HHS Public Access

Author manuscript

Acad Pediatr. Author manuscript; available in PMC 2019 August 01.

Published in final edited form as:

Acad Pediatr. 2018 August ; 18(6): 685–691. doi:10.1016/j.acap.2018.01.007.

Early Childhood Stress and Child Age Predict Longitudinal Increases in Obesogenic Eating Among Low-Income Children

Alison L. Miller, Ph.D.[1,2], **Ashley N. Gearhardt, Ph.D.**[3], **Lauren Retzloff, M.P.H.**[1], **Julie Sturza, M.P.H.**[1], **Niko Kaciroti, Ph.D.**[1,4], and **Julie C. Lumeng, M.D.**[1,5,6]

[1]Center for Human Growth and Development, 300 N. Ingalls Street, 10th floor, University of Michigan, Ann Arbor, MI, 48109

[2]Department of Health Behavior and Health Education, 1415 Washington Heights, University of Michigan School of Public Health, Ann Arbor, MI, 48109

[3]Department of Psychology, 300 Church Street, University of Michigan, Ann Arbor, MI, 48109

[4]Department of Biostatistics, 1415 Washington Heights, University of Michigan School of Public Health, Ann Arbor, MI, 48109

[5]Department of Pediatrics and Communicable Diseases, 1500 E. Medical Center Drive, University of Michigan Medical School, Ann Arbor, MI, 48109

[6]Department of Nutritional Sciences, 1415 Washington Heights, University of Michigan School of Public Health, Ann Arbor, MI, 48109

Abstract

OBJECTIVE—To identify whether psychosocial stress exposure during early childhood predicts subsequent increased eating in the absence of hunger (EAH), emotional overeating, food responsiveness, and enjoyment of food.

METHODS—This was an observational longitudinal study. Among 207 low-income children (54.6% non-Hispanic white, 46.9% females) early childhood stress exposure was measured by parent report and a stress exposure index was calculated (higher scores indicating more stress

Corresponding Author: Alison Miller, PhD, Center for Human Growth and Development 300 North Ingalls Street, 10th Floor, University of Michigan, Ann Arbor, MI 48109-5406 alimill@umich.edu, 734-615-7459.

Conflicts of Interest: The authors have no potential conflicts of interest to disclose.

Contributors' Statement:

Dr. Miller conceptualized and designed the study, drafted the initial manuscript, and approved the final manuscript as submitted.

Dr. Gearhardt provided critical review of the manuscript and approved the final manuscript as submitted.

Ms. Retzloff carried out statistical analyses, provided critical review of the manuscript, and approved the final manuscript as submitted.

Ms. Sturza provided oversight of the statistical analyses, provided critical review of the manuscript, and approved the final manuscript as submitted.

Dr. Kaciroti provided oversight of the statistical analyses, provided critical review of the manuscript, and approved the final manuscript as submitted.

Dr. Lumeng conceptualized and designed the study, provided critical review of the manuscript, and approved the final manuscript as submitted.

exposure). Eating behaviors were measured in early (M: 4.3 (SD 0.5) years) and middle (M: 7.9 (SD 0.7) years) childhood. Observed EAH was assessed by measuring kilocalories of palatable food the child consumed after a meal. Parents reported on child eating behaviors on the Child Eating Behavior Questionnaire. Child weight and height were measured and body mass index z-score (BMIz) calculated. Multivariable linear regression, adjusting for child sex, race/ethnicity, and BMIz, was used to examine the association of stress exposure with rate of change per year in each child eating behavior.

RESULTS—Early childhood stress exposure predicted yearly increases in EAH (β=0.14, 95% confidence interval (CI) 0.002, 0.27) and Emotional Overeating (β=0.14, 95% CI 0.008, 0.27). Stress exposure was not associated with Food Responsiveness (trend for decreased Enjoyment of Food; β=−0.13, 95% CI 0.002, −0.26). All child obesogenic eating behaviors increased with age (p's<.05).

CONCLUSIONS—Early stress exposure predicted increases in child eating behaviors known to associate with overweight/obesity. Psychosocial stress may confer overweight/obesity risk through eating behavior pathways. Targeting eating behaviors may be an important prevention strategy for children exposed to stress.

