Determinants of dietary intake in a sample of white and Mexican-American children

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ABSTRACT

Objective To assess the influence of several potential psychosocial determinants on children's eating behavior.

Participants Three hundred fifty-one Mexican-American and non-Hispanic white children (mean age=4.4 years old at baseline) participated in the San Diego Study of Children’s Activity and Nutrition for up to 2.5 years.

Methods Child’s eating behavior was described by 3 dependent variables: total energy, percentage energy from fat, and sodium intake per 1,000 kcal. Dietary information was collected 4 days a year using a 24-hour food intake record, which was a combination of direct observation and interviews with food preparers. The 95 predictor variables from child, parental, demographic, and environmental domains were collected by behavioral observation, interviewer-administered questionnaires, and physical measurements.

Statistical analyses Bivariate and regression analyses via mixed linear models were performed.

Results Variables from the children’s domain (such as skinfold thickness and weight) had the strongest associations with energy intake; parental variables (such as fat avoidance behavior and prompts to increase children’s food intake) were associated with children’s percentage energy from fat and sodium intake. In regression analyses, parsimonious subsets of variables accounted for 46% of variance in energy intake (3 variables), 40% of the variance in percentage of energy from fat (4 variables), and 44% of variance in sodium intake per 1,000 kcal energy (1 variable) in between-subject variance components.

Conclusions Fat and sodium intake of children may be improved by improving parents’ nutrition habits and by having parents encourage children to eat a healthful diet. Few modifiable correlates of children’s energy intake were identified. J Am Diet Assoc. 1998;98:1282-1289.
that was significantly associated with consumption of healthful snacks, but knowledge explained much less than 1% of the variance (14). Birch (23) found a high correlation between preference for and consumption of snacks offered at school for 3- and 4-year-olds. Preference was the most important correlate of young Mohawk children's dietary intake (24). Many other psychological variables could be evaluated in youth of different ages.

**METHODS**

Low- to middle-income Mexican-American and white families were targeted for recruitment from state-funded preschools, children's centers (e.g., day camps, YMCAs) and Head Start centers in San Diego County, California. Parents or children with medical conditions that modified their dietary or physical activity (e.g., diabetes or congenital heart disease) were excluded. Consent forms were signed by 406 families, which represented 22% of the children enrolled in the target preschools; 351 families completed 2 home visits at baseline. Recruitment and family characteristics have been reported in detail elsewhere (37). Data were collected on the target child and up to 2 adult caregivers.

Subjects were 202 Mexican-American and 149 non-Hispanic white children; 52% were boys. Mean age was 4.39±0.48 for girls and 4.39±0.53 years for boys. Mean family socioeconomic status, based on the Hollingshead 2-factor index (38) (1=high, 5 = low), was 3.81±1.04 and 4.69±0.73, respectively, for white and Mexican-American families. No significant age, weight, or BMI differences were noted among the 4 gender-ethnic subgroups of children.

**Procedure**

Families agreed to the following procedure: (a) field staff observe eating and physical activity behavior of the target child.
Table 1 (cont’d)
Study of Children’s Activity and Nutrition measurement procedures

