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# Association of Food Parenting Practice Patterns with Obesogenic Dietary Intake in Hispanic/Latino Youth: Results from the Hispanic Community Children's Health Study/Study of Latino Youth (SOL Youth)

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## Abstract

Some food parenting practices (FPPs) are associated with obesogenic dietary intake in non-Hispanic youth, but studies in Hispanics/Latinos are limited. We examined how FPPs relate to obesogenic dietary intake using cross-sectional data from 1214 Hispanic/Latino 8–16-year-olds and their parents/caregivers in the Hispanic Community Children's Health Study/Study of Latino Youth (SOL Youth). Diet was assessed with 2 24-hour dietary recalls. Obesogenic items were snack foods, sweets, and high-sugar beverages. Three FPPs (Rules and Limits, Monitoring, and

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Pressure to Eat) derived from the Parenting strategies for Eating and Activity Scale (PEAS) were assessed. K-means cluster analysis identified 5 groups of parents with similar FPP scores. Survey-weighted multiple logistic regression examined associations of cluster membership with diet. Parents in the controlling (high scores for all FPPs) vs. indulgent (low scores for all FPPs) cluster had a 1.75 (95% CI: 1.02, 3.03) times higher odds of having children with high obesogenic dietary intake. Among parents of 12–16-year-olds, membership in the pressuring (high Pressure to Eat, low Rules and Limits and Monitoring scores) vs. indulgent cluster was associated with a 2.96 (95% CI: 1.51, 5.80) times greater odds of high obesogenic dietary intake. All other associations were null. Future longitudinal examinations of FPPs are needed to determine temporal associations with obesogenic dietary intake in Hispanic/Latino youth.

### Keywords

Food parenting practices; Hispanic/Latino; diet; obesity; acculturation

## INTRODUCTION

According to the 2015–2016 National Health and Nutrition Examination Survey, Hispanic/Latino youth aged 2–19 years in the United States (US) have an obesity prevalence approximately 50 percent greater than that of non-Hispanic/Latino Whites (21.9% vs. 14.7% with body mass index [BMI] ≥age- and sex-specific 95$^{th}$ percentile of the 2000 Centers for Disease Control and Prevention growth charts, respectively) (1). Compared to youth without obesity aged 7–18 years in the US, youth with obesity are five times more likely to be adults with obesity (2), which can increase risk for comorbidities such as type 2 diabetes and cardiovascular disease (3,4). Thus, there is a critical need to identify targets for obesity prevention in Hispanic/Latino youth.

Energy-dense, micronutrient-poor foods such as processed snack foods, sweets, and high-sugar beverages have been identified as obesity-promoting, or obesogenic, items (5,6). Food parenting practices, defined as the behaviors and actions implemented by parents to influence their child’s attitudes, behaviors, or beliefs regarding food (7), have been associated with BMI and obesogenic dietary intake (8–11). Much of the research on food parenting practices has relied on the Child Feeding Questionnaire (CFQ) (10,11), as proposed by Birch et al. (12), which examines three food parenting practices: Pressure to Eat, Monitoring, and Restriction. Of these three practices, Pressure to Eat, described as parents’ tendency to encourage children to eat more food, has most consistently been related to significantly greater obesogenic dietary intake (8). However, across 78 studies included in a recent systematic review and meta-analysis of food parenting practices (as measured by any instrument) and their association with dietary intake, only one study was conducted in a predominately Hispanic/Latino sample (8).

Growing evidence suggests there are ethnic/racial differences in the use of food parenting practices and their associations with risk for obesity (13). This may be explained by cultural differences in the selection and meaning of specific food parenting practices (14). For example, Hispanic/Latino parents have reported higher use of Pressure to Eat than non-

Hispanic Whites (15,16), perhaps reflecting a cultural belief that heavier children are an indicator of good parenting and health (17–19). There also appear to be differences in the use of food parenting practices according to acculturation, with less acculturated Hispanic/Latino parents using more controlling practices, such as Pressure to Eat (20–23).

No previous studies, to our knowledge, have examined the association between food parenting practices and obesogenic dietary intake in a sample of pre-adolescent and adolescent Hispanic/Latino youth. The Hispanic/Latino study included in the systematic review by Yee et al. (8) showed a positive association between Pressure to Eat (referred to as "Control" in the study) and obesogenic dietary intake among females in a sample of predominantly first generation Mexican American parents of kindergarteners and second-graders enrolled in schools participating in an obesity prevention intervention (21). However, another study of Mexican American fifth-graders who were also enrolled in schools participating in an obesity prevention trial that was not included in the Yee et al. review found no significant association between Pressure to Eat and obesogenic dietary intake in males or females (24). It may be that food parenting practices have a different association with dietary intake in older versus younger children (8) due to older children having greater autonomy over their diets (7,25).

Food parenting practices have generally been examined independent of one another (7). However, parents actually use these practices in combination (7), and the combined effect of food parenting practices on dietary intake has been shown to differ from that of the individual effects (26). Specifically, although Pressure to Eat has previously been associated with increased obesogenic dietary intake, as in the meta-analysis by Yee et al. (8), Gevers et al. (27) found that a cluster of parents with *low* scores on Pressure to Eat and other coercive and non-coercive controlling food parenting practices (i.e., Rules and Monitoring) was more likely to have children with increased snack consumption compared to other food parenting practice clusters.

Examining clusters of parents instead of the individual food parenting practices may better reflect how food parenting practices are associated with obesogenic dietary intake. Such clusters may also serve as a proxy for general parenting and feeding styles. Specifically, low use of Pressure to Eat and Monitoring has been associated with a permissive parenting style (28–30) and feeding style (i.e., a parenting style specific to the context of feeding) (31). Given that both the cluster in Gevers et al. (27) characterized by low use of controlling food parenting practices and the permissive parenting or feeding style (32) have been associated with greater intake of obesogenic foods and beverages, clusters of food parenting practices characterized by low use of coercive and non-coercive controlling food parenting practices may promote high obesogenic dietary intake. Further, categorizing parents into clusters based on similarities in food parenting practices can show how practices are generally combined and can identify potential parent groups at risk for promoting high consumption of obesogenic foods/beverages in their children (26,27).