Keywords

Psychosocial Stress; Eating Behavior; Longitudinal Study

INTRODUCTION

Childhood obesity remains prevalent among low-income children, a population that can experience significant psychosocial stress, such as household chaos, negative life events, and exposure to interpersonal conflict.[1] Certain eating behaviors, including eating in the absence of hunger (EAH; i.e., continuing to eat after having eaten to satiety) and emotional overeating (i.e., eating in response to emotional distress) are known to increase in response to stress exposure in adults.[2] In children, EAH, emotional overeating, and other "food approach" behaviors including food responsiveness (i.e., eating in response to external versus internal cues) and enjoyment of food (i.e., high interest in food and eating) have been associated with overweight/obesity.[3, 4] It has been suggested that children exposed to stressful environments may engage in these obesity-promoting eating behaviors as a mechanism to cope with stress,[5] as food can be soothing and is relatively available to children. Yet, it is not known whether stress exposure during early childhood associates with increases in such obesity-promoting, or "obesogenic" eating behaviors across childhood. If so, eating behaviors such as EAH, emotional overeating, food responsiveness, and enjoyment of food may be important targets in efforts to prevent overweight/obesity among young children who are exposed to high levels of stress.

Prior work has highlighted associations between psychosocial stress and childhood overweight/obesity,[5] with eating behavior hypothesized as a key mechanism underlying such associations.[4, 6] Eating behaviors associated with increased consumption (e.g., EAH, emotional overeating, enjoyment of food, and food responsiveness) have been identified in early and middle childhood[7, 8] and some have been shown to increase across this period.[8]

Yet, there are few longitudinal examinations and we do not know whether stress exposure may prompt more rapid changes in such eating behaviors across childhood. Identifying whether psychosocial stress exposure associates with the development of obesogenic eating behaviors across time is a critical first step in determining whether eating behavior is an early-emerging pathway through which stress exposure may promote obesity risk.

Few studies have examined stress exposure in relation to obesogenic eating behavior in children; almost none have used longitudinal designs. Psychosocial stress exposure has been associated cross-sectionally with unhealthy dietary intake in studies including children under age 10 years.[6] Scholars examining stress exposure and reported obesogenic eating behaviors in 5–12 year-old children[9, 10] found that exposure to stressful life events was associated with concurrent emotional eating[6] and longitudinally with sweet food consumption, external eating and emotional eating (particularly in girls).[9] Studies in preschoolers found associations between parent stress and food responsiveness,[4] and between blunted cortisol, a biological stress indicator, and more observed EAH among 3–5 year-old low-income preschoolers.[5] We could identify no studies testing longitudinal associations between psychosocial stress exposure and observed obesogenic eating behaviors across early to middle childhood. Identifying prospective associations between early stress exposure and future changes in eating behavior could inform obesity prevention efforts addressing this pathway.

Therefore, we sought to test the hypothesis that psychosocial stress exposure during early childhood predicted longitudinal increases in observed and parent-reported child eating behaviors known to associate with overweight/obesity, including EAH, emotional overeating, food responsiveness, and enjoyment of food. We examined these associations among a cohort of low-income children followed longitudinally from early to middle childhood.

METHODS

Participants and Recruitment

This was an observational longitudinal study. Participants were low-income children from the Midwest United States enrolled in a study of stress and eating behavior.[5] Families were originally recruited from Head Start, a federally-funded preschool program for families living in poverty. Families agreed to be re-contacted for follow-up studies; data for the current report are drawn from two studies funded to assess this cohort during early childhood and one funded to assess the cohort during middle childhood. This study was approved by the University of Michigan Institutional Review Board. Parents/legal guardians (typically mothers) provided written informed consent. Inclusion criteria were that: the child was enrolled in Head Start, not in foster care, born at ≥35 weeks gestation without serious perinatal/neonatal complications, and did not have food allergies or serious medical problems; the parent and child were able to communicate in English; and neither parent had ≥a 4-year college degree.

Mother-child dyads participated in data collection at two points during early childhood where mothers completed questionnaires and children completed behavioral protocols (M

child age at first visit=4.2 years; SD 0.5; range 2.9–5.2; n=380; M child age at second visit=4.8 years; SD 0.7, range 3.2–7.1; n=330) and again in middle childhood (M child age at third visit=7.9 years; SD 0.7, range 7.0–10.2; n=263). A mean of 7.2 (4.9) months elapsed between the first and second visits, and 3.0 (0.7) years between the second and third visit.

