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Psychosocial and demographic predictors of fruit, juice and vegetable consumption among 11–14-year-old Boy Scouts

M Shayne Gallaway[1,*], Russell Jago[2], Tom Baranowski[3], Janice C Baranowski[3] and Pamela M Diamond[4]

[1]Houston Health Science Center, School of Public Health, The University of Texas at Houston, 1200 Hermann Pressler Drive, Suite E-627, Houston, TX 77030, USA: [2]Department of Exercise, Nutrition and Health Sciences, University of Bristol, Bristol, UK: [3]Department of Pediatrics, Children's Nutrition Research Center, Baylor College of Medicine, Houston, TX, USA: [4]Houston Health Science Center, Center for Health Promotion, The University of Texas at Houston, Houston, TX, USA

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Abstract

Objective: Psychosocial and demographic correlates of fruit, juice and vegetable (FJV) consumption were investigated to guide how to increase FJV intake.
Design: Hierarchical multiple regression analysis of FJV consumption on demographics and psychosocial variables.
Setting: Houston, Texas, USA.
Subjects: Boys aged 11–14 years ($n = 473$).
Results: FJV preference and availability were both significant predictors of FJV consumption, controlling for demographics and clustering of Boy Scout troops. Vegetable self-efficacy was associated with vegetable consumption. The interaction of preference by home availability was a significant predictor of FJV. The interaction of self-efficacy by home availability showed a trend towards significantly predicting vegetable consumption. No significant interactions were found between body mass index and the psychosocial variables.
Conclusions: Findings suggest that future interventions emphasising an increase in preference, availability and efficacy may increase consumption of FJV in similar populations.

Keywords
Psychosocial
Fruit
Juice
Vegetables
Correlates
Children
Adolescents
Self-efficacy
Preferences
Home availability

There is strong epidemiological evidence of a protective role of fruit and vegetables in the prevention of cancer[1,2], coronary heart disease[3] and becoming overweight[4]. According to the National Health and Nutrition Examination Survey 1999–2002, 16% (>9 million) of all US children and teens were overweight[5]. Overweight and obesity substantially increase the risk of illness from high blood pressure, high cholesterol, heart disease and stroke[6], type 2 diabetes[7] and some cancers[8].

Children's dietary intake behaviour is important because it may track into adolescence and adulthood[9–11]. Persons of all ages[12], all ethnic subgroups (non-Hispanic white, non-Hispanic black, Hispanic, and other)[13,14] and in various countries[15–17] eat fewer than the recommended number of servings of fruit, juice and vegetables (FJV). Factors identified as contributing to low FJV consumption in the past have included low home availability and accessibility[18,19], low preference and low self-efficacy[19,20].

FJV preferences predicted FJV intake in both child and adult populations[21–32]. FJV self-efficacy – the ability to select, prepare and eat FJV – has been associated with consumption in some studies[23,25,28,31,33,34] but not in others[24,27]. This might indicate that previously reported associations between self-efficacy and FJV intake may be influenced by other factors. Home FJV availability has been associated with consumption among children[29,30,32,34–36].

Interactions among predictors of FJV consumption have been investigated. The interaction between preference and home availability predicted FJV consumption[30]. An interaction between self-efficacy and availability also predicted FJV consumption[29,36]. A recent study investigated whether psychosocial determinants of FJV intake differed between normal and overweight boys[37]. FJV consumption among overweight children may differ from that of children with normal weight-for-age as a result of lower FJV preference, home availability or efficacy. The primary objective of the present study was to assess whether FJV preferences, home FJV availability and FJV self-efficacy were associated with FJV consumption. The secondary objective was to examine possible interactions among FJV preference, home availability, self-efficacy and body mass index (BMI) on consumption, as a new contribution to the existing literature.

*Corresponding author: Email Michael.S.Gallaway@uth.tmc.edu

Social desirability has been defined as a tendency to overestimate desirable traits and underestimate undesirable ones, when using self-report measures[38]. A significant negative association was found between reported sweetened beverage preference and social desirability among a sample ($n = 95$) of 8–10-year-old African American girls, suggesting that social desirability biased participant response; and social desirability was also a confounder between BMI and self-reported levels of energy intake[39]. It is therefore important to control for this possible self-report bias.