Examining these food parenting practice clusters within the context of other behavioral and physical aspects of the home environment may provide a more complete picture of how food parenting practices are associated with dietary intake (33,34). General parenting style impacts the emotional climate of parent-child interactions and the child's responsiveness to parenting behaviors, which can moderate the efficacy of parenting practices (35). Further, the availability of obesogenic foods in the home has previously been associated with dietary intake in Hispanics/Latinos (36) and may influence whether certain food parenting practices are needed (such as setting limits on consumption of snack foods) and their effect on weight control/maintenance (37).

Thus, the objective of this research was to examine how combinations of food parenting practices are associated with obesogenic dietary intake in Hispanic/Latino youth 8 to 16 years old and whether other home environment determinants (i.e., general parenting style and home food availability of obesogenic foods/beverages) and the child's socio-demographic characteristics (i.e., age group and sex) modify this association. Consistent with the one previous study which derived groups of parents based on parents' use of food parenting practices (27) and with expectations that this cluster would resemble a permissive feeding style, we hypothesized that parents in a cluster characterized by *low* controlling food parenting practices would have children with an increased odds of high obesogenic dietary intake. We expected this association to be strongest among pre-adolescent, female youth, based on the significant findings among females in the study by Arredondo et al. (21). Further, we hypothesized stronger associations in the context of 1) a permissive parenting style (low demandingness, high responsiveness), due to expectations that this parenting style would reinforce practices characteristic of a cluster typifying a permissive feeding style, and 2) high home food availability of obesogenic items, due to children living in such environments having relatively easy access to obesogenic items which low controlling parents would not be restricting their access to.

# METHODS

## Study population.

The Hispanic Community Children's Health Study/Study of Latino Youth (SOL Youth) (38) is an ancillary study of the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) (39). HCHS/SOL is a prospective, community-based cohort study of self-identified Hispanic/Latino individuals aged 18–74 years who were selected using a stratified, two-stage probability sampling design within designated geographical areas across the four participating field centers (Bronx, New York; Chicago, Illinois; Miami, Florida; San Diego, California), supported by a Coordinating Center at the University of North Carolina at Chapel Hill (39,40). All children aged 8 to 16 years living in the household of a parent/caregiver (henceforth referred to as the parent) who completed the HCHS/SOL baseline examination were eligible for SOL Youth and were invited to participate (38). Of the 1777 identified eligible youth, 1466 participated, corresponding to 1019 parents. Questionnaires were interviewer-administered in English or Spanish at the initial clinic examination. Protocols for the parent and child were approved by the institutional review boards at each of the institutions involved and are published (38–40). Written informed consent and assent were obtained from the parent and child, respectively.

### Food parenting practices.

Parents completed a single 26-item Parenting strategies for Eating and Activity Scale (PEAS) (41) regardless of the number of children they had enrolled in SOL Youth. PEAS, as opposed to the CFQ, was selected for SOL Youth because the original factor structure of the CFQ is not valid for low-income, Hispanic/Latino parents (12,42,43). PEAS was specifically developed to be culturally appropriate for Hispanic/Latino parents and measures five parenting practices (based on 5-point Likert-type responses) in the context of both diet and physical activity: Limit Setting, Discipline, Control, Monitoring, and Reinforcement (12,41). However, the original factor structure of PEAS was validated only for the combined food and physical activity parenting practice items and among Hispanic/Latino mothers of 5- to 8-year-olds (41). Thus, we derived a new factor structure for assessing food-specific parenting practices based on the 16 food-related items among parents of pre-adolescent and adolescent Hispanic/Latino youth (details found in Statistical Analysis).

### Obesogenic dietary intake.

Diet was assessed using two interviewer-administered 24-hour dietary recalls in the youth's language of choice (Spanish or English). Children as young as 8 years of age can reliably report their own food intake for the previous 24 hours, and thus parents were not used as proxies in these interviews (44–46). The first interview was conducted in-person at the clinic examination, and the second interview was conducted via telephone at least five, but no more than 30, days later. Interviews were completed using the Nutrition Data System for Research (NDSR) software from the Nutrition Coordinating Center at the University of Minnesota, which employs the multiple pass procedure. NDSR versions 10–12 (2010–2012) were used to collect data, and all raw files were processed using version 13 (2013) (47,48). To aid in recalling portion sizes, participants were provided with food models for the in-person interview and a Food Amounts Booklet for the telephone-based recall.

Dietary items defined as obesogenic for the purposes of this study are listed in Table 1 and include snack foods, sweets, sugar-sweetened beverages (any non-dairy beverage with added caloric sweeteners (6)), sweetened milk, and 100% fruit juice. Although sugar is not added to 100% fruit juice, it is included because it is similar to soda in energy and sugar content (49), and the 2015–2020 Dietary Guidelines recommend limited consumption (6). Obesogenic dietary intake was measured using the mean intake in servings per day across the two dietary recalls.

### Home environment characteristics.

**Home food availability of obesogenic items.—**Home food availability of obesogenic items was assessed using a parent-completed questionnaire of how often 17 food/beverage items were available in the home (5-point Likert-type scale ranging from never [1] to always [5] available) in any amount over the previous 30 days (50). Of these items, 9 were selected as obesogenic (regular soda, sports drinks, fruit drinks, 100% fruit juice, sweetened cereal, sweet baked goods, regular chips/crackers, chocolate candy, and other candy; Cronbach's $\alpha$=0.66 in SOL Youth), similar to classifications used by Couch et al. (51) and Ding et al. (50) in previous implementations of this questionnaire. Home food availability of obesogenic items was defined as the sum of the Likert-type rating of frequencies of these nine obesogenic items. Thus, potential scores ranged from 9 to 45.

**General parenting style.—**General parenting style was assessed using the 16-item Authoritative Parenting Index (52). The questionnaire assesses the two dimensions of authoritative parenting defined by Maccoby and Martin (53): demandingness and responsiveness (Cronbach's $\alpha$=0.81 and 0.69 for demandingness and responsiveness in SOL Youth, respectively) (52). Parents completed a separate questionnaire for each child and received a continuous score for the demandingness and responsiveness subscales based on their 4-point Likert-type responses. Potential scores for demandingness ranged from 7 to 28 and from 9 to 36 for responsiveness (52). Individuals were not further classified into the four parenting styles proposed by Maccoby and Martin (i.e., authoritative, authoritarian, permissive, or uninvolved) (53) due to the Authoritative Parenting Index requiring the "tertile-split procedure" to determine parenting style (52). This approach to classification is sample-specific and results in only those individuals in the highest or lowest tertiles of each subscale being categorized. By using the individual scales, we avoided excluding a third of our sample and increased the generalizability of our findings.