A total of 249 dyads participated in both early childhood visits and subsequent middle childhood visit. Stress exposure was assessed in early childhood and eating behavior in both early and middle childhood. Data collected during the early childhood visits are referred to as "baseline" (mean combined age 4.3 (0.5) years) and data collected during middle childhood as "follow-up" (mean age 7.9 (0.7) years). This report is limited to 207 mother-child dyads who participated in EAH behavioral protocol and questionnaire-based assessments at both baseline and follow-up. The 117 participants who completed baseline but not follow-up did not differ from participants who completed the follow-up visit with regard to child sex (p=.57), race/ethnicity (p=.28), baseline BMI z-score (p=.14), or maternal education (p=.77). The 207 participants included in this analysis did not differ from the 42 excluded participants who had a follow-up visit but were missing the variables of interest with regard to child sex (p=.22), race/ethnicity (p=.17), baseline BMI z-score (p=.56), or maternal education (p=.07).

Measures

Mothers reported child sex, birth date, and race and ethnicity; for this analysis child race/ethnicity was categorized as non-Hispanic white versus not. Mothers reported their educational attainment (categorized for analysis as < high school or > high school to ≤ 4-year degree). Children were weighed and height measured by trained research staff using a Detecto DR-550C scale (calibrated weekly) and Seca 213/217 stadiometer. Body mass index z-score (BMIz) was calculated for age and sex based on the US Centers for Disease Control Growth Charts.[11]

Predictor: Psychosocial Stress Exposure Index

Table 1 displays the measures used to calculate psychosocial stress exposure. Consistent with other theoretical approaches (e.g., Adverse Childhood Events [ACES]; cumulative risk perspectives) we measured multiple early life stressors that could create an adverse environment for child development.[1, 12] Mothers completed interviewer-administered questionnaires to assess child psychosocial stress exposure in the following areas: parent-child relationships (e.g., parenting style,[13] maternal depression[14]), family-level functioning (e.g., family conflict,[15] home chaos[16]), and contextual factors (e.g., violence exposure,[17] negative life events[18]). Questionnaires had all been used in prior work with low-income populations. Table 1 presents characteristics and scoring. Following prior methods,[12, 19] we used an index approach to analyze early childhood psychosocial stress exposure. Criterion scores (1 versus 0) were generated based on a cutoff for each measure drawn from prior literature (Table 1). An overall stress exposure index score was calculated as the sum of each of the 7 criterion scores divided by 7, generating a range of 0 to 1. Thus, families not meeting the cutoff for any measure had a stress exposure index score of 0, while families meeting the cutoff for all 7 measures had a stress exposure index score of 1. In addition, scores for proximal parenting (maternal depression, permissive parenting, harsh parenting),

family-level (family conflict, home chaos), and broader social-contextual stressors (violence exposure, negative life events) were calculated using the same method.

Outcomes: Eating Behaviors

Children participated in standardized protocols[20] to assess EAH. At baseline, EAH was measured immediately after breakfast at Head Start using methods published previously.[21] Head Start regulations require that breakfasts meet nutritional standards. The researcher confirmed by observation that the child had eaten, and immediately following breakfast, asked the child to indicate whether s/he was "hungry," "in between" or "full" using corresponding cartoon figures. The researcher proceeded with the protocol when the child reported being "full" or "in between", then brought the child to a separate room. For 10 minutes the child had free access to toys and pre-measured bowls of Trix® cereal (32 grams (g); 120 kcals), mini Chips Ahoy® cookies (90g; 435 kcals), fruit snacks (164g; 631 kcals), Cheez-Its® (60g; 300 kcals), pretzel sticks (36g; 129 kcals) and Chicken in a Biskit® crackers (60g; 310 kcals). The researcher said, "You can play with any of the toys and eat any of the foods on this table. I'm going to do some work." After 10 minutes, remaining food was weighed; this value was subtracted from the initial weight.

