jneb.2014.08.007>.
- Kim, S.A., Moore, L.V., Galuska, D., et al., 2014. Vital signs: Fruit and vegetable intake among children - United States, 2003–2010. *MMWR Morb. Mortal. Wkly Rep.* 63, 671–676.
- Klesges, R.C., Obarzanek, E., Klesges, L.M., et al., 2008. Memphis girls health enrichment multi-site studies (GEMS): phase 2: design and baseline. *Contemp. Clin. Trials* 29: 42–55. <http://dx.doi.org/10.1016/j.cct.2007.05.001>.
- Knai, C., Pomerleau, J., Lock, K., McKee, M., 2006. Getting children to eat more fruit and vegetables: a systematic review. *Prev. Med.* 42:85–95. <http://dx.doi.org/10.1016/j.ypmed.2005.11.012>.
- Krebs-Smith, S.M., Guenther, P.M., Subar, A.F., Kirkpatrick, S.J., Dodd, K.W., 2010. Americans do not meet federal dietary recommendations. *J. Nutr.* 140:1832–1838. <http://dx.doi.org/10.3945/jn.110.124826>.
- Krolner, R., Rasmussen, M., Brug, J., Klepp, K.I., Wind, M., Due, P., 2011. Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part II: qualitative studies. *Int. J. Behav. Nutr. Phys. Act.* 8:112. <http://dx.doi.org/10.1186/1479-5868-8-112>.
- Kumanyika, S.K., Gary, T.L., Lancaster, K.J., et al., 2005. Achieving healthy weight in African-American communities: research perspectives and priorities. *Obes. Res.* 13: 2037–2047. <http://dx.doi.org/10.1038/oby.2005.251>.
- Kumanyika, S.K., Swank, M., Stachecki, J., Whitt-Glover, M.C., Brennan, L.K., 2014. Examining the evidence for policy and environmental strategies to prevent childhood obesity in black communities: new directions and next steps. *Obes. Rev.* 15 (Suppl. 4): 177–203. <http://dx.doi.org/10.1111/obr.12206>.
- Mohd Shariff, Z., Lin, K.G., Sariman, S., et al., 2015. The relationship between household income and dietary intakes of 1–10 year old urban Malaysian. *Nutr. Res Pract.* 9: 278–287. <http://dx.doi.org/10.4162/nrp.2015.9.3.278>.
- Neumark-Sztainer, D., Wall, M., Perry, C., Story, M., 2003. Correlates of fruit and vegetable intake among adolescents. Findings from Project EAT. *Prev. Med.* 37:198–208. [http://dx.doi.org/10.1016/S0091-7435\(03\)00114-2](http://dx.doi.org/10.1016/S0091-7435(03)00114-2).
- Ogden, C.L., Carroll, M.D., Kit, B.K., Flegal, K.M., 2012. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. *JAMA* 307: 483–490. <http://dx.doi.org/10.1001/jama.2012.40>.
- Reynolds, C.R., Paget, K.D., 1983. National normative and reliability data for the revised children's manifest anxiety scale. *Sch. Psychol. Rev.* 12, 324–336.
- Rideout, V.J., Foehr, U.G., Roberts, D.F., 2010. Generation M2: Media in the Lives of 8- to 18-Year-Olds. Menlo Park, CA, Kaiser Family Foundation ([Accessed December 8, 2016]; Available from:). <http://files.eric.ed.gov/fulltext/ED527859.pdf>.
- Riediger, N.D., Shoostari, S., Moghadasian, M.H., 2007. The influence of sociodemographic factors on patterns of fruit and vegetable consumption in Canadian adolescents. *J. Am. Diet. Assoc.* 107:1511–1518. <http://dx.doi.org/10.1016/j.jada.2007.06.015>.
- Ritchie, L.D., Spector, P., Stevens, M.J., et al., 2007. Dietary patterns in adolescence are related to adiposity in young adulthood in black and white females. *J. Nutr.* 137, 399–406.
- Robinson, T.N., Kraemer, H.C., Matheson, D.M., et al., 2008. Stanford GEMS phase 2 obesity prevention trial for low-income African-American girls: design and sample baseline characteristics. *Contemp. Clin. Trials* 29:56–69. <http://dx.doi.org/10.1016/j.cct.2007.04.007>.
- Salbe, A.D., Weyer, C., Harper, I., Lindsay, R.S., Ravussin, E., Tataranni, P.A., 2002. Assessing risk factors for obesity between childhood and adolescence: II. Energy metabolism and physical activity. *Pediatrics* 110:307–314. <http://dx.doi.org/10.1542/peds.110.2.307>.
