

Socioenvironmental influences on children's fruit, juice and vegetable consumption as reported by parents: reliability and validity of measures

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Abstract

Objective: To pilot test theory-based questionnaires to measure socioenvironmental influences on children's fruit, juice and vegetable (FJV) consumption as reported by parents.

Design: Cross-sectional.

Setting: Parents of fourth to sixth grade students completed socioenvironmental questionnaires. The students completed food records (FRs) for 2 days in the classroom.

Subjects: Interviews were completed by 109 parents (17% African-American, 32% Hispanic-American and 51 Euro-American).

Results: Student mean daily FJV intake was 2.1 servings. Principal components analyses revealed subscales measuring positive and negative parenting practices; self-efficacy for modelling and planning/encouraging FJV consumption, and making FJV available; encouraging, consequences and discouraging food socialization practices; negative home, cost and canned/frozen food barriers; meal planning; child shopping; mother food preparation; and child lunch and dinner FJV preparation practices. Internal consistencies were adequate to high. Negative parent practices and negative home FJV barriers were significantly negatively correlated with child FJV consumption variables. Planning/encouraging self-efficacy was positively associated with fruit consumption, and child dinner FJV preparation was significantly negatively correlated with child juice consumption.

Conclusions: These questionnaires may provide important insights about the relationship between parent-reported socioenvironmental influences and children's FJV consumption. Future work should test these questionnaires with larger groups of parents and youths, with more reliable estimates of usual FJV intake, e.g. 7-day food records, to obtain a detailed understanding of how parents influence what children eat. Tests of models of relationships among these variables are warranted, but should control for possible confounding variables, e.g. socioeconomic status, gender of the child, etc.

Keywords
Reliability
Socioenvironmental influences
Fruit
Vegetables
Children
Parents

Children's consumption of fruit, juice, vegetables and dietary fat do not meet recommended guidelines^{1–4} and are risk factors for the development of chronic diseases⁵. Identifying the factors that influence children's dietary practices is a first step in the design of effective dietary intervention programmes⁶. Social cognitive theory and its principle of 'reciprocal determinism' provides a framework for understanding behaviour within a family context^{8,9}. Behaviour, including dietary behaviour, is the result of environmental and personal factors, and in turn affects these environmental and personal factors in constant reciprocal relationships^{8,9}. Within a family the

parent and child are part of each others' environment, and from their mutual interaction emerge characteristic ways of functioning^{9–11}. Within this conceptualization, families can influence children's dietary behaviours by manipulating the environment, behaving in specific ways, and communicating personal characteristics (Table 1).

Manipulating the environment

Availability of foods in both home and outside-the-home environments (e.g. restaurants) reflect family choices and can facilitate or inhibit their consumption¹². Availability concerns whether foods of interest are present in an

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Table 1 A social cognitive/reciprocal determinism framework for ways in which families influence each other's food behaviour*Family environment*

Availability of foods (reflects selection)
at home (reflects purchasing, growing)
at selected stores and restaurants

Facilitating of foods (reflects selection)

selection of menus
selection and implementation of cooking or other preparation
accessibility of foods

Barriers to change

Family behaviour

Modelling

Requests

Table food management

monitoring
choices, encouragement, consequences, contingencies, incentives
explanations, rationales

Emotional support

listening/rationales

Personal-parent

Socialization (transfer of beliefs)

values, preferences, expectations, norms

environment (e.g. carrots in the refrigerator). Parents are the 'gatekeepers' of the home food supply and selection of places to eat^{13,14}.

Families can facilitate consumption of foods through the selection and implementation of menus, cooking or other food preparation practices, and promoting food accessibility. Accessibility concerns whether foods are available in a form and location that is likely to increase their consumption (e.g. ready-to-eat carrot sticks in a plastic bag at the front of a child-accessible refrigerator shelf next to a child's favourite low-fat dip). Barriers to dietary change exist in a family's environment. Recent qualitative research suggests that foods can be available in the home, but not accessible¹⁵⁻¹⁷, and availability and accessibility of foods have been identified as significant determinants of FJV intake among fourth and fifth grade students both at home and at school¹².

Family behaviour

Parents can directly influence their children's behaviour through modelling, requests, table food management practices and emotional support. Modelling concerns a child observing parents' food selection patterns and eating behaviour, and then imitating those behaviours¹⁸. Toddlers were observed to put food in their mouths more readily when they were following the example of their mothers relative to the same modelling behaviour by a stranger¹⁹. Mothers' own food behaviours with regard to time of eating, types of food liked or disliked, and places where eating occurred in the home influenced children's food behaviours²⁰. No self-reported measures of parent modelling of FJV consumption have appeared in the literature.

Table food management strategies include both practices and talk. Table food practices include monitoring of child

consumption, offering choices, controlling types and amounts of foods²⁰⁻²⁵, controlling timing of meals and snacks¹⁹⁻²³, and using food to pacify, reward or punish^{22,23}. Parents frequently limit their children's consumption of foods perceived to be 'unhealthy' by withholding these foods as punishment²⁶. Contrary to apparent parental beliefs, restricting children's food access does not produce dislike for the restricted food and encouraging a child to eat certain foods does not produce a liking for that food²⁷.