At follow-up, EAH was measured immediately after a dinnertime family meal following behavioral assessments at a community location. The child and parent (and other family members present) were each served a standardized meal consisting of a 12-inch deli meat sandwich, baked potato chips, apple sauce, fruit cup, condiments (mustard and mayonnaise) and water. Following the meal, the researcher invited the child to a separate room for dessert. For 5 minutes the child had free access to pre-measured bowls of 4 Little Debbie Oatmeal Cream Pies (152g, 680 kcals), 2 Little Debbie Cosmic Brownies with Chocolate Chip Candy (124g; 560 kcals), 8 Nabisco/Chips Ahoy Chewy Chocolate Chip Cookies (124g; 560 kcals), 8 Keebler Fudge Stripe Cookies (108g; 560 kcals), 8 Little Debbie Mini Powdered Donuts (100g, 440 kcals), and 3 Kellogg's Original Rice Krispy Treats (66g, 270 kcals). Children were instructed, "You can have dessert. You can't take it with you, but you can eat as much as you like here for five minutes. If you are ready to be done before that, all you have to do is let me know. I'm going to do some work now." After 5 minutes, remaining food was weighed and this value was subtracted from the initial weight.

EAH protocols differed somewhat across timepoints (e.g., foods, time of day, length), but both yielded a measure of total kcals consumed that were calculated based on manufacturer-provided calories per unit weight. Larger total kcals consumed represent a higher degree of EAH. Following recommended methods,[22] we determined the percent of daily calorie needs consumed during each EAH protocol by dividing total EAH calories consumed by the child's estimated daily energy requirement based on formulas accounting for child's sex, age, weight, height, and activity level (using "low active" as a conservative estimate).[23] We used this variable to indicate EAH as a percentage of daily energy needs (EAH%).

Mothers responded to the interviewer-administered Child Eating Behavior Questionnaire (CEBQ)[24] at baseline and follow up. The CEBQ has been used extensively with children in this age range.[3, 8] We examined Emotional Overeating (4 items, e.g., "my child eats more when anxious"), Food Responsiveness (5 items, e.g., "Given the choice, my child would eat

most of the time"), and Enjoyment of Food (4 items, e.g., "my child loves food") subscales. Mothers respond on a 5-point Likert scale (1=never; 5=always) and the mean is taken to generate scores that can range from 1–5. Scales demonstrated good reliability at both baseline and follow-up (baseline Emotional Overeating Cronbach's alpha=0.79; Food Responsiveness=0.84; Enjoyment of Food =0.84; follow-up Emotional Overeating=0.83; Food Responsiveness=0.85; Enjoyment of Food=0.83).

Statistical Analysis

Analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC). Univariate statistics were used to describe the sample, correlations to examine associations of key study variables, and paired t-tests to test for differences in eating behavior at baseline and follow-up. To test our hypothesis that early childhood psychosocial stress exposure predicted prospective increases in child eating behaviors, we calculated average rate of change per year in each eating behavior (EAH%, Emotional Overeating, Food Responsiveness, and Enjoyment of Food). We divided the change in eating behavior score between the early and middle childhood assessments by the number of years that had elapsed between the two visits. Thus, the parameter estimates reflect the average rate of change per year. We used these variables as outcomes in each of four multivariable linear regression analyses and posthoc analyses. Analyses controlled for child sex, race/ethnicity, and BMIz at baseline. Given sex differences in prior work,[5, 7, 9] we tested for interactions between child sex and psychosocial stress in predicting eating behaviors. We tested for interactions between baseline child overweight and stress exposure to see whether overweight children had more rapid increases in obesogenic eating. For all analyses, alpha level was set at 0.05.

RESULTS

Table 1 presents characteristics of the sample with regard to stress exposure. Mean stress exposure index was 0.52 (SD 0.25). Table 2 presents characteristics of the sample with regard to demographics and eating behaviors. The sample of children was 53% male; 55% white and 15% black; and 10% Hispanic ethnicity (any race). Mean child BMIz was 0.87 (SD 1.07); 40% of the sample was overweight/obese (BMI ≥ 85% for age and sex) at baseline.

BMIz associated with eating behavior in expected directions at both timepoints; obesity-promoting eating behaviors were positively associated with BMIz (all p's<.05). Mean BMIz, EAH% and CEBQ scores were significantly higher at follow-up (all p's<.05), suggesting that over time, the sample was becoming heavier (Cohen's d = 0.15) and engaging in more EAH% (Cohen's d=1.60) and more parent-reported obesogenic eating behaviors (Cohen's d=0.30 for Emotional Overeating, 0.50 for Food Responsiveness, and 0.24 for Enjoyment of Food).