### Covariates.

**Socio-demographics.—**Socio-demographic information including child's age, child's sex, parent's age, parent's sex, parent's education, parent's Hispanic/Latino background, and household income were assessed during the clinic visit using parent-completed questionnaires.

**Child's weight status.—**The child's height (cm) and weight (kg) were measured by trained examiners during the clinic visit. Height was measured using a wall-mounted stadiometer. Weight was measured with the individual in light clothing and no shoes using a digital scale (Tanita Body Composition Analyzer, TBF-300A). BMI was calculated as weight (kg) divided by height squared ($m^2$). BMI percentile was calculated using a SAS program from the CDC (54). These percentiles were used to categorize children into four weight groups to aid in interpretability of estimates: underweight (BMI<$5^{th}$ percentile), normal weight (BMI $5^{th}$–$84^{th}$ percentile), overweight (BMI $85^{th}$–$94^{th}$ percentile), and obesity (BMI≥$95^{th}$ percentile). Due to only $n$ = 35 participants being considered underweight, the underweight and normal weight groups were combined.

**Acculturation.—**Parental acculturation was defined using two measures, years lived in the US (assessed with one question) and the Acculturation Rating Scale for Mexican Americans-II Brief (ARSMA-II Brief) (55,56). The ARSMA-II Brief assessed language use and preference (5-point Likert-type responses) with the 6-item Hispanic/Latino Orientation Scale (LOS) and the 6-item Anglo Orientation Scale (AOS; Cronbach's $\alpha$=0.85 for both LOS and AOS in SOL Youth) (55). Parents were classified into three groups according to mean AOS and LOS scores: bicultural (AOS and LOS≥3.0), assimilated (AOS≥3.0, LOS<3.0), and marginalized (AOS and LOS<3.0)/separated (AOS<3.0, LOS≥3.0). The marginalized and separated categories were combined because only five parents were classified as marginalized.

**Acculturative stress.—**Parental acculturative stress was reported using the 9-item Acculturative Stress Index (57). Each item related to experiences with perceived discrimination, intergenerational conflict, or language conflict over the past year (Cronbach's α=0.77 in SOL Youth) (57).

### Statistical analysis.

We conducted an exploratory factor analysis of the food-specific PEAS items on a random split half-sample to derive a new food-specific PEAS factor structure. Factors were retained by the proportion criterion and were rotated using varimax rotation. Factors were labeled according to those variables with factor loadings≥|0.30|, using names in accordance with a recent content map for food parenting practice constructs (7). A confirmatory factor analysis was conducted using the new factor structure in the validation half-sample. A k-means cluster analysis was conducted based on z-transformed scores for the new factors in parents with no missing data for any of the food-related PEAS items (*n* = 1000). Cluster solutions with 2 to 10 clusters were examined. Each analysis was run for a maximum of 1000 iterations, and seeds containing less than or equal to 5% of the sample were removed during each iteration (58). The best solution was selected according to the pseudo-F statistic (59,60).

To examine the associations between clusters and dietary intake, dietary recalls with total energy intakes below the sex-specific 1$^{st}$ percentile or greater than the sex-specific 99$^{th}$ percentile, or that were deemed unreliable according to the interviewer immediately after the participant completed the dietary recall (e.g., the participant was unable to recall one or more meals), were excluded (*n* = 34). Youth with only one dietary recall were also excluded (*n* = 104) since systematic differences were found between the in-person versus telephone dietary recalls. Remaining participants with missing covariate data (*n* = 93; missing at least one response for the continuous covariates and at least two responses used to define the categorical covariates) and missing food-specific PEAS responses (*n* = 27) were excluded. The final analytic sample size included 1214 youth. Individuals who were included in our sample were more likely to be of Mexican origin compared to individuals who were excluded (53.4% vs. 38.0%), but there were no other significant differences between individuals who were included versus excluded.

Differences in BMI percentile and socio-demographic characteristics of each cluster were assessed using Pearson's chi-squared tests and analysis of variance (ANOVA). Post-hoc significance levels were adjusted for using Tukey's test. A multinomial logistic regression model was run to examine whether acculturation status and potential home environment effect modifiers (home food availability of obesogenic items and demandingness and responsiveness) were associated with the odds of cluster membership (largest cluster as reference group). Due to the highly skewed distribution of obesogenic dietary intake, we created two categories of intake, divided at the median (3.4 servings/day). A logistic regression model was used to assess whether cluster membership (reference group: cluster with the lowest odds of obesogenic dietary intake) was associated with high obesogenic dietary intake. Interaction terms between cluster membership and each potential effect modifier (child's age group, child's sex, home food availability of obesogenic items, and demandingness and responsiveness) were tested individually in separate logistic regression models. Presence of effect modification was based on a p-value<0.10 for the interaction term. If the overall F-test for the interaction terms between individual cluster membership and the potential effect modifier had a p-value<0.10, backwards selection was used for removing non-significant interaction terms until all remaining interaction terms were significant at p<0.10. Main effects for each of the potential effect modifiers were tested using the logistic regression model adjusted for all covariates and cluster membership. Covariates included child's age group (2 categories), parent's age, child's sex, parent's sex, child's BMI percentile group (3 categories), parent's education (3 categories), household income (3 categories), field center (4 categories), parent's Hispanic/Latino background (7 categories), years parent lived in US (3 categories), ARSMA-II Brief category (3 categories), and Acculturative Stress Index.

All regression analyses and descriptive statistics accounted for stratification and for clustering by primary sampling units and were weighted to adjust for sampling probability of selection and nonresponse with the use of complex survey procedures in SAS software version 9.4 (SAS Institute).

## RESULTS

A description of the parents and youth in the SOL Youth target population is provided in Table 2. Parents were predominately female (88.8%) and from low socioeconomic status households (37.8% of households had less than a high school education and 51.6% of households had an income less than $20,000). The majority of children were over 11 years of age (58.2%) and were considered underweight/normal weight (53.7%). Mean obesogenic dietary intake among children was 3.8 servings per day, with the majority of their intake coming from sugar-sweetened beverages (1.1 servings per day) and sweets (1.3 servings per day).