<table>
<thead>
<tr>
<th>Variables assessed</th>
<th>Instrument</th>
<th>No. of times assessed over 2.5 years of study</th>
<th>Method</th>
<th>Validity</th>
<th>Reliability</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child’s opportunity to make food choices and total meals eaten out in restaurants</td>
<td>Eating out and play opportunities questionnaire (29 items)</td>
<td>3</td>
<td>Interview-administered questionnaire</td>
<td>...</td>
<td>2-wk test-retest reliability scores for restaurant choices, $r = .76$</td>
<td></td>
</tr>
<tr>
<td>Child’s number of hours of television per week</td>
<td>Television viewing questionnaire (2 items)</td>
<td>3</td>
<td>Interview-administered questionnaire</td>
<td>...</td>
<td>2-wk test-retest, $r = .80$</td>
<td>26</td>
</tr>
<tr>
<td>Parent’s fat avoidance behavior</td>
<td>Fat avoidance scale (7 items)</td>
<td>6</td>
<td>Interview-administered questionnaire</td>
<td>Validated against food intake records, $r = .48$</td>
<td>Internal consistency, $r = .41 - .46$</td>
<td>42, 47</td>
</tr>
<tr>
<td>Parent’s salt avoidance behavior</td>
<td>Salt avoidance scale (6 items)</td>
<td>6</td>
<td>Interview-administered questionnaire</td>
<td>...</td>
<td>Two-week test-retest, $r = .999$</td>
<td>...</td>
</tr>
<tr>
<td>Family environment, supportiveness, cohesion, adaptability, and conflict</td>
<td>Moos family environment scale and 3 subscales from (27 items)</td>
<td>2</td>
<td>Interview-administered questionnaire</td>
<td>...</td>
<td>$\alpha$ reliability, $r = .69$</td>
<td>48, 49</td>
</tr>
<tr>
<td>Parental acculturation</td>
<td>Short acculturation scale</td>
<td>2</td>
<td>Interview-administered questionnaire</td>
<td>...</td>
<td>...</td>
<td>50</td>
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<tr>
<td>Child’s height</td>
<td>Digital electronic scale</td>
<td>3</td>
<td>Physical</td>
<td>...</td>
<td>Interobserver reliability</td>
<td>...</td>
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<tr>
<td>Child’s weight</td>
<td>Measuring tape</td>
<td>3</td>
<td>Physical</td>
<td>...</td>
<td>Interobserver reliability</td>
<td>...</td>
</tr>
<tr>
<td>Sum of child’s triceps and subscapular skinfold measure</td>
<td>Calibrated Lange calipers</td>
<td>3</td>
<td>Physical</td>
<td>...</td>
<td>Field interobserver reliabilities, $r = .92$ (triceps), $r = .91$ (subscapular)</td>
<td>...</td>
</tr>
</tbody>
</table>

*Version 2.2, 1990, Nutrition Coordinating Center, University of Minnesota, Minneapolis, Minn.

*BEACHES=Behaviors of Eating and Activity for Child Health: Evaluation System.

at school, (b) parents make similar observations at home and are subsequently interviewed, and (c) interviews and observations are completed every 6 months. Once every 6 months, a “measurement wave” occurs in the form of 2 visits between 1 and 3 weeks apart. Families were paid $30 per completed measurement wave for a total of 6 measurement waves during the 2.5 years of observation.

**Measurement Techniques**

Three distinct measurement techniques were used: behavioral observation, interviewer-administered questionnaires, and physical measurements. All measures are summarized in Table 1. All questionnaires were administered and recorded by a trained field observer. Specific measures and variables are described in Table 1 (9 of 11 observers were bilingual).

**Dietary behavior assessment** Three dependent variables viewed as predictors of risk of cardiovascular disease were assessed: energy intake, percentage energy from fat, and milligrams sodium per 1,000 kcal energy. Dietary components were estimated using a food intake record, that is, a modified 24-hour recall that included direct observation of lunch and dinner meals at school and home, respectively, plus an interview of the mother or primary food preparer for breakfast foods and unobserved snacks. Two food intake records were completed 1 to 3 weeks apart for each target child per measurement wave. A trained and certified field observer entered the data into a computer using the Minnesota Nutrition Data System (version 2.2, 1990, Nutrition Coordinating Center, University of Minnesota, Minneapolis, Minn.). The system profiles 102 nutrients for about 16,000 foods, including 5,000 brand names. The percentage missing and percentage estimated values, respectively, for energy are 0% and 3%; for total fat, 0% and 3%; and for sodium, 0% and 4%.

**Behavioral assessment of eating, physical activity, and environment** A direct observation technique called Behaviors of Eating and Activity for Child Health: Evaluation System (BEACHES) was used to evaluate some of the predictor variables (39). Data were entered into a laptop computer using a series of codes to characterize physical and social environment, physical activity, ingestion of food, and interactions of environment with physical activity and eating behavior (39).

Home observations began 30 minutes before the evening meal and lasted for 1 hour. School lunch was observed for a maximum of 20 minutes, and school recess was observed for a maximum of 30 minutes on the same day.

Energy expenditure was estimated from BEACHES activity codes. Each code was transformed into an estimate of energy expended per kilogram of body weight (39); then estimates were summed to indicate total energy expended per kilogram per minute of observation at home.

For quality assurance, observers were reassessed and retrained on BEACHES every 6 weeks and retrained and recertified on the food intake record and all other physical, physiological, and behavioral instruments every 6 months.
Data Analyses

The independent variables were categorized into 5 domains, and descriptive information on all study variables (including dependent dietary variables) is presented in Table 2.