Table 3 presents results of multivariate adjusted linear regression models examining associations of baseline stress exposure with average rate of change per year in eating behaviors from baseline to follow up. Baseline stress exposure index score (see Table 1) was positively associated with rate of change per year in EAH% (β=0.14 (SE 0.07), p=.047), and Emotional Overeating (β=0.14 (SE 0.07), p=.038), indicating that for every 1-standard

deviation (SD) increase in the stress exposure index score, there was an increase of 0.14 SD in each of these eating behaviors. There were not significant associations between baseline stress exposure and rate of change per year in Food Responsiveness (β=0.06, (SE 0.07) p=.38), and a trend for more baseline stress to associate with decreased Enjoyment of Food (β=−0.13, (SE 0.07) p=.053). There were no interactions between stress exposure and child sex in predicting eating behaviors, or between stress exposure and child baseline overweight in predicting eating behaviors (all p's>.50).

Post-hoc analyses were conducted to determine whether proximal parenting, family-level, or social-contextual stress indices were most closely associated with eating behaviors. Regression analysis results were that proximal parenting stress associated with increased Emotional Overeating (β=0.13 (SE 0.07), p=.039) (trend for increased EAH%; β=0.13 (SE 0.07), p=.06). No other associations emerged.

DISCUSSION

There were three main findings of this study, with the hypothesis that stress predicts eating behaviors partially but not fully supported. First, all obesogenic eating behaviors increased across development, with the largest increases in EAH. Second, within a low-income population of children, greater early childhood psychosocial stress exposure was associated with greater subsequent increases in observed eating in the absence of hunger, and parent-reported emotional overeating, from early to middle childhood. Third, stress exposure was not significantly associated with subsequent changes in child food responsiveness or enjoyment of food. Results suggest that early life stress may shape the development of certain obesogenic eating behaviors across childhood, which could be a mechanism linking early life stress exposure with childhood obesity.

EAH[20] and Emotional Overeating[8] have been shown to increase from early to middle childhood[25] and associate with higher weight outcomes in children.[3, 26] We found that these behaviors, as well as food responsiveness and enjoyment of food increased with development. We observed the largest increases for EAH, consistent with prior work.[7, 20] It may be that EAH had the largest increases because it was objectively-measured, whereas the other outcomes were parent-reported. Overall, effect sizes for child age-eating behavior associations were larger than for stress exposure-eating behavior associations; monitoring increases in such behaviors across childhood may be important. For example, using CEBQ items as a prompt to help parents identify behaviors such as emotional overeating (e.g., "eating more when anxious") or food responsiveness (e.g., "eating most of the time" or "always asking for food") during early childhood may be a way to start such conversations. Such an approach could aid pediatricians in implementing AAP practice guidelines for obesity prevention in primary care (e.g., not using food as a reward or as a soothing technique).[27]

Findings inform the limited prior work that has examined psychosocial stress in relation to eating behavior in children. Given associations between low childhood SES and increased adult EAH,[28] scholars have requested examination of psychosocial stress and child EAH.[25] Our work suggests the association may emerge in childhood. Our findings on emotional

eating were consistent with studies of Belgian children, which found stress exposure positively associated with parent- and child-reported emotional eating at age 9 years[6] and longitudinally across two years.[9] Among Australian preschoolers, parent stress was associated with food responsiveness,[4] which we did not find. Neither of these studies focused on low-income children. Current findings thus extend prior literature by highlighting associations between psychosocial stress exposure and increased observed and parent-reported obesogenic eating behavior across childhood in a US, low-income sample. We also found that proximal parenting stress (depression, parenting style) was more strongly associated with child emotional overeating than more distal factors (e.g., violence exposure). Understanding how stress that is transmitted through parenting may influence child eating and weight outcomes could be an important direction for future work.