The factor analysis identified three food-specific parenting practices (i.e., three factors) measured by PEAS (Table 3; $X^2$=487.45, df=101; Root Mean Square Error of Approximation [RMSEA]=0.09 [95% CI: 0.08, 0.09]; Standardized Root Mean Square Residual [SRMR]=0.06; and Bentler's Comparative Fit Index [CFI]=0.84). The RMSEA<0.10 and SRMR<0.08 indicated a good model fit, with the three-factor solution reproducing the data well (61). The Bentler's CFI was less than the model fit criteria of ≥0.95, suggesting low average correlation between variables (62). We explored including correlated errors between items and allowing items to load on multiple factors; however, these changes did not improve fit. Thus, the 3-factor solution without correlated errors was selected for use. The three new factors are defined in Table 3 and were named Rules and Limits, Monitoring, and Pressure to Eat.

Based on standardized scores for these factors, each parent was placed into one of five clusters (Figure 1). The controlling and indulgent clusters were characterized by all high and all low scores for each factor, respectively, while the remaining three clusters were characterized by a high score for only one of the factors (pressuring cluster: high Pressure to Eat score; disciplinary cluster: high Rules and Limits score; tracking cluster: high

Monitoring score). Differences were observed across clusters in the unadjusted levels of socio-demographic characteristics; there were no differences across clusters according to child's BMI percentile (Supplementary Table 1). Adjusted associations of acculturation-related measures and potential home environment effect modifiers with cluster membership are shown in Table 4. The purpose of these analyses was to determine how acculturation and acculturative stress related to the use of food parenting practices as well as whether the potential effect modifiers were related to our primary exposure (cluster membership). We found that, relative to belonging in the controlling cluster, the odds of belonging in the disciplinary or tracking cluster were 0.31 (95% CI: 0.18, 0.55) and 0.53 (95% CI: 0.31, 0.89) times lower for every one-point increase in scores for the Acculturative Stress Index (overall F-test $p<0.01$), respectively.

Table 5 presents results of the logistic regression models for associations of food parenting practice cluster membership with obesogenic dietary intake. Results for the main effects models did not include interaction terms with any of the potential effect modifiers but did include adjustment for their main effects. The joint F-test for cluster membership had a $p=0.13$; however, exploration of pairwise comparisons showed that parents in the controlling cluster had a 1.81 (95% CI: 1.05, 3.13) times greater odds of having children with high obesogenic dietary intake compared to those in the indulgent cluster. Further, parents in the pressuring cluster had a 2.19 (95% CI: 1.18, 4.06) times greater odds of having children with high obesogenic dietary intake compared to those in the indulgent cluster. All other associations for the main effect of cluster membership with obesogenic dietary intake were null.

We observed significant effect modification by age group for the pressuring cluster only (Table 5; $p=0.02$). A joint F-test for cluster membership and the interaction term between pressuring cluster membership and age group had a $p=0.02$. Pairwise comparisons from the effect modification model showed similar results to those from our exploratory analyses in the main effects model. Specifically, membership in the controlling cluster was associated with a 1.75 (95% CI: 1.02, 3.03) times greater odds of having children with high obesogenic dietary intake compared to those in the indulgent cluster. Regarding the pressuring cluster, we found that parents of 12- to 16-year-olds in the pressuring cluster had a 2.96 (95% CI: 1.51, 5.80) times greater odds of having children with high obesogenic dietary intake compared to parents of 12- to 16-year-olds who were in the indulgent cluster, while there was no association between pressuring compared to indulgent cluster membership and obesogenic dietary intake among the younger children. No other effect modification was observed for child's age group, child's sex, home food availability of obesogenic items, or demandingness and responsiveness.

We further explored whether the main effects of the potential effect modifiers were associated with obesogenic dietary intake. We found that males had a 1.70 (95% CI: 1.25, 2.30) times greater odds of high obesogenic dietary intake compared to females, and every additional obesogenic item made available in the home was associated with a 1.05 (95% CI: 1.02, 1.08) times greater odds of high obesogenic dietary intake (results not shown in tables).

## DISCUSSION

This is the first study to investigate the association of food parenting practices and obesogenic dietary intake in pre-adolescent and adolescent Hispanics/Latinos. In the target population of SOL Youth Hispanic/Latino children and their parents living in four distinct US cities, we found that, contrary to our hypothesis, parents in a cluster characterized by *high* controlling food parenting practices (controlling cluster; high scores for Rules and Limits, Monitoring, and Pressure to Eat) had increased odds of having children with high obesogenic dietary intake compared to parents in a cluster characterized by *low* controlling food parenting practices (indulgent cluster; low scores for Rules and Limits, Monitoring, and Pressure to Eat). Further, parents who reported high use of Pressure to Eat in combination with limited use of Rules and Limits and Monitoring had increased odds of having 12- to 16-year-olds with high obesogenic dietary intake compared to indulgent parents.

Although two previous studies derived food parenting practice-based clusters (26,27), we are the first to identify food parenting practice-based clusters specifically for parents of Hispanic/Latino youth. The three food-specific PEAS factors we based our clusters on are similar to factors seen in other food parenting practice instruments, with Pressure to Eat and Monitoring including all items from the corresponding factors from the CFQ (63). While parental acculturation was not a predictor of cluster membership, parental acculturative stress was inversely associated with membership in the disciplinary cluster (high Rules and Limits and Monitoring scores and low Pressure to Eat score) and tracking cluster (high Monitoring and low Rules and Limits and Pressure to Eat scores) versus the controlling cluster. This finding is consistent with previous studies' reports that general stress is positively associated with use of controlling food parenting practices, particularly Pressure to Eat (64,65). Parents may use more controlling practices under acculturative stress due to stress clouding their ability to recognize and respond to children's satiety cues (66) or due to parents using food parenting to increase their perceived control in an environment in which they generally feel a lack of control (67).

Consistent with our hypothesis, one of the clusters we derived was characterized by low use of controlling food parenting practices (the indulgent cluster), which appeared to represent a permissive feeding style. Permissive feeding styles have been associated with increased weight status in low-income, Hispanic/Latino youth (10,31,68–70) and greater intake of obesogenic foods and beverages (32). However, contrary to our hypothesis and the literature, we found that the indulgent cluster was associated with the lowest odds of obesogenic dietary intake, with individuals in the controlling or pressuring cluster compared to the indulgent cluster having an increased odds of high obesogenic dietary intake.

