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The Association of Parental/Caregiver Chronic Stress with Youth Obesity: Findings from the Study of Latino Youth and the Hispanic Community Health Study/Study of Latinos Sociocultural Ancillary Study

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Abstract

Background: Prior studies indicate that chronic stress is associated with obesity in adults. However, whether parental/caregiver stress is associated with obesity in their offspring has not been widely examined in Hispanic/Latino populations. In this study, we evaluated the role of caregiver chronic stress on child obesity and whether home food environment or child lifestyle behaviors explained the association.

Methods: The study included a sample of Hispanic/Latino youth and their caregivers ($n = 473$) from the Study of Latinos (SOL) Youth study and the Hispanic Community Health Study/SOL Sociocultural Study, which enrolled children aged 8–16 years from four cities (Bronx, Chicago, Miami, and San Diego), and provided assessments of adult chronic stress. Poisson regression models were used to assess the association between parental/caregiver stress and child obesity, adjusting for potential confounders.

Results: Twenty-two percent of caregivers did not report any chronic stressors, 48% reported 1–2, and 29% reported ≥3 stressors. The prevalence of obesity in youth increased with number of caregiver stressors from 23% among those without caregiver stressors to 35% among those with ≥3 stressors (p for trend 0.03). After model adjustment, youths whose caregivers reported ≥3 stressors were more likely to be obese than youths whose caregivers reported no stressors (prevalence ratio = 1.53; 95% confidence interval 1.01–2.32). This association was independent of food home environment, child diet quality, and child physical activity, but it was not independent of caregiver obesity.

Conclusions: These findings suggest that parental/caregiver chronic stress is related to obesity in their children. Future research is needed to confirm this association in longitudinal studies and in other population groups.

Keywords: obesity, caregiver stress, youth, home environment

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Introduction

Prior studies in adults indicate that psychosocial stress is related to cardiovascular disease risk.[1,2] In the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), we showed that among Hispanic/Latino adults, chronic stress is associated with traditional cardiovascular risk factors, obesity, and lower diet quality.[3,4] In particular, chronic stress was associated with obesity and adiposity measures (waist circumference and percentage body fat), associations that were independent of energy intake and physical activity.[4] There is a growing literature in adolescents suggesting that psychosocial stress is associated with unhealthy lifestyle behaviors and excess weight.[5–8]

Relationships between some aspects of the family context and youth responses to stress are well documented.[9–11] For example, findings from recent studies link poverty,[12] family conflict,[13,14] and parental mental health[15,16] to youth's biological stress dysregulation. A recent meta-analysis also indicated that parental psychosocial stress is associated with youth's obesity status.[17] In this regard, data from NHANES showed that there was a higher likelihood of childhood obesity in stressed mothers from food-secure households,[18] an association that was not found among food-insecure households. Another study of Swedish young children reported higher odds of obesity in children from families reporting higher stress levels.[19]

Elevated stress in parents could affect the characteristics of the home environment, decreasing the availability of healthy foods and support for physical activity, which in turn could contribute to obesity in their children. Parenting practices, such as monitoring and limit setting, are associated with children's food intake and TV time,[20–22] on the other hand, parental psychosocial stress could also affect parenting practices[23] and therefore it could increase the risk of obesity in the child by increasing obesogenic lifestyle behaviors (high energy intake and increased sedentary time).

In this study, we examined the association of caregiver chronic and perceived stress with obesity in their children in a sample of low-income Hispanic/Latino youth, a population that has been understudied and whose families are at high risk of obesity and experience high levels of stress.[3,4] We also tested whether this association was explained by the food home environment or youth's lifestyle behaviors (*e.g.*, diet and physical activity) to understand potential mediators of the association between caregiver stress and obesity in youth.

Methods

HCHS/SOL is a population-based cohort study of 16,415 Hispanic/Latino adults (ages 18–74 years) who were selected using two-stage probability sampling design from four US communities (Chicago, IL; Miami, FL; Bronx, NY; and San Diego, CA). The HCHS/SOL Sociocultural Ancillary Study (SCAS) enrolled 5313 participants from HCHS/SOL between February 2010 and June 2011, with a participation rate of 85%.[24] Participants were asked to return to the HCHS/SOL clinic within 9 months of their baseline examination to complete a comprehensive set of psychosocial measures that included self-reported stress. However, the majority of participants (72%) completed the psychosocial assessment within 4 months.