Table food talk includes verbally prompting children to eat when not hungry²⁰⁻²⁴, explaining the benefits of foods perceived as healthy²²⁻²⁴ and the use of reasoning to encourage consumption²⁰⁻²⁴. Many parents encourage children to consume more fruits and vegetables. Hertzler noted that parents' feedback to children about eating vegetables was associated with children's lower preferences for vegetables²⁸. It is important to note that these cross-sectional data do not identify a causal relationship between parental feedback and child behaviour. In fact, child behaviour could have prompted the parental feedback.

Personal characteristics

Family food socialization is the process by which parents' personal beliefs, including preferences, values, attitudes, norms and expectations toward food intake, influence corresponding children's beliefs and eating behaviours toward nutritionally desirable dietary outcomes^{13,18,22,25}. These beliefs may be also transmitted by any of the family environmental or behavioural factors.

Family interaction characteristics

Measures of family functioning (e.g. conflict or cohesiveness²⁹) have been typical ways of characterizing how families habitually interact. Parenting inventories, alternatively, capture characteristic ways in which parents relate to children.

Parent personal characteristics

Parental style refers to methods used by parents to maintain or modify children's behaviours. Authoritative parenting facilitates the development of the child's self-control, while authoritarian and permissive parenting impede its development^{30,31}. Parents who reported using a high degree of parental control over what and how much their children ate had children who showed relatively little evidence of energy regulation^{31,32}. There are systematic ways in which family food behaviours would be expected to vary by type of parenting (Table 2). While a measure of parenting in general has appeared³⁴, parenting influences may be specific to food. No FJV-specific parenting measure has appeared in the literature.

An adaptation of cognitive motivation theory³⁵ (closely related to social cognitive theory) suggests that parents will promote (be motivated for) more FJV consumption in their children at the confluence of several events. The

Table 2 Ways in which family food behaviours are expected to vary by parenting category

	Authoritative	Authoritarian	Permissive
Modelling	Deliberate and inadvertent	Deliberate	Inadvertent
Requests	Child → parent Parent → child	Parent → child	
Table food management			
Monitoring	Yes	Yes	No
Practices	Choices/consequences	Demands	Child initiated
Talk	Explanations/rationales	Contingencies	Unrelated
Expectation	Child acceptance Family change	Child compliance	No expectation

parent must believe that a child's FJV consumption is positively related to the child's current and future healthy development (e.g. in this case the positive outcome expectation of prevention of chronic disease from the child's FJV consumption) and the parent perceives he or she can do what is necessary to help their child eat more FJV (i.e. self-efficacy for helping the child to eat more FJV). Parents need a variety of family resources to successfully encourage children's FJV consumption, including: (i) the knowledge, skills and self-efficacy for purchasing and preparing FJV their child will eat (i.e. behavioural capabilities for purchasing and preparing child-preferred FJV); (ii) the knowledge, skills and self-efficacy for encouraging their child to eat FJV (i.e. behavioural capability for promoting child's FJV consumption); (iii) the financial resources to purchase any FJV desired, or if they have minimum financial resources, the knowledge, skill and self-efficacy to purchase low cost FJV with low perishability; (iv) the social resources (contact, influence) to enable the family to overcome any barriers to change; and (v) the family cohesiveness to act as a unit to overcome barriers. When these events co-occur the parent can be characterized as highly motivated, skilled and resourced to help the child eat more FJV. There are no currently available instruments to assess these factors.

This paper presents the reliability and validity characteristics of questionnaires assessing these parental socioenvironmental constructs among a multiethnic group of parents. Items were generated to represent the theoretical constructs as reflected in statements identified in focus group discussions with parents of fourth through sixth grade African-, Euro-, Hispanic- and Asian/other-American students³⁹.

Methods

Sample

This study was approved by the Institutional Review Board of the University of Texas MD Anderson Cancer Center. Parents of fourth to sixth grade children from seven parochial schools in the greater Houston, Texas, area were recruited (Table 3). Parental consent was obtained.

Procedures

Child food records

Trained data collectors visited each classroom on three consecutive days. On the first day, students were instructed on how to complete the FR forms, and completed the FRs for the meals already eaten on that day. A rover monitored and provided assistance with the FRs as needed³⁵. On the following 2 days, the data collectors prompted the students to record the rest of the foods eaten each day. Participating children received small gifts.

The FR had 24 lines for recording different foods consumed, with columns for the meal at which the food was consumed (breakfast, lunch, supper, snack), the number of servings, the people with whom this food was eaten (if any), the location where eaten, the location where the food was prepared, and the method of preparation (if known). The FRs were hand-coded by trained dietitians for servings of FJV using the food guide pyramid serving sizes³⁶. Mixed dishes had to provide at least half a serving of fruit or vegetable per usual serving to be counted. For example, 1 cup of beef stew with vegetables was credited with providing one vegetable serving since the standard recipe included 0.5 cup of vegetables per 1 cup of stew. A hamburger sandwich with two slices of tomato and lettuce was credited with providing half a vegetable serving. This has been shown to be a valid measure of FJV intake among 9–12-year-old children^{36,37}.