The high use of Coercive Control, defined as "parent's pressure, intrusiveness, and dominance in relation to children's feelings and thoughts, as well as their behaviors," (7) in both the controlling and pressuring cluster may explain why membership in these clusters was associated with increased odds of high obesogenic dietary intake compared to the indulgent cluster. Previous research has suggested that use of Coercive Control limits children's ability to self-regulate their dietary intake and promotes overconsumption of controlled foods when they are freely available (71–74). While this explanation would seem to indicate that high use of controlling or pressuring practices would thus be associated with increased weight status in Hispanic/Latino youth, such conclusions cannot be made given the cross-sectional nature of this study. Specifically, it is possible that these food parenting practices were used in *response* to children having high obesogenic intake. For example, it may be that children of parents in the controlling cluster were picky eaters who avoided consuming more healthful items such as vegetables (75) in favor of consuming obesogenic items (33). Hispanic/Latino parents have previously reported high levels of concern about picky eating (76), and thus parents may have been using controlling food parenting practices to promote more dietary variety or healthful eating. Given that picky eating has shown a mixed relationship with weight status (77), caution should be taken in concluding that children of parents in the controlling food parenting practice cluster have an increased risk for overweight or obesity.

It may also be that parents in the pressuring cluster were using Pressure to Eat in response to their children under-eating or having a low weight, despite their high obesogenic dietary intake (7,11). Hispanic/Latino parents tend to view heavier children as indicators of good health (17–19), and thus they may be more likely to use pressuring tactics due to skewed perceptions of their child being below a “healthy” weight. Further, in the only previous longitudinal study of food parenting practices and weight status among Hispanic/Latino school-aged children (8–10 years old at baseline), use of Pressure to Eat was actually associated with lower weight status after one year of follow-up among males (78). Thus there is a need for future studies to examine longitudinal associations between these clusters and weight outcomes in order to clarify whether the observed association between pressuring cluster membership and high obesogenic dietary intake is related to an increased risk for obesity.

Another explanation for the findings is that our reference cluster, the indulgent cluster, more closely represented an uninvolved feeding style (low demandingness, low responsiveness) (31) than a permissive feeding style. Though associations between overweight/obesity and an uninvolved style appear similar to those seen with a permissive style (10,79), an uninvolved feeding style has been correlated with decreased intake of sugar-sweetened beverages (70). The food-specific items from PEAS did not measure food parenting practices related to the responsiveness domain of feeding styles, such as Autonomy Support and Promotion (7), making it difficult to determine which feeding styles our food parenting practice clusters most closely resemble.

Though a previous systematic review and meta-analysis of food parenting practices and dietary intake by Yee et al. (8) did not observe effect modification by age for Pressure to Eat (comparing studies of 2- to 6-year-olds vs. 7- to 11-year-olds), the authors did observe an overall positive association between Pressure to Eat and obesogenic dietary intake. This is similar to our finding that the pressuring cluster, characterized by high Pressure to Eat and low Rules and Limits and Monitoring scores, was associated with high obesogenic dietary intake compared to the indulgent cluster, except our significant findings were limited to adolescents. This effect modification is contrary to our expectation that associations of food parenting practices and dietary intake would be stronger among pre-adolescents than adolescents due to pre-adolescents’ reduced autonomy. One potential explanation is that adolescents are more responsive to Pressure to Eat than pre-adolescents. Children instinctively self-regulate food intake according to hunger and satiety, but this ability tends to weaken as they age (80). This could result in adolescents consuming more obesogenic foods in response to external pressures to eat, even in the absence of hunger.

It is also possible that the combination of high use of Pressure to Eat with limited use of Rules and Limits is responsible for the effect modification by age of the association of pressuring compared to indulgent cluster membership with high obesogenic dietary intake. High scores for Pressure to Eat characterized both the pressuring and controlling cluster, yet only in the pressuring cluster where Rules and Limits and Monitoring scores were low did we see that age modified the association with obesogenic dietary intake. Previous studies have not found that age modifies the association between Monitoring and obesogenic dietary intake, but increased use of Rules and Limits has been more strongly associated with decreased obesogenic dietary intake among older versus younger children (8). Thus it makes sense that low use of Rules and Limits in combination with high Pressure to Eat would promote obesogenic intake among adolescents specifically in the pressuring compared to indulgent cluster.

One would then expect that other clusters characterized by limited use of Rules and Limits would be positively associated with high obesogenic dietary intake and that age would modify these associations. However, this was not the case, with low use of Rules and Limits in the context of tracking cluster membership having a null association with obesogenic dietary intake regardless of age. These findings highlight the importance of examining food parenting practices in combination and suggest that Pressure to Eat (the main difference between the pressuring and indulgent clusters) is an important determinant of the relationship between food parenting practices and obesogenic dietary intake.

Despite the effect modification by age, we did not observe any effect modification by child's sex. It is possible that the youth in our sample presented similar awareness and responsiveness to controlling food parenting practices (21), and thus there were no observed differences in the association between food parenting practices and obesogenic dietary intake by sex. A recent meta-analysis also observed that parents did not differ in their use of Coercive Control across males and females, and thus that may explain why we did not observe effect modification by sex (81).

We also hypothesized that both home food availability of obesogenic items and parenting style would modify associations between food parenting practices and obesogenic dietary intake because they define the home environment in which food parenting practices are implemented. Though home food availability of obesogenic items was positively associated with odds of obesogenic dietary intake, the interaction with food parenting practice cluster membership was not significant. Increased autonomy in food selection and decreased intake of foods from the home among 8- to 16-year-olds (37) likely resulted in the null findings for effect modification. However, Loth et al. (82) previously observed that the association between Restriction (a construct not measured by food-specific items in PEAS) and obesogenic dietary intake in their sample of racially/ethnically diverse adolescents was modified by home food availability of obesogenic items. Thus home food availability may only modify associations between select food parenting practices and obesogenic dietary intake.

We did not observe a significant association between parenting style and obesogenic dietary intake or a significant interaction between parenting style and food parenting practice clusters. Although the findings for parenting style and dietary intake are less consistent than those seen for feeding styles, previous literature has found that an authoritative parenting style is associated with decreased intake of snacks and sugar-sweetened beverages (32). Studies examining parenting style as an effect modifier have also had mixed findings (70,83,84). Theory suggests that parenting styles affect the efficacy of parenting practices by determining the practices implemented, the behaviors that give those practices meaning, the nature of parent-child interactions, and the child's openness to parental influence (35). Given our findings and the mixed body of literature, future studies are needed to clarify the relationship between parenting style and obesogenic dietary intake and disentangle how parenting style and food parenting practices interact.