SOL Youth is an ancillary study to HCHS/SOL that enrolled a subset of the offspring of HCHS/SOL participants from the same four field centers. Between 2012 and 2014, 6741 households were screened by a phone call using a standardized script; the screening identified 1777 eligible children between the ages of 8–16 years, of whom 1466 were enrolled, achieving a participation rate of 82%. Details about the aims and methodology of HCHS/SOL, SOL Youth, and HCHS/SOL SCAS are published elsewhere.[24–28]

The study was conducted with approvals of the Institutional Review Boards of each of the institutions involved in the study (Albert Einstein College of Medicine, Feinberg School of Medicine, Northwestern University, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, University of Miami Miller School of Medicine, and San Diego State University). For this analysis, a subset of the SOL Youth sample was identified in which 680 children had parents who also participated in SCAS and completed the chronic stress scale. One child per family was randomly selected leaving a final analytic sample of 473 children. Included and excluded children were similar in age and sex distribution, sociodemographic characteristics, and obesity.

Measures

Obesity. Child and caregiver height and weight were obtained at each field center. Height (cm) was measured with a wall stadiometer (SECA 222, Germany) and weight (kg) was obtained with a digital scale (Tanita Body Composition Analyzer, TBF 300, Japan). Weight categories in the child were defined using age- and sex-specific percentile.[29] Obesity in the adult was defined as BMI ≥ 30.

Chronic stress burden. Chronic stress burden (8 items) asked parents/caregivers about ongoing stressors in important life domains (health, work, and relationships) that have lasted for at least 6 months.[30,31] The validity of this instrument in this population is supported by theoretically expected associations with adult obesity and cardiovascular disease risk factors.[3,4] A score was created by summing the number of ongoing stressors reported (range 0–8), which was later categorized into number of reported stressors (0, 1, 2, or ≥3).

Perceived stress scale. Perceived stress scale[32] queried participants' perceptions of feeling stressed during the last month (10 items). Responses were on a five-point scale from never to very often. Scores were summed to indicate current stress levels, with higher scores suggesting greater perceived stress (Cronbach's α for participants answering questionnaire in English = 0.86; Cronbach's $\alpha = 0.84$ in Spanish).

Home food environment. Home food environment (17 items) asked parents/caregivers about the availability at home of food items such as fruit and vegetables, milk, juices, sugared beverages, chips, and other types of snacks during the past month. Response items ranged from never to always. This measure was adapted from the 3-day Home Food Environment Survey to assess healthful and less healthful food items that are most common in households.[33–35] This 17-item scale has been used in multiethnic samples of adolescents with good reliability (Cronbach's α varying from 0.60 to 0.83) and expected associations with dietary intake.[33–35] A score for home food environment was created by summing responses of each item, and a higher score indicated a healthier home environment.

Healthy Eating Index 2010. Child dietary intake was obtained with two interviewer-administered 24-hour recalls using the Nutrition Data System for Research software developed by the University of Minnesota. Healthy Eating Index 2010 (HEI-2010) is a measure of overall diet quality, independent of quantity, derived from twelve dietary components that reflect key aspects of dietary quality, including fruit, vegetables, grains, dairy, protein foods, fatty acids, sodium, and empty calories. HEI scores were calculated from the average of two 24-hour dietary recalls. HEI-2010 scores range from 0 to 100 with higher scores indicating greater adherence to the 2010 Dietary Guidelines for Americans.[36]

Physical activity and sedentary behavior. Detailed description of methods to assess physical activity is reported elsewhere.[37] Participants were asked to wear an Actical accelerometer (version B-1, model 198-0200-03) positioned above the iliac crest, with removal only for swimming, showering, and sleeping, for 1 week. Data collected from 5:00 am the day following the clinic visit through midnight on day six were used for all participants. Epoch length was set to 15 seconds to capture more variable and intermittent activity patterns in youth.[38]

Nonwear time was defined as consecutive zero counts for at least 90 minutes, allowing for short time intervals with nonzero counts lasting up to 2 minutes if no counts were detected during both the 30 minutes upstream and downstream from that interval. Any nonzero counts except the allowed short intervals were considered as wear time.[39] Data were summarized for children with at least three adherent days (wear time ≥8 to <19 hours/day) and were categorized into the following intensity levels according to the following cut points: sedentary (<18 counts/15-second epoch), light (18–440 counts/15 seconds), and moderate or vigorous (>440 counts/15 seconds).[37,40]

Sociodemographic variables. Participants also reported their Hispanic/Latino background (Central American, Cuban, Dominican, Mexican, Puerto Rican, South American, and other/mixed), age, sex, place of birth (foreign born vs. US born, a proxy for acculturation), and years living in the United States. Caregivers reported their annual household income and educational attainment.