Table 3 Participation rates for parent interviews

	Number of students who consented	Number of parents who consented	Number of interviews completed from those who consented
African-American	40	31 (78%)	19 (61%)
Hispanic-American	68	52 (76%)	35 (67%)
Euro-American	122	101 (83%)	55 (54%)
Total	230	184 (80%)	109 (59%)

Parent interviews

At-home interviews with parents were scheduled on Saturday and Sunday afternoons. Two trained data collectors administered the questionnaires to the parent. Two weeks later, a small subgroup of parents ($n=25$) completed the questionnaires a second time by telephone. Parents received a gift certificate to a local grocery store for participating.

Instruments

Parental style refers to methods used by parents to maintain or modify children's behaviours. Three child-control patterns have been identified: authoritarian, permissive and authoritative^{30,31}. Authoritative parenting facilitates the development of the child's self-control, while authoritarian and permissive parenting impede its development. The original authoritative parenting index (API) was designed for completion by children and contains 20 statements about mothers³⁴. This scale was adapted for use with mothers by having mothers compare their behaviour to the statement: 1 = not like me, 2 = sort of like me, 3 = a lot like me and 4 = just like me. Two subscales representing parental demandingness (i.e. setting and enforcing behaviour standards, monitoring and supervising child activities, maintaining structure and regimen^{31,38}) and responsiveness (i.e. being affectionate, comforting, supportive and accepting, involved with child activities^{31,38}) were obtained in previous research with fourth through ninth grade students completing this questionnaire. Table 4 list the specific items.

Parent food-socialization-encouraging practices were measured by a 15-item scale adapted from previous work^{22,24} (Table 5). Responses were 1 = never, 2 = sometimes, 3 = often and 4 = always.

Parent food-socialization-discouraging practices were measured with a 14-item scale that was adapted from previous work on parental behaviours to discourage consumption of a particular food^{22,24} (Table 6). Responses were 1 = never, 2 = sometimes, 3 = often and 4 = always.

Menu planning and grocery shopping practices were measured with 10 menu planning and grocery shopping questions generated from the parent focus group comments³⁹ (Table 7). Responses were 1 = never, 2 = sometimes, 3 = often and 4 = always.

Family food preparation practices were measured with 21 questions about family food preparation practices generated from the parent focus group comments³⁹ (Table 8). Responses were 1 = never, 2 = sometimes, 3 = often and 4 = always.

Parent/family barriers to eating FJV were measured with 19 items generated from the parent focus group comments³⁹ (Table 9). The response scale was 1 = disagree a lot, 2 = disagree a little, 3 = not sure/do not know, 4 = agree a little and 5 = agree a lot.

Parent self-efficacy to provide/encourage healthy diets for their children was measured with 23 items, generated from the parent focus group comments³⁹ (Table 10). These items were chosen to reflect parental self-efficacy for modelling the consumption of FJV, planning and encouraging FJV consumption, and making FJV available

Table 4 Factor structure for parent version of the API questionnaire

	Factor 1 loadings	Factor 2 loadings
<i>Factor 1: Authorative parenting</i>		
I want to hear about my child's problems	0.88	-0.02
I make sure my child tells me where he/she is going	0.86	0.09
I usually know where my child is after school	0.79	0.11
I tell my child when he/she does a good job on things	0.76	-0.19
I am interested in my child's school work	0.74	-0.07
I check to see if my child does his/her homework	0.71	-0.10
I often ask my child what he/she does with friends	0.64	-0.20
I make my child feel better when he/she is upset	0.58	0.17
I tell my child that I like my child just the way he/she is	0.54	-0.16
I am usually pleased with how my child behaves	0.52	-0.16
I tell my child times when he/she must come home	0.50	-0.02
<i>Factor 2: Negative parenting</i>		
It is hard for me to say 'no' to my child	0.06	0.70
I am always telling my child what to do	-0.08	0.56
I make rules without asking my child what he/she thinks	0.01	0.55
I forget the rules I make for my child	-0.20	0.52
I can be talked into things easily	0.24	0.50
Eigen value	5.64	2.04
% variance explained	30%	11%
Cronbach's alpha	0.72	0.73
Pearson test-retest	0.53	0.82
Mean (SD)	38.2 (3.4)	10.4 (3.2)
<i>Items not loading on either factor</i>		
I have rules for my child to follow	0.19	-0.25

Table 5 Factor structure for parent food-socialization-encouraging practices questionnaire