A mixed-effects linear model (40,41) was used to analyze data. The specification treated the sequence of measurements of a single variable for each child or parent as depending on fixed effects (eg, age, gender, ethnicity, socioeconomic status, and marital status), a random effect that defines a child’s typical level for that variable, another random effect for the measurement wave (nested within subject), and yet another random effect for the visit within wave.

The first random effect (the between-subject effect) is of interest in this study because it describes the typical level for
a particular child. Variance and covariance components for the 
between-subject effects of the dietary variables and the indepen-
dent variables are estimated and used to form a matrix of 
correlation coefficients. This matrix is used to form estimates 
of the contributions, that is, proportions of variance explained, 
of various sets of independent variables. Demographic vari-
ables are included as fixed effects; therefore, the estimates of 
proportion of variance explained pertain to the variance re-
mainning in the dietary variable after adjustment for the demo-
graphic variables. This approach is essentially that used by 
Sallis et al (42) and is reviewed in detail by Berry (43). Infer-
ences about quantities estimated via the mixed-effects model 
were based on jackknife estimates of their standard errors.

To get a sense of the relative importance of the various 
independent variables, the proportion of variance explained in 
the dietary variables was calculated for each possible subset of 
independent variables. Because there is a large number of such 
subsets, these are displayed in tables in order of increasing $R^2$, 
and only those subsets in which each independent variable 
attains the nominal $P<.05$ level are presented.

RESULTS

Description of Variables Used in Analyses

Table 2 lists the means and standard deviations for all the 
variables used in the analyses at baseline and at the last 
measurement wave, which varied depending on the instru-
ment. Significant differences on selected variables were ob-
served over time between ethnic groups with this cohort and 
are published elsewhere (16,37). In brief, Mexican-American 
children tended to have greater skinfold thickness measure-
ments, consume a higher percentage of energy from fat, and 
engage in less physical activity than white children.

Bivariate Correlates with Dietary Behavior

Association of the between-subject components of dietary 
behavior and each independent variable was determined; the 
correlations are described next. Fixed effects were included in 
the model for demographic variables.

Child variables Children's personal variables were the most 
highly correlated with energy intake. Positive correlations 
were noted between the child's total dietary intake and 
total skinfold thickness, weight, and energy expenditure at 
home. An inverse association was observed for children's 
percentage energy from fat and their fat avoidance behavior; in 
contrast, a positive association was noted for the number of 
hours spent watching television per week and the percentage 
energy from fat. Inverse associations were observed between 
sodium intake and the child's food knowledge and child's fat 
avoidance behavior.

Parental variables Salt avoidance behavior was the only 
independent variable that predicted the child's energy intake. 
Associations between the child's percentage energy from fat 
and the parental variables included salt avoidance behavior, fat 
avoidance behavior, parental control over fat, parental control 
over food, and prompts to increase/decrease eating both at 
home and at school lunch (correlations ranged from -.22 to 
-.45, $P<.05$). Parental factors were partially successful in ex-
plaining a child's sodium intake per 1,000 kcal energy. Parental 
fat and salt avoidance scores and parental fat and salt knowledge 
were negatively correlated with child's sodium intake.

Demographic variables White children consumed more en-
ergy, a lower percentage of energy from fat, and less sodium 
than Mexican-American children. Gender influenced energy 
and sodium intakes: boys consumed more energy and less 
sodium than girls. Higher sodium intakes were found for 
children from lower socioeconomic levels. Less acculturated 
Mexican-American children consumed more sodium than those 
who were more acculturated. Unexpectedly, a negative asso-
ciation was observed between age of the child and energy 
intake; an approximate decrease of 60 kcal per day was noted 
as the child aged from 4 to 7 years old.

Environmental variables The greater the child's access to 
food (ie, percentage of intervals with food present), the lower 
was his or her energy intake. We found a similar inverse 
association between food present in the home and the child's 
fat intake. Furthermore, we found that the greater the number 
of people living in the home, the higher the child's sodium intake.