### Strengths and Limitations.

A key strength of this study is the use of a large, representative sample of Hispanic/Latino youth living in multiple geographic areas and across pre-adolescence and adolescence to examine food parenting practices and their associations with obesogenic dietary intake. The development of a new factor structure for the food-specific PEAS items ensured that we were measuring food parenting practices relevant to the population of interest. Further, use of trained interviewers and examiners ensured high quality data collection for all variables, and diet measurement via multiple 24-hour dietary recalls allowed for a better representation of usual intake that other studies may not have captured.

However, our study is not without limitations. SOL Youth is a cross-sectional study, and thus no conclusions can be made regarding temporality. Parents completed a single PEAS questionnaire for all children, and it is possible that parents use different food parenting practices depending on the child's age, sex, weight status, or developmental status (85). We were also limited by PEAS not capturing responsive food parenting practices and by the lack of a questionnaire on feeding styles. These shortcomings make it difficult to determine whether food parenting practices characteristic of a more permissive or uninvolved feeding style are associated with high obesogenic dietary intake. Additionally, misreporting on diet assessment is a well-established limitation in nutrition epidemiology research. Examinations in children and adolescents indicate that underreporters of total energy tend to report less sugar-sweetened beverages, sweets, and snacks than plausible reporters, all of which defined our outcome of interest (86–88). Further, obesogenic foods/beverages are frequently consumed during snack occasions, which are less structured than meal occasions and thus more prone to misreporting (86).

### Implications.

Future studies are needed to examine food parenting practices pertaining to responsiveness, such as those on child involvement, encouragement, praise, reasoning, and negotiation (7), in order to clarify whether a food parenting practice cluster resembling a permissive or uninvolved feeding style is associated with low obesogenic dietary intake. Studies should also have parents complete food parenting practice questionnaires for each child to allow for derivation of age-specific food parenting practice clusters. Such clusters could enhance the limited literature of the use and impact of food parenting practices in older children and adolescents, specifically. Future studies should also examine the role of child's acculturation status and acculturative stress in relation to use of food parenting practices and child's dietary intake given previous work in SOL Youth has shown a positive association between integrated (bicultural) acculturation status and more healthful diets (89). Longitudinal studies of food parenting practices among Hispanics/Latinos are needed to better understand the impact of food parenting practices on obesogenic dietary intake and whether child socio-demographic characteristics and home environment characteristics modify this association.

### Conclusions

We found that parents with high use of Rules and Limits, Monitoring, and Pressure to Eat in combination have increased odds of having children with high obesogenic dietary intake compared to parents with low use of these three practices. Further, children aged 12 to 16 years with parents who reported high use of Pressure to Eat and low use of Rules and Limits and Monitoring had increased odds of having high obesogenic dietary intake. Future longitudinal work is needed to determine whether discouraging use of controlling food parenting practices, particularly Pressure to Eat among older youth, may help reduce obesogenic dietary intake in Hispanic/Latino youth.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## NON-STANDARD ABBREVIATIONS

| | |
|---|---|
| **FPPs** | food parenting practices |
| **SOL Youth** | Hispanic Community Children's Health Study/Study of Latino Youth |
| **PEAS** | Parenting strategies for Eating and Activity Scale |

| | |
|---|---|
| **CFQ** | Child Feeding Questionnaire |
| **ARSMA-II Brief** | Acculturation Rating Scale for Mexican Americans-II Brief |
| **LOS** | Hispanic/Latino Orientation Scale |
| **AOS** | Anglo Orientation Scale |

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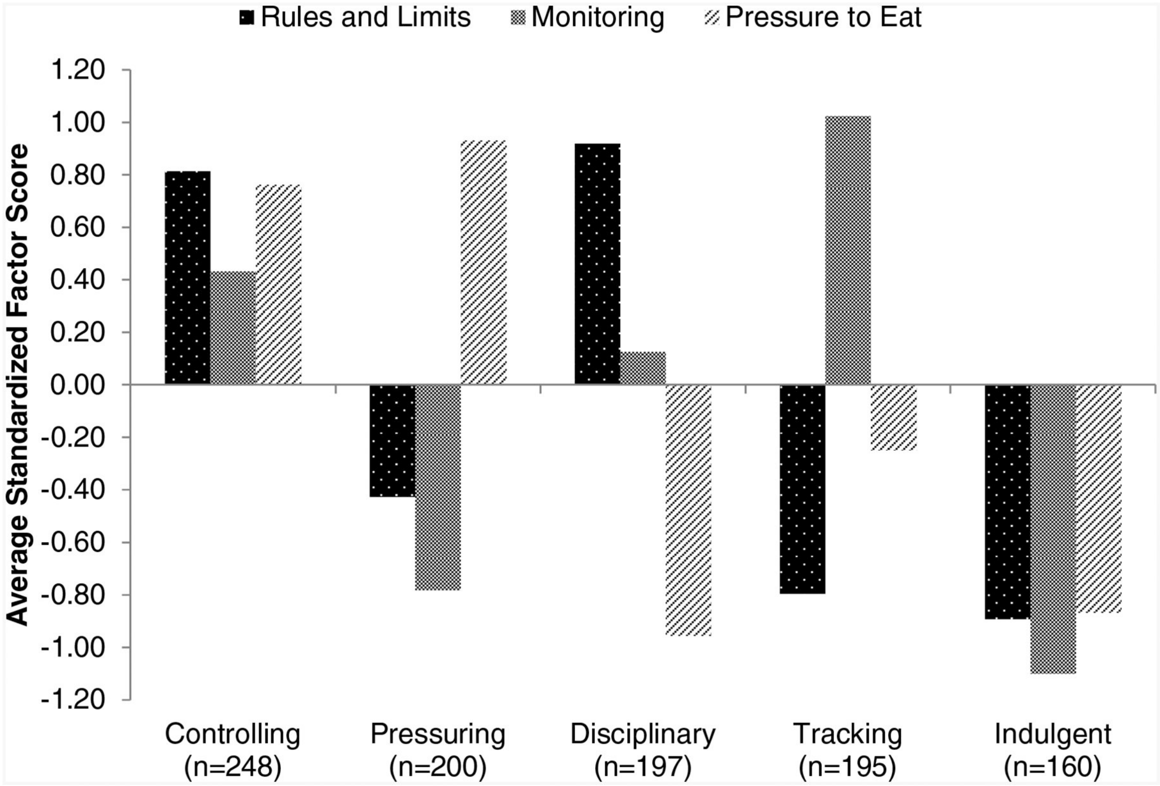