	Factor 1 loadings	Factor 2 loadings
<i>To encourage your child to eat a particular food, how often do you ...</i>		
<i>Factor 1: Expectancies</i>		
Tell your child this food will give him/her energy	0.81	-0.17
Tell your child that it's good for his/her health	0.79	0.05
Tell your child that it's good for him/her	0.76	-0.01
Tell your child he/she will get strong	0.74	0.22
Tell your child it tastes good	0.55	0.23
Tell your child to taste it because it's delicious	0.51	-0.08
Let your child see you eat the food	0.46	-0.10
<i>Factor 2: Consequences</i>		
Give your child something he/she will like (other than dessert)	0.07	0.73
Tell your child if you will take them somewhere if he/she eats it	0.16	0.72
Take away a privilege from your child (e.g. watching TV, going outside, etc.) if it is not eaten	-0.02	0.68
Make something else for him/her	0.09	0.66
Tell your child if he/she eats it you will give him/her dessert	0.09	0.58
Force your child to eat it	0.10	0.45
Eigen value	3.7	2.19
% variance explained	25%	15%
Cronbach's alpha	0.79	0.70
Pearson test-retest	0.61	0.77
Mean (SD)	22 (4.1)	9.3 (2.8)
<i>Items not loading on either factor</i>		
Tell your child if he/she doesn't want it, he/she doesn't have to eat it	-0.20	-0.06
Tell your child you're not making anything else	0.03	-0.05

in the home. The response scale was 1=very sure I cannot, 2=I think I cannot, 3=not sure, 4=I think I can and 5=very sure I can.

FJV availability measures whether three 100% fruit juices, 13 fruits and 18 vegetables were present in the home in the past week (response=yes/no) and *FJV accessibility* measures whether two 100% fruit juices, three fruits and

three vegetables were in a form and location that encouraged their consumption, e.g. peeled, sliced carrot sticks in the refrigerator (response=yes/no). These items were adapted from the 5 A Day (Georgia) project¹².

Data analyses

Principal components analysis with varimax rotation was

Table 6 Factor structure for parent food-socialization-discouraging practices questionnaire

	Factor 1 loadings
<i>To discourage your child from eating a particular food, how often do you ...</i>	
<i>Factor 1</i>	
Get rid of it	0.69
Tell your child it's not nutritious	0.68
Tell your child it will make him/her sick	0.67
Tell your child it's too sweet	0.65
Give your child something else to do	0.62
Put it somewhere your child can't find it	0.60
Tell your child it's too greasy	0.59
Tell your child it's bad for his/her teeth	0.56
Say 'don't eat it'	0.56
Take away things your child likes to do (privileges) for eating it	0.54
Give your child a small portion	0.46
Tell your child it will make him/her fat	0.44
Just don't buy it	0.43
Just don't give it to your child	0.41
Eigen value	5.97
% variance explained	31%
Cronbach's alpha	0.84
Pearson test-retest	0.89
Mean (SD)	31.1 (7.4)

Table 7 Factor structure for parent menu planning/shopping practices questionnaire

	Factor 1 loadings	Factor 2 loadings
<i>Factor 1: Parent rationale</i>		
I check food labels for ingredients before purchasing a product for the first time	0.82	-0.22
I read the nutrition information provided on food packages before purchasing a product for the first time	0.77	-0.25
I plan menus before doing my food shopping	0.62	0.23
I make out a list before doing the shopping	0.56	0.05
I compare prices on several food products when I go food shopping	0.46	0.17
I check the food ads in the newspaper before going food shopping	0.41	0.21
<i>Factor 2: Child shopping influence</i>		
My children ask me to buy certain fruits at the grocery store	0.16	0.76
My children ask me to buy certain vegetables at the grocery store	0.28	0.76
My children go grocery shopping with me	-0.05	0.66
My children ask me to buy certain foods at the grocery store	-0.05	0.51
Eigen value	2.57	1.97
% variance explained	26%	20%
Cronbach's alpha	0.68	0.67
Pearson test-retest	0.89	0.84
Mean (SD)	16.1 (3.8)	10.4 (2.4)

conducted on each new questionnaire. The number of factors retained was determined using the scree plot criterion⁴⁰ and interpretability of resulting factors. Items loading 0.40 or higher on more than one factor, and items

with highest factor loadings of less than 0.40 were removed. Cronbach's alpha was calculated for each scale. Pearson and Spearman correlations were calculated to assess test-retest reliability for the scales between