This study assessed the BMI, psychosocial and demographic influences on the amount of FJV intake reported by 11–14-year-old males.

Methods

Study population

Participants were a convenience sample of 11–14-year-old Boy Scouts residing in Houston, Texas, USA or surrounding communities, recruited to participate in an achievement badge programme. The eight-week intervention was implemented at two separate periods of time, spring 2003 and fall 2003. The total baseline number of participants recruited ($n = 473$) was randomised by troop into either the Fit for Life[40] or 5 A Day Achievement[41] Badge Intervention. This study was approved by the Institutional Review Board, and all participants provided parental consent and assent.

Measures

Demographic variables

Demographic variables included race/ethnicity, age and family education. All variables were self-reported by either a parent or guardian. Race/ethnicity of the participant was selected as one of the following: 'black or African American', 'white', 'American Indian or Alaska Native', 'Asian or Pacific Islander', 'Hispanic or Latino', and 'Other (please specify)'. Family education was selected as one of the following: '6th grade or less', '8th grade or less', 'attended some high school', 'high school graduate or GED' (General Education Development), 'technical school', 'some college', 'college graduate', and 'postgraduate study'.

Psychosocial variables

The Social-Cognitive Theory[42] served as the theoretical framework in selecting psychosocial determinants for inclusion in this study. FJV preferences were assessed using a previously validated questionnaire with a mean test–retest reliability of 0.73 (fruit, $P < 0.001$) and 0.71 (vegetables, $P < 0.001$)[43]. Response categories included: 'I do not like this', 'I like this a little' and 'I like this a lot', and were coded as 1, 2 or 3, respectively, and summed to achieve preference scores for fruit and juices (FJ) and vegetables (V). FJ and V self-efficacy were assessed using a previously validated 21-item questionnaire with a test–retest reliability ranging from 0.35 to 0.67[24]. Home FJ and V availability were assessed using a previously validated 48-item questionnaire that reported correlations between actual and reported availability of fruits ($r = 0.56$, $P < 0.001$), juices ($r = 0.52$, $P < 0.001$) and vegetables ($r = 0.44$, $P < 0.001$)[44]. Social desirability was measured through the administration of the 'lie scale' from the revised Manifest Anxiety Scale to control for socially desirable responses[45].

Anthropometry

Height (cm) was measured to the nearest 0.1 cm using a stadiometer (Perspective Enterprises). Body weight (kg) was measured to the nearest 0.1 kg using a calibrated scale (SECA, model 770 or 882). BMI ($kg\,m^{-2}$) and BMI percentile were calculated for all participants using age- and gender-specific percentiles from the 2000 growth charts of the Centers for Disease Control and Prevention[46]. BMI percentile was categorised into one of the following categories: normal (BMI < 85 percentile), at risk (85 percentile < BMI < 95 percentile), or overweight (BMI > 95 percentile). BMI percentiles were developed for the US population and are the most common indicator to assess the size and growth patterns of American children because body size changes with age and differs according to gender.

Fruit, 100% juice and vegetable consumption

FJV consumption was assessed using a food-frequency questionnaire previously validated with four 24-hour dietary recall interviews, with a mean test–retest reliability of 0.54 ($P < 0.01$) (fruit, 0.71 ($P < 0.0001$); juice, 0.42 ($P < 0.05$); vegetables, 0.53 ($P < 0.01$)) and a mean validity of 0.77 ($P < 0.001$) (fruit, 0.74 ($P < 0.001$); vegetables, 0.41 ($P < 0.01$))[47]. Participants reported consumption of 18 specific brands or types of drinks in addition to four types of 100% fruit juices. All the scores were divided by seven to produce average servings of FJV consumed daily. Intake was computed for each variable (fruit and juice, vegetables).