Regression Analyses

Table 3 summarizes the results of the all-subsets regressions. 
For each dependent variable, each regression contains a com-
bination of the independent variables that were found to be 
significant at $P<.05$ as well as fixed effects. All such combina-
tions were computed but only those in which every variable 
was statistically significant at $P<.05$ are reported. Each subset 
was arranged in order of increasing number of variables and 
increasing $R^2$. Thus, the last line of each subset shows the 
combination that explains the most variance and in which 
every variable attains $P<.05$. The $R^2$ represents the variance in 
child nutrient intake explained by the variable(s) in addition to 
any effects of demographic variables.

Child's energy intake is best explained by the combination of 
child energy expenditure, access to food, and total skinfold 
thickness. These 3 variables explain 46% of variance in energy 
intake. Child's percentage of energy from fat is best explained 
by the combination of the parental fat avoidance scale, paren-
tal salt avoidance survey, parental control over food, and 
prompts to increase food at lunch. These 4 variables explain 
40% of variance in percentage energy from fat intake. Finally, 
child's sodium intake per 1,000 kcal energy is best explained by 
parental salt avoidance survey.

DISCUSSION

In addition to expected demographic correlates of energy 
intake, the strongest determinants of child energy intake were 
energy expenditure and variables related to child's size and 
adiposity. These associations are expected because larger and 
more active children need to consume more energy. The 
findings also support the construct validity of these measures. 
In a review by Shah and Jeffery (19), associations between 
energy intake and measures of adiposity were inconsistent 
(18), so the correlation between energy intake and skinfold 
thickness is notable in our study because it is consistent with 
the hypothesis that excess consumption must be a factor in 
childhood obesity.

The only parental variable associated with child energy 
intake indicates that parents who avoid salt have children who 
consume less energy. This suggests that attempts to reduce 
sodium intake may have other benefits for children's diets. For 
example, providing fruits instead of salty snacks may help 
children control energy intake.

The dominant correlates of child percentage of energy from 
fat were from the parental domain. Six parental variables were 
significantly ($P<.05$) related to the child's fat intake; the signifi-
cant environmental variable is controlled by parents, which 
contributes to a substantial overlap between the parent's and 
the child's fat avoidance score. The negative association of
Table 3
Significant relationships (P<.05) between predictor variables and child's energy intake*

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Direction of association</th>
<th>Total energy*&lt;sup&gt;(R²)&lt;/sup&gt;</th>
<th>% Energy from fat*&lt;sup&gt;(R²)&lt;/sup&gt;</th>
<th>Sodium (mg/1,000 kcal)&lt;sup&gt;(R²)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single predictor</strong></td>
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<td></td>
</tr>
<tr>
<td>Salt avoidance scale (parent)</td>
<td>-</td>
<td>.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child's access to food</td>
<td></td>
<td>.09</td>
<td></td>
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<tr>
<td>Total skinfold thickness (child)</td>
<td>+</td>
<td>.11</td>
<td></td>
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<tr>
<td>Weight (child)</td>
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<td>.16</td>
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<td></td>
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<tr>
<td>Energy expenditure (child)</td>
<td>+</td>
<td>.18</td>
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<tr>
<td>Salt avoidance scale (parent) + total skinfold thickness (child)</td>
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<td>.15</td>
<td></td>
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<tr>
<td>Child's access to food + total skinfold thickness (child)</td>
<td></td>
<td>.19</td>
<td></td>
<td></td>
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<tr>
<td>Energy expenditure (child) + salt avoidance survey (parent)</td>
<td></td>
<td>.20</td>
<td></td>
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<tr>
<td>Salt avoidance survey (parent) + weight (child)</td>
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<td>.21</td>
<td></td>
<td></td>
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<tr>
<td>Energy expenditure (child) + total skinfold thickness (child)</td>
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<td>.31</td>
<td></td>
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<tr>
<td>Energy expenditure (child) + child's access to food</td>
<td></td>
<td>.33</td>
<td></td>
<td></td>
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<tr>
<td>Energy expenditure (child) + weight (child)</td>
<td></td>
<td>.34</td>
<td></td>
<td></td>
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<tr>
<td><strong>Combination of 3 predictors</strong></td>
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<tr>
<td>Energy expenditure (child) + salt avoidance survey (parent) + skinfold thickness (child)</td>
<td></td>
<td>.34</td>
<td></td>
<td></td>
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<tr>
<td>Energy expenditure (child) + salt avoidance survey (parent) + weight (child)</td>
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<td>.36</td>
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<tr>
<td>Energy expenditure (child) + child's access to food + total skinfold thickness (child)</td>
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<td><strong>Single predictor</strong></td>
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<tr>
<td>Total television hours per week</td>
<td>+</td>
<td>04</td>
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<tr>
<td>Prompts to increase food (lunch)</td>
<td>-</td>
<td>05</td>
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<tr>
<td>Prompts to increase food (home)</td>
<td>-</td>
<td>07</td>
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<tr>
<td>Parental control over food</td>
<td>-</td>
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<td>Salt avoidance survey (parent)</td>
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<tr>
<td>Parental control over fat</td>
<td>-</td>
<td>16</td>
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<td>Fat avoidance scale (parent)</td>
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<td>Fat avoidance scale (child)</td>
<td>-</td>
<td>21</td>
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<td><strong>Combination of 2 predictors</strong></td>
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<tr>
<td>Salt avoidance survey (parent) + prompts to increase food (home)</td>
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<td>.19</td>
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<tr>
<td>Salt avoidance survey (parent) + prompts to increase food (lunch)</td>
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<td>.20</td>
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<td>Parental control over fat + prompts to increase food (home)</td>
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<td>.22</td>
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<tr>
<td>Salt avoidance survey (parent) + parental control over fat</td>
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<td>.23</td>
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<td>Salt avoidance survey (parent) + parent control over food</td>
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<td>Parental control over fat and prompts to increase food (lunch)</td>
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<tr>
<td>Fat avoidance scale (parent) + salt avoidance survey (parent)</td>
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<td>.26</td>
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<td></td>
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<tr>
<td>Fat avoidance scale (child) + prompts to increase food (lunch)</td>
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<td>.26</td>
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<tr>
<td>Fat avoidance scale (child) + salt avoidance survey (parent)</td>
<td></td>
<td>.27</td>
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<tr>
<td>Fat avoidance scale (child) + parental control over food</td>
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<td>Fat avoidance scale (child) + parental control over fat</td>
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<tr>
<td>Fat avoidance scale (parent) + parental control over fat</td>
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<td>.29</td>
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<tr>
<td>Fat avoidance scale (parent) + parental control over food</td>
<td></td>
<td>.30</td>
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</table>