Table 8 Factor structure for family food preparation questionnaire

	Factor 1 loadings	Factor 2 loadings	Factor 3 loadings
<i>Factor 1: Parent FJV preparation practices</i>			
How often do you include a fruit in that snack?	0.80	0.25	-0.09
How often do you include a vegetable in that snack?	0.75	0.18	0.21
How often do you include a vegetable in your child's lunch?	0.72	0.00	0.17
How often do you prepare your child's snacks?	0.68	0.04	-0.03
How often does your child prepare his/her own snacks?	0.62	0.30	-0.10
How often does your child eat vegetables at dinner?	0.56	0.04	0.23
How often do you include a fruit in your child's lunch?	0.54	0.02	-0.18
How often does your child eat vegetables for a snack?	0.53	0.23	0.27
How often do you prepare your child's lunch?	0.49	-0.36	0.04
How often does your child eat fruit for a snack?	0.49	0.35	-0.04
<i>Factor 2: Child lunch/snack FJV preparation</i>			
How often do you tell him/her to include a fruit in his/her lunch?	0.08	0.82	0.20
How often does your child put fruit in the lunch he/she packs?	-0.06	0.77	0.17
How often do you tell him/her to eat a fruit at their snack?	0.24	0.72	-0.04
How often do you tell him/her to include a vegetable in his/her lunch?	0.38	0.62	0.37
<i>Factor 3: Child dinner FJV preparation</i>			
How often do you tell him/her to include a vegetable at dinner?	0.08	0.18	0.89
How often does your child prepare his/her own dinner?	-0.22	0.11	0.83
How often do you tell him/her to include a fruit at dinner?	0.22	0.25	0.82
Eigen value	5.92	3.69	1.85
% variance explained	28%	18%	9%
Cronbach's alpha	0.73	0.82	0.84
Pearson test-retest	0.82	0.81	0.86
Mean (SD)	22 (4.6)	8.7 (3.5)	4.4 (2.3)
<i>Items not loading on any factor</i>			
How often does your child prepare his/her own lunch?	-0.44	0.68	0.10
How often do you tell him/her to eat a vegetable at his/her lunch?	0.43	0.57	0.26
How often does your child fix and put vegetables in the lunch he/she prepares?	0.15	0.58	0.43
How often does your child eat vegetables at dinner?	0.24	0.11	0.09

Table 9 Factor structure for parent/family barriers questionnaire

	Factor 1 loadings	Factor 2 loadings	Factor 3 loadings
<i>Factor 1: FJV family barriers</i>			
My family wastes too much food when I serve fruit and vegetables	0.82	-0.05	-0.04
Nothing I do seems to get my kids to eat more vegetables	0.76	0.01	0.01
If I were to add more vegetables to my usual dishes, no one in my family would eat them	0.74	-0.02	0.08
Nothing I do seems to get my kids to eat more fruit	0.70	0.11	-0.05
No one eats vegetables in my home	0.69	0.06	0.01
No one eats fresh fruit in my home	0.62	0.08	-0.12
I don't have time to fix vegetable dishes	0.60	0.09	-0.24
If I were to serve fruit for desserts, no one in my family would eat them	0.52	-0.10	0.29
None of the dishes my family likes include fruit or vegetables	0.44	0.22	-0.14
<i>Factor 2: FJV cost and spoilage barriers</i>			
Some fresh fruit and vegetables do not look appealing in the store	0.03	0.79	-0.06
Fresh fruit and vegetables spoil too quickly	0.05	0.79	-0.09
Fresh fruit and vegetables cost too much	0.18	0.73	0.18
<i>Factor 3: FJV canned/frozen barriers</i>			
Canned vegetables are not as healthy as fresh or frozen vegetables	0.00	-0.10	0.81
Canned vegetables do not taste as good as fresh or frozen vegetables	-0.13	0.03	0.72
Frozen vegetables are not right for my family	0.02	0.08	0.53
Eigen value	4.18	1.90	1.68
% variance explained	25%	11%	10%
Cronbach's alpha	0.68	0.83	0.53
Pearson test-retest	0.82	0.92	0.79
Mean (SD)	13.6 (5.8)	8.8 (3.6)	9.4 (3.0)
<i>Items not loading on any factor</i>			
My family eats the fruit too quickly, instead of lasting the week	-0.21	0.21	0.14
My children should fix their own snacks, I shouldn't have to fix them anything for snacks	0.20	-0.13	0.08

the administrations at time 1 and time 2. Pearson and Spearman correlations were calculated between all subscales. The consumption variables (mean FJV intake and FJV intake per 1000 kcal) were tested for normality. As a result, Spearman correlation coefficients were calculated between the consumption variables and the parent scales as an assessment of construct validity. Data were analysed using the Statistical Package for Social Sciences (SPSS version 6.1.2 for Windows, 1995, SPSS Inc., Chicago).

Results

Interviews were completed by 109 parents (17% African-American, 32% Hispanic-American and 51% Euro-American) (see Table 3). Due to the time required for at-home interviews, 33 of these interviews were conducted by telephone. Only one significant difference between at-home and telephone interviews was detected, suggesting no severe bias due to method of data collection. Telephone-interviewed mothers reported lower positive parenting practices than at-home-interviewed mothers ($P < 0.01$). Mean daily FJV intake of the students was 2.1 servings.

The API questionnaire yielded two factors: positive and negative parenting practices (see Table 4). These two factors accounted for 41% of the variability in these items. Internal consistency for the positive parenting practices factor was adequate, with a lower test-retest coefficient. Internal

consistency for the negative parenting practices was adequate, and test-retest reliability was almost high. One of the original items did not load on either of these factors.