Statistical Analyses

Percentages are presented for categorical variables, mean and standard deviation are presented for normally distributed continuous variables, and median and interquartile range are shown for skewed continuous variables. Due to non-normal distribution of the total number of stressors of parent/caregiver, stressor count was categorized into 4 groups (0, 1, 2, or ≥3). Poisson models with robust variance estimates were used to model the prevalence ratios of child obesity associated with the number of stressors. Models, including parental perceived stress, used this predictor as a continuous measure.

The models were adjusted for child age, sex, place of birth, household income, and field center. *p*-Values for linear trend were reported to examine the dose–response effect of childhood obesity prevalence by increased number of chronic stressors. We further adjusted for home food environment and objectively measured moderate to vigorous physical activity, sedentary time, HEI-2010, and caregiver obesity one at a time to assess the possibility of mediation through these variables. The daily average wear time of accelerometer was adjusted in models with physical activity or sedentary time.

Due to missing Actical data (25%), we conducted multiple imputations for missing physical activity, sedentary time, and wear time. We used monotone regression method in SAS to generate five imputation datasets. The imputation model included chronic stress, child age, sex, and place of birth, field center, and household income. Because of limited sample size in some strata, analyses were not stratified by child sex. All *p*-values were two-sided with a significance level at 0.05. All analyses were performed using SAS version 9.4 (SAS Institute, Inc., Cary, NC).

Results

In this sample of Hispanic/Latino youth, 50% were males, 55% were between the ages of 8–12, 75% were born in the United States, and 44% were of Mexican heritage (Table 1). Fifty-seven percent of caregivers reported having a household income of ≤$20,000, and 29% of caregivers reported three or more chronic stressors. The majority of caregivers (80%) reported to be the child's biological mother, and 85% caregivers were born outside of the US 50 states. Sociodemographic characteristics and presence of obesity did not vary by child sex.

The number of caregivers' chronic stressors was positively associated with obesity in the offspring (Fig. 1); the proportion of youth with obesity increased with the number of caregivers' stressors from 23% among youth whose caregivers did not report any stressors to 35% among youth whose caregivers reported three or more stressors (p for linear trend = 0.03). In multivariate analyses (Table 2),

Table 1. Characteristics of the Study Population

	Overall		Girls		Boys	
	N	%	*N*	%	*N*	%
Age group						
8–12	260	55.0	116	49.8	144	60.0
13–14	129	27.3	72	30.9	57	23.8
15–16	84	17.8	45	19.3	39	16.3
Nativity						
Foreign born	117	24.7	62	26.6	55	22.9
US born	352	74.4	169	72.5	183	76.3
Missing	4	0.8	2	0.9	2	0.8
Hispanic/Latino group						
Dominican	61	12.9	30	12.9	31	12.9
Puerto Rican	36	7.6	18	7.7	18	7.5
Cuban	38	8.0	20	8.6	18	7.5
Central American	44	9.3	27	11.6	17	7.1
Mexican	193	40.8	97	41.6	96	40.0
South American	16	3.4	6	2.6	10	4.2
Mixed/other	55	11.6	24	10.3	31	12.9
Missing	30	6.3	11	4.7	19	7.9
Household income						
<$20k	261	55.2	133	57.1	128	53.3
$20 to <$40k	134	28.3	66	28.3	68	28.3
≥$40k	64	13.5	23	9.9	41	17.1
Missing	14	3.0	11	4.7	3	1.3
Parental chronic stress						
0	105	22.2	46	19.7	59	24.6
1	123	26.6	70	30.0	53	22.1
2	106	22.4	49	21.0	57	23.8
3 or more	139	29.4	68	29.2	71	29.6
BMI						
Obese	139	29.4	63	27.0	76	31.7
Overweight	103	21.8	48	20.6	55	22.9
Underweight/normal weight	231	48.8	122	52.4	109	45.4