Data analysis

As previous studies have shown that different associations are detected for the prediction of fruit and juices than for vegetables[30], separate models were run in which either FJ consumption or V consumption was the dependent variable. Descriptive statistics were used to describe key variables and a Pearson correlation matrix was generated to assess correlations between psychosocial variables. Stepwise linear models that controlled for the clustering of the Boy Scouts by troops were performed using the PROC MIXED procedure in SAS version 8.0 (SAS

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Institute). The models were built in three stages: (1) demographics (and social desirability); (2) BMI and psychosocial variables; and (3) interaction terms including BMI and psychosocial variables. Non-significant psychosocial variables and interaction terms were removed from the multiple regression models in a backward deletion process ($P < 0.10$) until all variables remaining were significant ($P < 0.10$). Troop-related intra-class correlations were calculated using the formula developed by Singer[48]. Level 1 (within-unit variance) and level 2 (between-unit variance) R^2 values were estimated with the formulas developed by Snijders and Bosker[49].

Results

Participants were on average 12.8 (standard deviation (SD) 1.1) years of age and predominantly white (73%) (see Table 1). The mean BMI was 21.3 (SD 4.5) $kg\,m^{-2}$, and 32.6% of the subjects were in the BMI-for-age percentile categories of at risk or overweight. This sample had a high family education, with close to 70% living in a home with a college graduate.

The mean reported daily consumption of total FJV was 5.9 (SD 4.8) servings (FJ servings, 3.2 (SD 2.9); V servings, 2.6 (SD 2.2)). Mean daily consumption of FJV and the psychosocial variables did not differ by ethnic group, overweight status or family education. Psychosocial determinants of FJV consumption were found to be significantly inter-correlated (Table 2).

Table 1 Frequency of demographic characteristics ($n = 473$)

Demographic characteristic	*n*	%
BMI ($kg\,m^{-2}$)	451	95.3
Normal (BMI < 85 percentile)	297	62.8
At risk (85 percentile < BMI < 95 percentile)	79	16.7
Overweight (BMI > 95 percentile)	75	15.9
Ethnicity	471	99.6
White	345	72.9
African American	17	3.6
Hispanic	64	13.5
Other/mixed	45	9.5
Family education	467	98.7
HS graduate or less	27	5.7
Some college/technical school	110	23.3
College graduate	167	35.3
Postgraduate studies	163	34.5

BMI – body mass index; HS – high school.

After inclusion of all demographics and social desirability, ethnicity (white vs. non-white) was the only variable that significantly predicted FJ consumption. There were no significant first-level predictors of vegetable consumption. When main effect psychosocial terms were added to the model, preferences were significantly associated with daily consumption of FJ ($P < 0.001$) and V ($P < 0.001$); self-efficacy was significantly associated with daily V ($P < 0.001$), but not FJ consumption; home availability was a significant predictor of FJ ($P < 0.001$) and V ($P < 0.001$). Social desirability was not significantly associated with FJ or V consumption (see Table 3). When the interactions were added to the models in stage 3 only the preferences by home availability interaction was associated with daily FJ ($P = 0.04$) and V ($P = 0.01$) consumption. The interaction of self-efficacy by home availability was marginally associated with V ($P = 0.08$), but not FJ consumption. Excluding potatoes (sweet potatoes, white potatoes, potato salad, French fries) from vegetable intake resulted in similar findings (results not shown). No significant interactions were found between BMI and the psychosocial variables.

The interaction of preference by home availability with FJ consumption appears in Fig. 1. For each level of home FJ availability, FJ consumption was proportionally higher for those with higher vs. lower FJ preference. The two preference lines intersected at a level of approximately 1 on FJ availability and FJ consumption. Exactly the same pattern was obtained for V preference×home V availability and V self-efficacy × home V availability terms.