Two subscales for the parent food-socialization-encouraging questionnaire were identified: expectancies and consequences (see Table 5). These two factors accounted for 40% of the variability in these items. The internal consistency and the 2-week test-retest reliabilities were adequate. Two of the original items did not load on either factor.

Only one factor for parent food-socialization-discouraging practices was identified, accounting for 31% of the variability in these items (see Table 6). Both the internal consistency and the 2-week test-retest reliabilities were high.

Two subscales were obtained from the menu planning and grocery shopping questionnaire (parent food-related planning practices and child shopping influence), accounting for 46% of the variability in the items (see Table 7). Internal consistencies were modest, but 2-week test-retest reliabilities were high.

Three factors were obtained from the family food preparation questionnaire: parent FJV preparation practices, child lunch/snack FJV preparation and child dinner FJV preparation (see Table 8). These three factors accounted for 55% of the variability in these items. Internal consistency and 2-week test-retest reliabilities were generally high. Four items did not load on any factor.

Table 10 Factor structure for parent self-efficacy questionnaire

	Factor 1 loadings	Factor 2 loadings	Factor 3 loadings
<i>How sure are you that you can ...</i>			
<i>Factor 1: FJV parent modelling/socialization</i>			
Regularly tell your child you like fruit for snacks	0.86	0.10	-0.02
Regularly tell your child you like vegetables for snacks	0.77	0.08	0.24
Regularly tell your child you like fruit for lunch	0.73	0.00	0.19
Regularly tell your child you like vegetables for supper	0.67	0.08	0.14
Regularly leave out a bowl of fruit for snacks	0.43	0.27	-0.07
Regularly involve your child in preparing fruit and vegetables	0.41	0.30	0.04
<i>Factor 2: FJV parent planning/encouraging</i>			
Regularly plan menus for the family that contain 1 serving of fruit at every supper	0.10	0.77	-0.09
Regularly plan menus for the family that contain 1 serving of vegetable at every supper	-0.04	0.66	0.13
Regularly have fruit at each dinner	0.30	0.66	-0.11
Regularly insist that your child try at least one bite of a new fruit	0.27	0.55	0.11
Regularly insist that your child try at least one bit of a new vegetable	0.16	0.49	0.21
Regularly serve 2 vegetables at dinner	0.30	0.48	0.15
Regularly encourage your child to eat fruit	0.15	0.46	0.16
Regularly use a grocery list for shopping trips	-0.16	0.42	0.11
<i>Factor 3: FJV availability and accessibility</i>			
Regularly cut up vegetables and have them available in the refrigerator for your child	0.10	0.00	0.77
Regularly have cut-up fruit available for your child's snack	0.11	0.09	0.69
Regularly serve a new vegetable once a week	0.25	0.02	0.58
Regularly serve a new vegetable once a month	0.35	0.15	0.51
Regularly have low-fat dip available in the refrigerator for your child to have with cut-up vegetables	-0.13	0.33	0.50
Regularly encourage your child to eat low-fat food	-0.14	0.32	0.49
Eigen value	5.02	2.16	1.89
% variance explained	23%	10%	9%
Cronbach's alpha	0.78	0.75	0.70
Pearson test-retest	0.39	0.75	0.66
Mean (SD)	27.8 (3.3)	35.1 (4.4)	24.4 (3.9)
<i>Items not loading on any factor</i>			
Regularly encourage your child to eat vegetables	0.07	0.35	0.24
Regularly praise your child for trying a new vegetable at a meal	0.12	0.29	0.21

Three FJV barrier factors were obtained: negative family barriers, cost/spoilage barriers and canned/frozen food barriers (see Table 9). These three subscales accounted for 46% of the variance in these items. The internal consistencies varied from low to high, but the test-retest reliabilities were all high. Two items did not load on any of these factors.

Three self-efficacy factors were obtained: parent FJV modelling self-efficacy, parent FJV planning/encouraging self-efficacy and FJV availability/accessibility self-efficacy (Table 10). These factors accounted for 42% of the variability. Internal consistencies were adequate. Two-week test-retest reliability was adequate except for FJV modelling self-efficacy. Two items did not load on any of these factors.

Internal consistencies for the FJV availability and accessibility scales were low to adequate, as were 2-week test-retest reliabilities (Table 11).

Fruit ($r = -0.21$, $P < 0.05$), vegetable ($r = -0.32$, $P < 0.01$), high fat vegetable ($r = -0.24$, $P < 0.05$), total FJV ($r = -0.37$, $P < 0.001$), fruit per 1000 kcal ($r = -0.21$, $P < 0.05$) and total FJV per kcal ($r = -0.33$, $P < 0.01$) were significantly

negatively correlated with negative parenting practices. Fruit ($r = -0.20$, $P < 0.05$) and total FJV ($r = -0.19$, $P < 0.05$) consumption were significantly negatively correlated with home FJV barriers. Juice consumption ($r = -0.35$, $P < 0.001$) was significantly negatively correlated with dinner FJV preparation. Planning self-efficacy was positively correlated with fruit ($r = 0.23$, $P < 0.05$) and fruit per 1000 kcal ($r = 0.22$, $P < 0.05$) consumption.