after adjusting for potential confounders, youth with caregivers reporting ≥3 chronic stressors were more likely to be obese than those with caregivers without stressors (odds ratio = 1.56; 95% confidence interval 1.03–1.21). There was a linear response; as the number of caregivers' chronic stressors increased, the association became stronger (p for linear trend = 0.019). No interaction was found with child age or gender. The additional adjustment for home food environment did not substantially affect the magnitude of the association between caregiver chronic stress and child obesity. Similar findings were observed when adjusting for moderate/vigorous physical activity or sedentary time, suggesting that the association between caregiver stress and child obesity was independent of home environment, physical activity, and sedentary time. When the models were adjusted for child HEI, a measure of diet

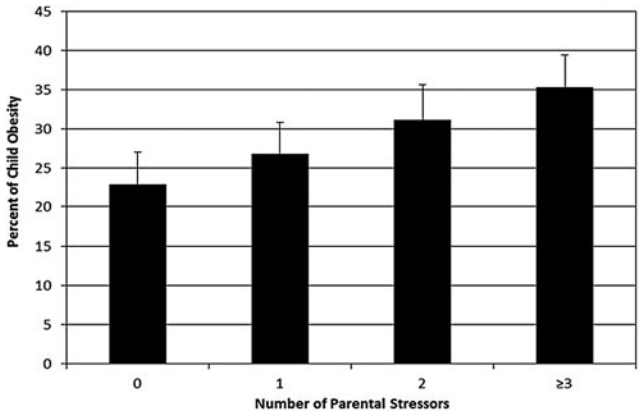

Figure 1. Percent of youth obesity by number of parental chronic stressors.

quality, the association of parental stress and child obesity was slightly attenuated. However, when the models were adjusted for caregiver obesity status, the association between caregiver stress and child obesity became nonsignificant (Table 2). Separate similar models were conducted to test the association of caregiver perceived stress with obesity in youth, but no association was observed.

Discussion

Our main finding that caregiver chronic stress was associated with higher odds of obesity in their offspring is consistent with prior studies.[18,19,41] It has been postulated that parents with high stress levels may lack the energy for keeping less obesogenic environments at home, for example, decreasing the availability of healthier food items, cooked meals, and regular family meals. At the same time, parents experiencing high levels of stress may lack the energy or may be time constrained for engaging their children in greater physical activity and for monitoring their children's food habits, all of which may result in higher child obesity risk.

In fact, studies have shown that parental psychosocial stress was related to family and child food habits. Results from Project-EAT showed that parental work–life stress was associated with less frequent family meals and higher fast-food intake.[42] In another study, there was an association of family stressors on child BMI that reported to be mediated by less positive family meal patterns (*e.g.*, eating meals together and eating meals prepared away from home).[23] In a diverse sample of children and adolescents, higher number of parental stressors was significantly related to child obesity and child fast-food consumption, but not with self-reported child physical activity levels.[43]

We did not observe an association of parental perceived stress and obesity in their children, these results are consistent with our previous reports that indicate that the perceived stress scale, which asks for appraisals of stress during the past 30 days, is not related to obesity or cardiovascular disease in Hispanic/Latino adults, perhaps because the pathways to obesity and cardiovascular disease involve protracted processes.[3,4]

Home food availability is consistently associated with dietary intake in youth[44]; but in our study, when models were adjusted for home food environment, the effect estimates did not change, suggesting that the association of parental stress and child obesity was independent of the home food environment. However, after adjusting for caregiver obesity status, the association was no longer

Table 2. Prevalence Ratios for the Association between Parental Stress and Child Obesity