Discussion

The preference by home availability interaction was associated with FJ and V consumption (Table 2). The full models accounted for 30% or more of the variance in intake, which is better than found in previous analyses that did not include these interactions[21–30,35,36]. Preferences and home availability were the highest correlates of FJ and V consumption in previous studies that reported preference[22–25,27–30] and/or availability[29,30,35,36]. Previously an interaction was detected between preference

Table 2 Inter-correlations between psychosocial variables of fruit and juice (FJ) and vegetable (V) consumption

	Availability – FJ	Availability – V	Preference – FJ	Preference – V	Self-efficacy – FJ	Self-efficacy – V
Availability – FJ	1					
Availability – V	0.544 (0.000)	1				
Preference – FJ	0.197 (0.000)	0.135 (0.004)	1			
Preference – V	0.080 (0.089)	0.310 (0.000)	0.577 (0.000)	1		
Self-efficacy – FJ	0.212 (0.000)	0.181 (0.000)	0.415 (0.000)	0.256 (0.000)	1	
Self-efficacy – V	0.181 (0.000)	0.261 (0.000)	0.394 (0.000)	0.399 (0.000)	0.796 (0.000)	1

Data are presented as Pearson correlation (*P*-value, two-tailed).

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Table 3 Three-stage hierarchical regression analysis of fruit and juice (FJ) and vegetable (V) consumption

		Stage 1					Stage 2					Stage 3				
IV	DV	E	SE	Pr	R2L1	R2L2	E	SE	Pr	R2L1	R2L2	E	SE	Pr	R2L1	R2L2
FJ	Ethnicity (ref: white)	0.64	0.28	0.03			0.24	0.24	0.30			0.22	0.23	0.35		
	BMI (kg m^{-2})	−0.00	0.03	0.99			0.02	0.02	0.44			0.02	0.02	0.49		
	Age (years)	−0.14	0.12	0.24			−0.07	0.10	−0.67			−0.05	0.10	0.62		
	GED/HS diploma	referent														
	Some college	0.15	0.58	0.79			−0.01	0.48	0.98			−0.10	0.48	0.84		
	College graduate	0.47	0.56	0.41			0.29	0.46	0.53			0.27	0.46	0.56		
	Postgraduate studies	0.61	0.57	0.28			0.19	0.47	0.69			0.15	0.47	0.75		
	Social desirability	−0.02	0.02	0.30			−0.01	0.02	0.39			−0.01	0.02	0.33		
	Preference						0.07	0.01	<0.001			0.03	0.03	0.33		
	Self-efficacy						0.02	0.02	0.32			dropped				
	Home availability						0.27	0.02	<0.001			0.03	0.12	0.83		
	Preference×availability											0.01	0.00	0.04		
					0.00	0.10				0.33	0.38				0.33	0.36
V	Ethnicity (ref: white)	0.14	0.25	0.58			0.17	0.22	0.43			0.14	0.22	0.51		
	BMI (kg m^{-2})	0.00	0.02	0.96			−0.00	0.02	0.90			0.00	0.02	0.86		
	Age (years)	0.10	0.10	0.34			0.06	0.09	0.49			0.07	0.09	0.42		
	GED/HS diploma	referent														
	Some college	0.61	0.51	0.24			0.41	0.46	0.37			0.30	0.45	0.50		
	College graduate	0.60	0.49	0.23			0.54	0.44	0.22			0.43	0.44	0.33		
	Postgraduate studies	0.63	0.50	0.21			0.54	0.44	0.23			0.43	0.44	0.33		
	Social desirability	0.01	0.02	0.63			0.01	0.01	0.46			0.02	0.02	0.31		
	Preference						0.10	0.01	<0.001			0.02	0.03	0.51		
	Self-efficacy						0.05	0.02	0.02			−0.02	0.04	0.68		
	Home availability						0.16	0.03	<0.001			−0.34	0.14	0.01		
	Preference × availability											0.01	0.00	0.01		
	Self-efficacy × availability											0.01	0.01	0.08		
					−0.02	−0.09				0.25	0.26				0.27	0.30

IV – independent variable; DV – dependent variable; E – estimate; SE – standard error; Pr – probability of significance, R2L1 – R^2 level 1; R2L2 – R^2 level 2; BMI – body mass index; GED – General Education Development; HS – high school.
*Backwards deleted least significant psychosocial main effects and psychosocial interactions.