Correlation coefficients among the parent scales are presented in Table 12. The confidence intervals confirmed the tests of statistical significance. All confidence intervals were within ± 0.20 units of correlation. Only two of the parent psychosocial correlations were above 0.40 (modelling and planning self-efficacy and planning and availability self-efficacy), suggesting substantial independence of the scales.

Discussion

Distinct new socioenvironmental subscales encompassing parent and family environment influences on childrens' FJV consumption were identified. The statistical procedures

Table 11 Reliability of the FJV availability and accessibility scales

	Cronbach's alpha (<i>n</i> = 109)	Pearson test–retest (<i>n</i> = 24)
<i>Accessibility</i>		
Fruit	0.08	0.51
Juice	0.23	0.12
Vegetable	0.38	0.27
Total FJV	0.31	0.50
<i>Availability</i>		
Fruit	0.60	0.27
Juice	0.43	0.65
Vegetable	0.55	0.26
Total FJV	0.67	0.15

to identify subscales were standard. The parent version of the API yielded two subscales based on parent behaviours: positive and negative parenting practices. These were identical to the subscales obtained from the child version of the API completed by their fourth through sixth grade children in the same study⁴¹. In contrast, two different subscales, demandingness and responsiveness, were obtained from students in North Carolina³⁴. This difference may be due to the ethnically diverse group of parents participating in the present study, or it may reflect cultural/geographic/social class differences between the Texas and North Carolina groups. The negative parenting subscale was negatively associated with fruit and vegetable consumption, as would be expected. Although causal relationships can not be determined, recent research has suggested that parental control may be related to child obesity problems^{18,32}. Other confounding factors may be responsible for this relationship. Perhaps the positive parenting subscale did not tap parenting factors related to children's FJV consumption. Further research in this area is warranted.

Two encouraging family table food management practice subscales and one discouraging practice subscale were identified. Previous research has identified the use of family table food management strategies. Parents of African-American preschool children frequently prompted their children to eat, and they were generally successful in getting the children to eat through the use of commands, actions and rationales²¹. Mexican-American mothers' education was positively correlated with the amount of healthy foods served, use of reasoning to encourage consumption (also an aspect of authoritative parenting), enquiring about what the child eats away from home and preparing what the child likes among obese 4–8-year-old Mexican-American children²⁴. In this study these subscales were not related to children's FJV consumption, perhaps because the scale items were not specific for encouraging/discouraging children's FJV consumption. Specifying FJV as the target in each question may be necessary to achieve a relationship between socialization practices and FJV consumption.

Three parent self-efficacy subscales were identified:

self-efficacy for planning/encouraging FJV consumption, self-efficacy for modelling FJV consumption and self-efficacy for providing FJV. The planning/encouraging subscale was related to fruit consumption. These scales were also related to home availability and accessibility of FJV, which has been identified as a predictor of children's FJV consumption¹². Further testing on these instruments is warranted.

In contrast to previous work, parent-reported home FJV availability/accessibility was not related to child FJV consumption¹². This may be related to the fact that test–retest reliabilities for the availability and accessibility scales were weak, possibly reflecting the normal variation in the home food supply between grocery shopping trips (most interviews were obtained on the weekends). The parent home interviews were scheduled for the weekend following data collection in their child's school. However, a national holiday weekend, cancellations and missed appointments delayed some interviews for several weekends, so the parent–child data collection period did not always coincide. The relatively small sample may also not have had sufficient power to detect true relationships. Further testing and validation of these measures is needed.

Parent-reported FJV modelling self-efficacy was not related to child FJV consumption. In contrast, in this same study, child-reported parental FJV modelling was correlated with child fruit, juice and total FJV consumption⁴¹, supporting the literature on the important role of parents as models for their children's eating behaviours^{18,42}. Perhaps the modelling self-efficacy questions were not highly related to the actual modelling behaviour of parents, or only characteristics of modelling noticed by the children determine its effectiveness.

Negative family FJV barriers were related to children's lower fruit and total FJV consumption, as would be expected, but only one of the meal planning/food preparation subscales was related to FJV consumption.