Child's fat intake with fat avoidance and salt avoidance scores may indicate that these scales are markers for a variety of actions parents are taking to promote healthful diets. Parental fat avoidance scores were negatively correlated with child's fat and sodium intakes. This lack of specificity of effect suggests that parents tend to make changes in multiple aspects of diet rather than only changing fat and sodium intake. The negative associations between fat intake and prompts to increase food intake at home and school may be the result of those children who eat less fat, eliciting more prompts from adults around them.

Few significant correlates of child sodium intake were found. By far the strongest were parental salt knowledge and fat knowledge. These findings suggest that nutrition knowledge is particularly important in eating a reduced-sodium diet. Other studies have found associations between parent knowledge and children's eating behaviors (25,44), but it should not be implied that improving knowledge is an effective means of promoting change in behavior. The correlation of salt and fat knowledge, as well as salt and fat avoidance, with child sodium intake provides additional support for hypotheses that parents make multiple changes in their own diets rather than nutrient-specific changes and that parent knowledge and behaviors affect children's eating habits.

Few environmental variables were correlated with child dietary behavior, but 2 of the correlations suggest an interesting and unexpected pattern. The association of access to food in the home with energy consumption was counterintuitive, because the more access children had, the less they ate. Similarly, the more frequently food was present near the child at home, the less fat the child ate. The access-to-food variable was based on parental report, and the food-present variable was directly observed, so the finding of similar results with different measures strengthens confidence that the result is
Table 3 (cont’d)
Significant relationships (P<.05) between predictor variables and child’s energy intake*