**Figure 1.**

Clusters derived from k-means cluster analysis based on standardized factor scores in SOL Youth parents ($n = 1000$)

**Table 1.**

Obesogenic food/beverages categories and specific food groups included

| Category | Foods/beverages included |
|---|---|
| Snack foods | Crackers (all grain varieties), snack bars (all grain varieties); snack chips (all grain varieties); and popcorn (plain and flavored) |
| Sweets | Ready-to-eat cereal (presweetened, all grain varieties); cakes, cookies, pies, pastries, Danish, doughnuts, cobblers (all grain varieties); frozen desserts (dairy and non-dairy); pudding and other dairy desserts (includes artificially sweetened); chocolates; candies; and miscellaneous desserts |
| 100% fruit juice | Citrus and non-citrus juice |
| Sweetened milk | Ready-to drink flavored milk (whole, reduced fat, low fat and fat free), sweetened flavored milk beverage powder, and dairy-based sweetened meal replacement/supplement |
| Sugar-sweetened beverages | Sweetened varieties of soft drinks, fruit drinks, water, tea, coffee, coffee substitutes, and sports drinks |

**Table 2.**

Characteristics of the target population of SOL Youth (unweighted *n* = 1214)

| | Mean or n (SE or %) |
|---|---|
| ***Socio-demographics*** | |
| **Child's sex** (*n* and %) | |
| Female | 613 (49.5) |
| Male | 601 (50.5) |
| **Parent's sex** (*n* and %) | |
| Female | 1053 (88.8) |
| Male | 161 (11.2) |
| **Child's age, years** (*n* and %) | |
| 8–≤11 years | 538 (41.8) |
| 12–16 years | 676 (58.2) |
| **Parent's age, years** (mean and SE) | 40.9 (0.3) |
| **Child's BMI, kg/m$^2$** (mean and SE) | 22.3 (0.2) |
| **Child's BMI percentile group** (*n* and %)* | |
| Underweight/Normal weight | 622 (53.7) |
| Overweight | 259 (20.2) |
| Obesity | 333 (26.2) |
| **Parent's education** (*n* and %) | |
| <High school | 455 (37.8) |
| High school or equivalent | 342 (29.3) |
| >High school | 417 (32.9) |
| **Household income** (*n* and %) | |
| <$20,000 | 625 (51.6) |
| $20,000-$40,000 | 407 (32.7) |
| >$40,000 | 182 (15.7) |
| **Parent's Hispanic/Latino background** (*n* and %) | |
| Dominican | 136 (12.8) |
| Central American | 111 (7.1) |
| Cuban | 103 (6.4) |
| Mexican | 614 (53.4) |
| Puerto Rican | 130 (11.8) |
| South American | 77 (5.2) |
| Mixed/Other | 43 (3.2) |
| **SOL Youth field center** (*n* and %) | |
| Bronx | 330 (34.5) |
| Chicago | 290 (14.6) |
| Miami | 230 (14.3) |
| San Diego | 364 (36.6) |
| ***Acculturation*** | |
| **Years parent lived in US** (*n* and %) | |

| | Mean or n (SE or %) |
|---|---|
| Born in US | 160 (13.7) |
| <20 years | 596 (49.7) |
| ≥20 years | 458 (36.6) |
| **Parent's ARSMA-II Brief** (*n* and %) | |
| Bicultural | 333 (28.2) |
| Assimilated | 91 (7.8) |
| Separated/marginalized | 790 (64.1) |
| ***Parent's Acculturative Stress Index*** (mean and SE) | 1.8 (0.03) |
| ***Potential home environment effect modifiers*** | |
| **Home food availability of obesogenic items** (mean and SE) | 25.8 (0.2) |
| **Authoritative Parenting Index** (mean and SE) | |
| Demandingness | 25.1 (0.1) |
| Responsiveness | 24.8 (0.1) |
| ***Outcome*** | |
| **Obesogenic dietary intake** (mean and SE) | 3.8 (0.1) |
| Snack foods | 0.4 (0.04) |
| Sweets | 1.3 (0.1) |
| Sugar-sweetened beverages | 1.1 (0.1) |
| Sweetened milk | 0.2 (0.02) |
| 100% fruit juice | 0.6 (0.04) |
| **Obesogenic dietary intake** (mean and SE)† | |
| High | 2.1 (0.1) |
| Low | 5.4 (0.1) |

Unweighted *n* (weighted %)

SE, standard error; BMI, body mass index; US, United States; ARSMA-II Brief, Acculturation Rating Scale for Mexican Americans-II Brief

*Underweight/Normal weight: BMI<85th percentile; Overweight: BMI 85th–94th percentile; Obesity: BMI≥95th percentile

†High obesogenic dietary intake: ≥median (3.4 servings of obesogenic items)

**Table 3.**

Comparison of factor loadings for the exploratory versus full sample of parents in SOL Youth