Stress exposure was only associated with increased EAH and Emotional Overeating. Although effect sizes were modest, small increases in these eating behaviors could result in excessive weight gain over time. Psychosocial stress may accelerate these eating behaviors across childhood through multiple mechanisms. Parents living in poverty, like those in this sample, may find it difficult to provide children with nutritious food options (e.g., fresh fruit vs. prepackaged snacks). Stress exposure may sensitize neurological reward systems that prompt hedonically-driven, rather than hunger-driven eating of hyper-palatable foods.[29] Children may overeat such foods as a mechanism to self-soothe or cope with negative emotions (i.e., Emotional Overeating), over time establishing a “stress-eating” pathway from stress exposure to overweight/obesity.[2, 6]

Our findings of no association between stress and Food Responsiveness, and lack of positive association with Enjoyment of Food may suggest such behaviors are less stress-related. It has been suggested that such eating behaviors are genetically driven.[30] Examining whether such eating behaviors moderate stress exposure-eating associations in children could be an important next step. For example, children who are characterized by high food responsiveness and who do not cope well with stress may be at particular risk for overweight/obesity. Finally, the trend-level negative association between stress exposure and enjoyment of food is consistent with theories hypothesizing that over time, obesogenic eating behavior is driven less by hedonic pleasure of consuming food and more by habit or external cues.[29] This hypothesis may be important to test in studies with children.

Strengths of the current study were the longitudinal design, diverse sample, and both parent-reported and observational assessments of child eating behavior. There were also limitations. We did not investigate child dietary intake, which is an important future direction given prior associations of stress exposure with dietary composition.[6] Different snack foods (savory/sweet snacks vs. only sweets; calorie counts) and slightly different procedures (time of day, instructions) were used to assess EAH at different ages, which may have reduced comparability across the two age points. We assessed child exposure to psychosocial stress as reported by parents rather than by children or using objective measures (e.g., stress physiology). Our baseline age range was also relatively broad, and the experience of stress may vary developmentally. Ours was a poverty sample that had attended Head Start, and was also majority white/non-Hispanic; thus, findings may not generalize to Head Start populations with more racial/ethnic minority children; non-Head Start low-income

populations; families with higher parental education; or higher-income populations. As well, although this was a longitudinal study the design was observational, therefore we cannot assess causality.

In summary, we found that early-childhood psychosocial stress exposure was associated with increases in obesity-promoting eating behaviors into middle childhood. Although effect sizes were small, exposure may increase overweight/obesity risk over time. If pediatricians encounter young children who are experiencing psychosocial stress, it may be important to help parents find strategies to manage child eating (e.g., develop non-food alternatives to soothe an upset child), while recognizing that parents are likely also stressed. This is in line with both AAP guidelines on obesity prevention[27] as well as AAP policy statements and recent recommendations for practitioners to consider developing risk profiles to screen for early-life stressors such as ACES, and engage families in conversations regarding how early-life stressors can affect long-term child health.[1] Finally, as obesogenic eating behaviors increased with age, research on predictors of growth in such behaviors across childhood is needed in order to identify children at early risk and to develop effective prevention strategies.

Acknowledgments

Funding Sources: This work was supported by the National Institutes of Health [R01DK095695, R21DK090718 to A. Miller and J. Lumeng 1RC1DK086376 to J. Lumeng] and the American Heart Association [10GRNT4460043 to A. Miller].

Abbreviations

BMI	body mass index
BMIz	body mass index z-score
SD	standard deviation
EAH	eating in the absence of hunger
EAH%	eating in the absence of hunger as a percentage of daily needs
CEBQ	Child Eating Behavior Questionnaire
g	grams
kcal	kilocalories

References

1. Burke Harris N, Silvério Marques S, Oh D, Bucci M, Cloutier M. Prevent, Screen, Heal: Collective Action to Fight the Toxic Effects of Early Life Adversity. Academic Pediatrics. 2017; 17(7, Supplement):S14–S15. [PubMed: 28865647]
2. Groesz LM, McCoy S, Carl J, Saslow L, Stewart J, Adler N, et al. What is eating you? Stress and the drive to eat. Appetite. 2012; 58(2):717–721. [PubMed: 22166677]
3. Domoff SE, Miller AL, Kaciroti N, Lumeng JC. Validation of the Children's Eating Behaviour Questionnaire in a low-income preschool-aged sample in the United States. Appetite. 2015; 95:415–420. [PubMed: 26247701]