Several limitations of this paper should be noted. First, all data were self-reported from parents and children and thereby subject to possible attention, comprehension, memory and recording errors. Alternatively, dietary consumption was reported by the child and the socio-environmental variables were reported by the parent, thereby minimizing response bias accounting for the correlations with diet. Second, 2 days of food records are not a reliable estimate of usual FJV intake, but budget and time limitations precluded more days of data collection⁴³. The reliability correlations between the two days of reporting were 0.42 for fruit, 0.46 for juice, 0.31 for vegetables and 0.40 for total FJV. Higher reliabilities would probably have been detected with more days of dietary assessment. Correcting for these reliability coefficients would multiply the obtained correlations coefficients by factors of 1.47–1.80⁴⁴, which would substantially increase the obtained values. Third, in general, the internal consistencies of these subscales were moderate to high, but the test–retest

Table 12 Spearman correlations among parent-reported scales

Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Positive parenting	–	–0.07	0.15	–0.03	0.06	0.12	0.15	0.08	–0.18	–0.02	0.11	0.07	0.09	0.05	0.06	0.02	0.12	–0.09	–0.03	0.05	0.05	0.06	0.06	0.08
2. Negative parenting		–	0.04	0.08	0.03	–0.18	–0.11	–0.07	0.26**	0.19	–0.08	–0.12	0.25*	–0.20*	–0.08	0.16	0.12	0.20*	0.13	0.18	0.18	0.09	–0.05	0.09
3. Socialization/ encouraging			–	0.20*	0.33**	0.25*	0.08	0.12	–0.25*	0.00	0.04	0.09	0.11	0.17	0.24*	0.09	–0.01	–0.11	0.08	0.05	–0.05	–0.20	0.08	–0.08
4. Socialization/ consequences				–	0.00	0.00	–0.02	–0.04	0.12	0.00	–0.07	0.10	–0.15	–0.01	0.27**	0.23*	0.02	–0.03	0.06	0.06	0.05	0.14	0.12	0.19
5. Socialization/ discouraging					–	0.22*	0.13	0.15	–0.09	0.14	0.23*	0.24*	0.08	0.11	0.28**	0.07	0.14	0.13	0.24*	0.26*	0.01	0.03	–0.03	0.02
6. Modelling self-efficacy						–	0.43**	0.31**	–0.32**	–0.02	0.14	0.07	–0.05	0.26*	0.21*	–0.12	0.17	0.11	0.24*	0.25*	0.03	0.00	0.12	0.10
7. Planning self-efficacy							–	0.42**	–0.30**	–0.02	–0.05	0.34**	0.08	0.23*	0.26**	0.00	0.26**	0.24*	0.28**	0.33**	0.14	0.00	0.07	0.10
8. Availability self-efficacy								–	–0.31**	0.03	0.11	0.28**	0.22*	0.26**	0.13	0.03	0.36**	0.31**	0.29**	0.41**	0.24*	0.09	0.14	0.24*
9. Negative home barriers									–	0.08	–0.10	–0.24*	–0.06	–0.36**	–0.18	0.08	–0.24*	–0.20	–0.16	–0.24*	–0.18	–0.06	–0.22*	0.24*
10. Cost barriers										–	0.00	–0.05	–0.09	0.02	0.13	0.24*	–0.07	–0.05	0.10	0.03	–0.14	0.04	–0.06	–0.08
11. Canned/frozen barriers											–	–0.20*	0.07	0.28**	0.03	0.05	0.04	–0.09	–0.10	–0.06	–0.04	0.05	0.00	0.00
12. Meal planning												–	0.13	0.29**	0.10	0.05	0.28**	0.12	0.11	0.25*	0.09	0.08	0.05	0.09
13. Child shopping													–	0.18	0.28**	0.18	0.13	–0.04	0.04	0.06	–0.05	–0.02	–0.06	–0.07
14. Mother food preparation														–	0.22*	0.06	0.46**	0.12	0.20*	0.35**	0.19	0.08	0.30**	0.29**
15. Child lunch preparation															–	0.31**	0.11	0.07	0.22*	0.17	0.01	0.02	0.18	0.14
16. Dinner FJV																–	0.06	–0.06	0.22*	0.12	–0.06	0.07	0.21*	0.14
17. Fruit availability																								
18. Juice availability																								
19. Vegetable availability																								
20. Total FJV availability																								
21. Fruit accessibility																								
22. Juice accessibility																								
23. Vegetable accessibility																								
24. Total FJV accessibility																								

* $P < 0.05$.** $P < 0.001$.

reliabilities of some were low. Since internal consistency reliability was developed to estimate the same phenomenon as test–retest reliability (but overcome the problem of possible change over time)⁴⁴, the low test–retest reliabilities are disconcerting. One would not expect parenting practices to substantially change over a 2-week interval. It is possible that the high internal consistency values reflect some internal consistency response bias and the response bias changed over time. Perhaps individual items were poorly written and/or understood by the parents, or perhaps the result of the mixed mode of data collection – in person versus telephone influenced responses. Fourth, only 109 parents of children in parochial schools participated in this study limiting generalizability and power for these results. Finally, these data do not assess parental concordance on the family characteristics.

Conclusions

These questionnaires may provide important insights about the relationship between parent-reported socio-environmental influences and children's FJV consumption. Future work should test these questionnaires with larger groups of parents and youths, and obtain more reliable estimates of usual FJV intake (e.g. 7-day FRs) to obtain a detailed understanding of how parents influence what children eat. Tests of models of relationships among these variables are warranted, but should control for possible confounding variables, e.g. socioeconomic status, gender of the child, etc.

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