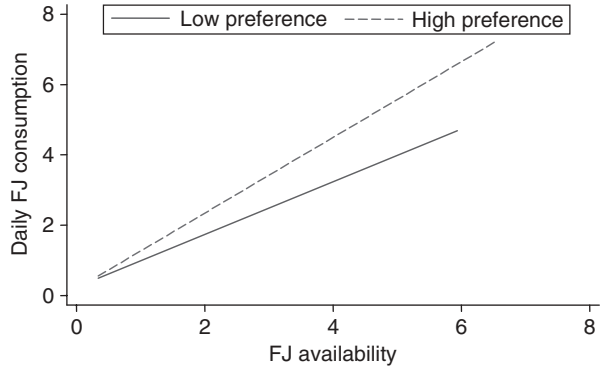

Fig. 1 Mean daily servings of fruit and juice (FJ) by availability according to high and low preference

and availability, and these results support those findings[30]. Dichotomising preference (low and high) at the mean and plotting the fitted regression lines for the association between FJ consumption and home availability indicated that those with higher preference had proportionally higher consumption of FJ for every level of home availability (Fig. 1). These findings suggest that increasing preference and availability will likely have more than an additive impact on increasing FJ and V consumption. Future research should determine whether the interaction of preference and availability holds true for all ages, females, and more ethnically diverse populations.

When the preference by home availability interaction term was in the FJ model, the main effect terms were no longer significant. This suggests the importance of the interactive nature of the relationship and may explain low predictive variance for the main effects alone in previous research[21,22,24–30,35,36,50].

No significant interactions were observed between BMI and the psychosocial variables as was seen in one previous study[37] for V consumption and home availability. This may be attributable to cultural, age or measurement (self-reported vs. measured height and weight) differences, and suggests that more research is needed.

In previous research V self-efficacy was associated with V consumption, but low R^2 values were obtained (0.02–0.17)[23,25,51]. The self-efficacy by home availability interaction was marginally associated with V consumption, which confirms previous findings[29,36], and the main effect term for self-efficacy was no longer significant. This may explain inconsistencies in the self-efficacy to behaviour relationship in the past.

Mean consumption of FJ and V did not differ by demographic variables (age, ethnicity, family education). Past studies have found lower consumption of FJV among

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less educated populations[52–54] and Hispanics[13]. The lack of such a difference in this sample may be at least partially attributed to the homogeneity of the convenience sample of Boy Scout troops selected. However, Boy Scout troops have been shown to be an effective channel to reach large numbers of boys[50,55]. Scouting membership is nearly 6 million in the USA and more than 20 million internationally in 155 countries[56], thus generalisation of these findings to Scouts alone would be substantial. Social desirability was not found to be significantly associated with FJ or V consumption. This differs from a past study[39], possibly due to the difference in age and gender of the current study population.

Findings indicate that influences on consumption of FJ and V vary. FJ and V preferences and availability were significant predictors for FJ and V consumption. Self-efficacy was found to be a marginally significant predictor of V only. Interventions attempting to increase FJV consumption among boys similar to this population should strongly focus on increasing FJV preference and FJV availability. The significance of the interaction implies that increasing prevalence and availability should have a substantially higher impact on increasing FJ and V consumption than increasing either of the psychosocial variables alone.

Strengths/limitations of the research

The strengths of this study include the large number of participants, the use of previously validated measures and the examination of FJ and V consumption in relation to both psychosocial and demographic determinants.

Limitations of this study include the cross-sectional nature of the data that prevents the inference of causal relationships. While participants were asked about 100% fruit juice and fruit drinks with added sugar separately, it is possible boys had difficulty in discriminating between the two. The convenience sample of Boy Scout troops selected to participate in this intervention may have been homogeneous. Recruitment required participants to have access to a computer and an email address, which may have introduced bias to groups not having a personal computer and may have contributed to the high percentage of the study population from households with a high amount of education. The self-reported nature of the data is likely to have substantial error.

Conclusion

Daily consumption of fruit and juice (FJ) and vegetables (V) were significantly associated with the corresponding preference by home availability interaction. Vegetable consumption was also associated with the self-efficacy by home availability interaction. Understanding these interactions and child consumption of FJV should help in the design of interventions tailored to reduce BMI in specific groups.

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