| **Food-specific PEAS items as described in SOL Youth** | **Rules and Limits** | | **Monitoring** | | **Pressure to Eat** | |
|---|---|---|---|---|---|---|
| | ***n*** | ***n*** | ***n*** | ***n*** | ***n*** | ***n*** |
| | **504** | **1000** | **504** | **1000** | **504** | **1000** |
| *Discipline* | | | | | | |
| 1. How often do you discipline your children for drinking a soda without your permission? | **0.75** | **0.73** | 0.15 | 0.15 | 0.04 | 0.06 |
| 2. How often must your children ask permission before drinking soda? | **0.69** | **0.69** | 0.32 | 0.28 | 0.03 | 0.02 |
| 3. How often do you discipline your children for getting a snack without your permission? | **0.68** | **0.68** | 0.09 | 0.11 | 0.14 | 0.14 |
| *Limit Setting* | | | | | | |
| 4. I limit the number of snacks my children eat. | **0.39** | **0.40** | 0.23 | 0.21 | 0.18 | 0.12 |
| 5. I limit the amount of soda my children drink. | **0.31** | **0.32** | 0.23 | 0.23 | 0.10 | 0.09 |
| *Monitoring* | | | | | | |
| 6. How often must your children ask permission before getting a snack? | **0.63** | **0.63** | 0.25 | 0.20 | 0.15 | 0.10 |
| 7. How much do you keep track of the salty snack foods (potato chips, tortilla chips) that your children eat? | 0.19 | 0.20 | **0.82** | **0.81** | 0.04 | 0.02 |
| 8. How much do you keep track of the sweet snacks (candy, ice cream, cake) that your children eat? | 0.24 | 0.25 | **0.75** | **0.74** | −0.01 | 0.01 |
| 9. How much do you keep track of the high fat foods that your children eat? | 0.09 | 0.15 | **0.72** | **0.73** | −0.01 | −0.04 |
| 10. How much do you keep track of the servings of fruits and vegetables your children are eating? | 0.26 | 0.24 | **0.42** | **0.47** | 0.06 | 0.07 |
| *Reinforcement* | | | | | | |
| 11. How often do you praise your children for eating a healthy snack? | 0.28 | 0.28 | **0.40** | **0.32** | 0.10 | 0.13 |
| *Control* | | | | | | |
| 12. I have to be especially careful to make sure my children eat enough. | 0.07 | 0.08 | 0.06 | 0.07 | **0.61** | **0.62** |
| 13. If I don’t regulate or guide my children’s eating, they would eat much less than they should. | 0.01 | 0.03 | 0.03 | 0.03 | **0.58** | **0.60** |
| 14. If my children say, “I’m not hungry,” I try to get them to eat anyway. | 0.02 | 0.03 | −0.02 | 0.00 | **0.56** | **0.57** |
| 15. My children should always eat all the food on their plate. | 0.12 | 0.07 | 0.07 | 0.07 | **0.43** | **0.43** |
| 16. I offer sweets (candy, ice cream, cake) to my children as a reward for good behavior. | 0.14 | 0.10 | 0.02 | −0.03 | **0.28** | **0.26** |

Note: Horizontal lines indicate the food-specific PEAS factor structure derived with exploratory factor analysis; bolded values indicate where each item had the highest factor loading

## Table 4.

Associations of acculturation, acculturative stress, and hypothesized home environment effect modifiers with odds of specified food parenting practice cluster membership versus controlling cluster membership (unweighted $n = 1214$)*

| | Pressuring ($n$ = 237) | Disciplinary ($n$ = 226) | Tracking ($n$ = 218) | Indulgent ($n$ = 192) |
|---|---|---|---|---|
| ***Acculturation*** | | | | |
| **Years parent lived in US** | | | | |
| Born in US | 1.11 (0.41, 3,00) | 0.80 (0.29, 2.17) | 0.76 (0.29, 2.00) | 1.02 (0.25, 4.06) |
| <20 years | 1.00 | 1.00 | 1.00 | 1.00 |
| ≥20 years | 1.06 (0.50, 2.21) | 1.39 (0.63, 3.07) | 1.08 (0.53, 2.20) | 1.46 (0.68, 3.13) |
| **Parent's ARSMA-II Brief** | | | | |
| Bicultural | 0.64 (0.32, 1.25) | 1.42 (0.64, 3.17) | 1.71 (0.83, 3.50) | 0.56 (0.22, 1.44) |
| Assimilated | 0.53 (0.11, 2.61) | 1.06 (0.32, 3.57) | 0.69 (0.19, 2.53) | 0.70 (0.11, 4.27) |
| Separated/marginalized | 1.00 | 1.00 | 1.00 | 1.00 |
| ***Parent's Acculturative Stress Index*** ** | 0.99 (0.62, 1.57) | 0.31 (0.18, 0.55)** | 0.53 (0.31, 0.89)* | 0.58 (0.33, 1.01) |
| ***Potential home environment effect modifiers*** | | | | |
| **Home food availability of obesogenic items** | 1.03 (0.97, 1.08) | 0.96 (0.90, 1.02) | 0.95 (0.90, 1.00) | 1.02 (0.96, 1.08) |
| **Authoritative Parenting Index** | | | | |
| Demandingness | 0.99 (0.88, 1.10) | 1.05 (0.94, 1.19) | 1.07 (0.94, 1.21) | 0.93 (0.81, 1.07) |
| Responsiveness | 0.89 (0.81, 0.99)* | 0.91 (0.81, 1.02) | 0.89 (0.80, 0.99)* | 0.95 (0.84, 1.07) |

Unweighted *n*; US, United States; ARSMA-II Brief, Acculturation Rating Scale for Mexican Americans-II Brief

* p<0.05,

** p<0.01

Multinomial logistic regression model (reference group: controlling cluster [$n = 341$]) adjusted for the following covariates: child's age, parent's age, child's sex, parent's sex, child's BMI percentile group, parent's education, household income, SOL Youth center, Hispanic/Latino background, years parent lived in US, ARSMA-II Brief, Acculturative Stress Index, home food availability of obesogenic items, demandingness, and responsiveness

**Table 5.**

Associations of specified food parenting practice cluster membership compared to indulgent cluster membership with odds of high versus low obesogenic dietary intake (unweighted $n = 1214$)

| Clusters | Odds Ratios (95% CI) |
|---|---|
| **Main effects model** | |
| Controlling | 1.81 (1.05, 3.13) * |
| Pressuring | 2.19 (1.18, 4.06) * |
| Disciplinary | 1.46 (0.82, 2.60) |
| Tracking | 1.60 (0.86, 2.97) |
| Indulgent | 1.00 |
| **Effect modification model** | |
| Controlling | 1.75 (1.02, 3.03) * |
| Pressuring | |
| *8–<11 years*† | 1.30 (0.61, 2.78) |
| *12–16 years*† | 2.96 (1.51, 5.80) ** |
| Disciplinary | 1.41 (0.79, 2.50) |
| Tracking | 1.58 (0.85, 2.92) |
| Indulgent | 1.00 |

* p<0.05,

** p<0.01

† odds of high vs. low obesogenic dietary intake for individuals in the pressuring cluster vs. indulgent cluster within given age groups

Logistic regression models adjusted for the following covariates: child's age, parent's age, child's sex, parent's sex, child's BMI percentile group, parent's education, household income, SOL Youth center, Hispanic/Latino background, years parent lived in US, ARSMA-II Brief, Acculturative Stress Index, home food availability of obesogenic items, demandingness, and responsiveness

Effect modification model included an interaction term between age group and pressuring cluster membership

High obesogenic dietary intake: ≥median (3.4 servings of obesogenic items)