- Sandvik, C., Gjestad, R., Samdal, O., Brug, J., Klepp, K.I., 2010. Does socio-economic status moderate the associations between psychosocial predictors and fruit intake in schoolchildren? The Pro Children study. *Health Educ. Res.* 25:121–134. <http://dx.doi.org/10.1093/her/cyp055>.
- Singh, A.S., Mulder, C., Twisk, J.W., van Mechelen, W., Chinapaw, M.J., 2008. Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obes. Rev.* 9:474–488. <http://dx.doi.org/10.1111/j.1467-789X.2008.00475.x>.
- Smith, A., 2014. African Americans and Technology Use: a Demographic Portrait. Pew Research Center, Washington, DC ([Accessed December 8, 2016]; Available from:). <http://www.pewinternet.org/2014/01/06/african-americans-and-technology-use/>.
- Thompson, F.E., Kipnis, V., Subar, A.F., et al., 2000. Evaluation of 2 brief instruments and a food-frequency questionnaire to estimate daily number of servings of fruit and vegetables. *Am. J. Clin. Nutr.* 71, 1503–1510.
- Thompson, D., Baranowski, T., Cullen, K., et al., 2008. Food, fun, and fitness internet program for girls: pilot evaluation of an e-health youth obesity prevention program examining predictors of obesity. *Prev. Med.* 47:494–497. <http://dx.doi.org/10.1016/j.ypmed.2008.07.014>.
- Thompson, D., Baranowski, T., Baranowski, J., et al., 2009. Boy scout 5-a-day badge: outcome results of a troop and internet intervention. *Prev. Med.* 49:518–526. <http://dx.doi.org/10.1016/j.ypmed.2009.09.010>.
- Thompson, D., Bhatt, R., Lazarus, M., Cullen, K., Baranowski, J., Baranowski, T., 2012a. A serious video game to increase fruit and vegetable consumption among elementary aged youth (Squire's Quest! II): rationale, design, and methods. *JMIR Res. Protocol.* 1, e19. <http://dx.doi.org/10.2196/resprot.2348>.
- Thompson, D., Cullen, K.W., Boushey, C., Konzelmann, K., 2012b. Design of a website on nutrition and physical activity for adolescents: results from formative research. *J. Med. Internet Res.* 14, e59. <http://dx.doi.org/10.2196/jmir.1889>.
- Thompson, D., Mahabir, R., Bhatt, R., et al., 2013. Butterfly girls; promoting healthy diet and physical activity to young African American girls online: rationale and design. *BMC Public Health* 13:709. <http://dx.doi.org/10.1186/1471-2458-13-709>.
- Thompson, D., Bhatt, R., Vazquez, I., et al., 2015. Creating action plans in a serious video game increases and maintains child fruit-vegetable intake: a randomized controlled trial. *Int. J. Behav. Nutr. Phys. Act.* 12:39. <http://dx.doi.org/10.1186/s12966-015-0199-z>.
- Thompson, D., Ferry Jr., R.J., Cullen, K.W., Liu, Y., 2016. Improvement in fruit and vegetable consumption associated with more favorable energy density and nutrient and food group intake, but not kilocalories. *J. Acad. Nutr. Diet.* 116:1443–1449. <http://dx.doi.org/10.1016/j.jand.2016.05.002>.
- Tohill, B.C., 2005. Dietary Intake of Fruit and Vegetables and Management of Body Weight [Electronic Resource]. World Health Organization (WHO).
- U. S. Department of Agriculture, 2016a. Choose my plate. All about the fruit group. ([Updated July 26, 2016; Accessed December 9, 2016]; Available from:). <https://www.choosemyplate.gov/fruit>.
- U. S. Department of Agriculture, 2016b. Choose My Plate. All about the vegetable group. ([Updated July 26, 2016; Accessed December 9, 2016]; Available from:). <https://www.choosemyplate.gov/vegetables>.
- U. S. Department of Health and Human Services - Office of Disease Prevention and Health Promotion, 2016. Physical activity guidelines: children and adolescents. ([Updated December 8, 2016; Accessed December 8, 2016]; Available from:). <https://health.gov/paguidelines/guidelines/children.aspx>.
- Whittemore, R., Chao, A., Popick, R., Grey, M., 2013. School-based internet obesity prevention programs for adolescents: a systematic literature review. *Yale J. Biol. Med.* 86, 49–62.
- Wind, M., de Bourdeaudhuij, I., te Velde, S.J., et al., 2006. Correlates of fruit and vegetable consumption among 11-year-old Belgian-Flemish and Dutch schoolchildren. *J. Nutr. Educ. Behav.* 38:211–221. <http://dx.doi.org/10.1016/j.jneb.2006.02.011>.