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Direction of association</th>
<th>Total energy* (R²)</th>
<th>% Energy from Fat* (R²)</th>
<th>Sodium (mg/1,000 kcal)**(R²)</th>
</tr>
</thead>
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<tr>
<td><strong>Combination of 3 predictors</strong></td>
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<tr>
<td>Fat avoidance scale (child) + salt avoidance survey (parent) + parental control over food</td>
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<tr>
<td>Fat avoidance scale (child) + salt avoidance survey (parent) + prompts to increase food</td>
<td>33</td>
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<tr>
<td>Fat avoidance scale (parent) + salt avoidance survey (parent) + parental control over food</td>
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<tr>
<td>Fat avoidance scale (child) + parental control over fat + prompts to increase food (lunch)</td>
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<td><strong>Combination of 4 predictors</strong></td>
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<tr>
<td>Fat avoidance scale (child) + salt avoidance survey (parent) + parental control over food + prompts to increase food (lunch)</td>
<td>39</td>
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<td></td>
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<tr>
<td>Fat avoidance scale (parent) + salt avoidance survey (parent) + parental control over food + prompts to increase food (lunch)</td>
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<tr>
<td><strong>Single predictor</strong></td>
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<td></td>
</tr>
<tr>
<td>Fat avoidance scale (child)</td>
<td>—</td>
<td>04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total no. of people in house</td>
<td>+</td>
<td>05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat avoidance scale (parent)</td>
<td>—</td>
<td>05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food knowledge (child)</td>
<td>—</td>
<td>06</td>
<td></td>
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</tr>
<tr>
<td>Salt avoidance survey (parent)</td>
<td>—</td>
<td>06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acculturation</td>
<td>—</td>
<td>08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat knowledge score (parent)</td>
<td>—</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt knowledge score (parent)</td>
<td>—</td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Combination of 2 predictors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total no. of people in house + fat avoidance scale (parent)</td>
<td>09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food knowledge (child) + salt avoidance survey (parent)</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt avoidance survey (parent) + total no. of people in house</td>
<td>12</td>
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<td></td>
</tr>
</tbody>
</table>

*For each dependent variable, each regression contains a combination of the independent variables that were found to be significant at P<.05. The last line of each group shows the combination in which every variable attained P<.05.
**Variance explained after adjusting for demographic variables.

meaningful. This finding can be interpreted as supporting child autonomy in food choices. If parents strictly control access to food, the child does not learn self-control skills and is likely to overeat when given access to food. The child has the opportunity to learn self-control of eating when food is freely present in the environment. This hypothesis is consistent with other writings on the importance of autonomy in children’s health behaviors (45), but it should be confirmed in other studies. The positive association between child sodium intake and number of people in the home could be due to a greater likelihood that someone in large households requests high-sodium foods or brings high-sodium foods into the home environment.

The results of multiple regressions indicate that, for 2 of the 3 child dietary variables, multiple variables are needed for the best explanation of child eating behaviors. In all cases, an important proportion of variance in child dietary intake is explained: from 40% to 46%. The analysis strategy, based on the stable component of repeated measures of dependent and independent variables, is expected to maximize observed associations. The availability of up to 12 measures of some variables enhanced reliability of these variables. However, the R² values reported in Table 3 are conservative, because they represent additional variance explained after controlling for demographic variables. These values estimate the amount of change in child nutrient intakes that could be expected if the independent variables were altered in an intervention.

The limitations of this study include reduced generalizability because of the sample residing in 1 geographic location, less than optimal reliability and validity of all measures, and the inability to include all possible hypothesized determinants of child dietary behaviors. At best, our results are specific to Mexican-American and non-Hispanic white children aged 4 to 7 years, and studies are needed to examine how determinants of dietary behaviors vary by age of the child.

Strengths of this study include examination of 3 health-related child nutrition variables and evaluation of multiple independent variables from multiple domains, which is consistent with contemporary models of health behavior (11,36). Other strengths are the large biethnic study sample, use of direct observation and physical measures whenever possible, documentation of psychometric characteristics of most variables, estimation of proportion of variance accounted for in child dietary intake, and ability to present results that provide hypotheses to guide improvements in child nutrition interventions. Our study is unique in its comprehensive examination of potential determinants of dietary behavior in young children. These results need to be confirmed in other studies, and the generalizability to age, ethnic, and geographically diverse samples needs to be tested.

APPLICATIONS
Manipulation of several determinants may be more successful in changing behaviors than targeting only child or parental influences on energy, fat, and sodium intake. Avoiding fat in food selection and preparation techniques seems to have multiple effects on children’s dietary behavior. Teaching parents to skin chicken, make tortillas with less or no fat, buy extra lean ground beef, and serve skim or 1% milk are only a few ways to lower fat in children’s food. Furthermore, parents should be encouraged to relax their control over what their child eats; instead, parents should make available nutrient-rich snacks to which their child can help himself or herself. Finally,
References