	PrR (95% CI)					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Number of parental chronic stressors						
0	Ref	Ref	Ref	Ref	Ref	Ref
1	1.15 (0.72–1.83)	1.17 (0.73–1.86)	1.17 (0.73–1.86)	1.15 (0.72–1.84)	1.14 (0.71–1.81)	1.10 (0.69–1.75)
2	1.38 (0.88–2.16)	1.39 (0.89–2.19)	1.35 (0.86–2.13)	1.33 (0.84–2.10)	1.36 (0.87–2.14)	1.35 (0.86–2.12)
3 or more	1.56 (1.03–2.36)	1.57 (1.04–2.38)	1.58 (1.04–2.39)	1.56 (1.03–2.37)	1.53 (1.01–2.32)	1.43 (0.94–2.11)
p for linear trend	0.019	0.018	0.019	0.021	0.025	0.050
Parental perceived stress						
Per unit change	1.01 (0.99–1.03)	1.01 (0.99–1.03)	1.01 (0.99–1.04)	1.01 (0.99–1.04)	1.01 (0.99–1.03)	1.01 (0.99–1.03)

Model 1 is adjusted by child age, child sex, child place of birth, household income, and field center. Model 2 is adjusted by covariates included in model 1 and additionally adjusted by home food environment. Model 3 is adjusted by covariates included in model 1 and additionally adjusted for objective moderate/vigorous activity and daily average wear time. Model 4 is adjusted by covariates included in model 1 and additionally adjusted for sedentary time and daily average wear time. Model 5 is adjusted by covariates included in model 1 and additionally adjusted for Healthy Eating Index 2010. Model 6 is adjusted by covariates included in model 1 and additionally adjusted for parental obesity.

95% CI, 95% confidence interval; PrR, prevalence ratio.

significant, suggesting that there may be other home environment characteristics at play. Because our measure of home food environment has not been fully validated, it is also possible that measurement error obscured the role of this variable.

Whether caregiver's weight status is a confounder or a mediator remains to be elucidated. Previously, we reported in adult Hispanics/Latinos associations of chronic stress and obesity,[4] which may indicate that caregiver obesity is in the pathway from caregiver stress to child obesity. Caregiver weight status is a strong predictor of childhood obesity, with environmental and genetic factors playing an important role. Thus, it may be that caregivers' stress influences their own lifestyle behaviors and obesity, and these in turn influence the characteristics of the home environment and obesity risk of their children.

Future studies with more comprehensive measures of the home environment may help elucidate the links between parental stress and child weight. In addition, prospective research will be needed to fully understand the temporal nature of these associations. The association of caregiver chronic stress and youth obesity was independent of youth lifestyle behaviors, indicating that this association could be mediated by other behavioral risk factors for childhood obesity (*e.g.*, child sleep habits and mental health functioning), which were not included in the present study.

In addition, direct biological pathways, such as epigenetic changes, may be involved. Recent studies in adults indicate that exposure to psychosocial stress induces methylation changes, which in turn are associated with increased adiposity and chronic diseases. Epigenetic studies in youth are scarce and it is an area that needs to be further investigated.

Caution is needed when interpreting the study findings due to some limitations in the study design. First, because the ascertainment of caregiver stress preceded the assessment of childhood obesity, we cannot distinguish between incident vs. prevalent obesity. The study did not assess stress levels in the child, and we cannot determine the impact of caregiver stress on childhood stress levels. Furthermore, biological measures of stressors, such as cortisol levels, were not obtained in the caregiver or the child, which precludes us from gaining insights into the biological pathways for stress exposure. Parenting practices were not included in the study, and prior research indicates that it could influence the association of caregiver stress with childhood obesity.[23,45]

Another limitation of the study is the relatively small sample size, which prevented us from exploring sex differences; studies in adults have reported differences in men and women when studying the association of stress on health.[46–48] Despite these limitations, the study findings have important implications. Recently, the American Academy of Pediatrics identified environmental stressors as important influences of child health and there are calls to address them in primary care.[49]

Although a number of studies point out the effects of socioeconomic adversity, limited attention has been paid to parent psychosocial stress as another contributor to what is referred as a toxic environment. Parental chronic stress may be a less severe risk factor than overt child stressors such as maltreatment or neglect. Nevertheless, because psychosocial stressors are more common, the effects could be more pervasive and could affect a much larger number of children.

Thus, this study contributes to the growing literature documenting the role of parental stressors on child health in a population that is underserved and experiences high levels of stressors.[3] Whereas limitations in the study design and the generalizability of our study findings limit drawing causal inferences, other investigators suggest that addressing parental psychosocial stress could improve preventive or treatment programs targeting childhood obesity.[17]

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Author Disclosure Statement

No competing financial interests exist.

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