4. Boswell N, Byrne R, Davies PSW. Eating behavior traits associated with demographic variables and implications for obesity outcomes in early childhood. Appetite. 2018; 120:482–490. [PubMed: 29024677]
5. Lumeng JC, Miller A, Peterson KE, Kaciroti N, Sturza J, Rosenblum K, et al. Diurnal cortisol pattern, eating behaviors and overweight in low-income preschool-aged children. Appetite. 2014; 73:65–72. [PubMed: 24177439]
6. Michels N, Sioen I, Braet C, Eiben G, Hebestreit A, Huybrechts I, et al. Stress, emotional eating behaviour and dietary patterns in children. Appetite. 2012; 59(3):762–769. [PubMed: 22918173]
7. Hill C, Llewellyn CH, Saxton J, Webber L, Semmler C, Carnell S, et al. Adiposity and "eating in the absence of hunger" in children. International Journal of Obesity. 2008; 32(10):1499–1505. [PubMed: 18645573]
8. Ashcroft J, Semmler C, Carnell S, van Jaarsveld CH, Wardle J. Continuity and stability of eating behaviour traits in children. European Journal of Clinical Nutrition. 2008; 62(8):985–990. [PubMed: 17684526]
9. Michels N, Sioen I, Boone L, Braet C, Vanaelst B, Huybrechts I, et al. Longitudinal association between child stress and lifestyle. Health psychology : official journal of the Division of Health Psychology, American Psychological Association. 2015; 34(1):40–50.
10. Michels N, Sioen I, Huybrechts I, Bammann K, Vanaelst B, De Vriendt T, et al. Negative life events, emotions and psychological difficulties as determinants of salivary cortisol in Belgian primary school children. Psychoneuroendocrinology. 2012; 37(9):1506–1515. [PubMed: 22385686]
11. Kuczmarski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, et al. 2000 CDC growth charts for the United States: Methods and development. National Center for Health Statistics Vital Health Statics. 2002; 11(246)
12. Sameroff AJ. Environmental Risk Factors in Infancy. Pediatrics. 1998; 102(Supplement E1):1287–1292. [PubMed: 9794971]
13. Arnold DS, O'Leary SG, Wolff LS, Acker MM. The Parenting Scale: a measure of dysfunctional parenting in discipline situations. Psychological Assessment. 1993; 5(2):137.
14. Radloff LS. The CES-D scale a self-report depression scale for research in the general population. Applied Psychological Measurement. 1977; 1(3):385–401.
15. Beavers W, Hampson R, Hulgus Y. Beavers systems model: Observational and self-report scales. Southwest Family Institute; Dallas, TX: 1991. b107
16. Matheny AP, Wachs TD, Ludwig JL, Phillips K. Bringing order out of chaos: Psychometric characteristics of the confusion, hubbub, and order scale. Journal of Applied Developmental Psychology. 1995; 16(3):429–444.
17. Fox NA, Leavitt LA. The Violence Exposure Scale for Children - VEX (preschool version). College Park: Department of Human Development, University of Maryland; 1995.
18. Dohrenwend BS, Askenasy AR, Krasnoff L, Dohrenwend BP. Exemplification of a method for scaling life events: The PERI Life Events Scale. Journal of Health and Social Behavior. 1978; 19(2):205–229. [PubMed: 681735]
19. Tyrka AR, Ridout KK, Parade SH, Paquette A, Marsit CJ, Seifer R. Childhood maltreatment and methylation of FK506 binding protein 5 gene (FKBP5). Development and psychopathology. 2015; 27(4pt2):1637–1645. [PubMed: 26535949]
20. Birch LL, Fisher JO, Davison KK. Learning to overeat: maternal use of restrictive feeding practices promotes girls' eating in the absence of hunger. American Journal of Clinical Nutrition. 2003; 78(2):215–220. [PubMed: 12885700]
21. Leung CY, Lumeng JC, Kaciroti NA, Chen YP, Rosenblum K, Miller AL. Surgency and negative affectivity, but not effortful control, are uniquely associated with obesogenic eating behaviors among low-income preschoolers. Appetite. 2014; 78:139–146. [PubMed: 24685763]
22. Madowitz J, Liang J, Peterson CB, Rydell S, Zucker NL, Tanofsky-Kraff M, et al. Concurrent and convergent validity of the Eating in the Absence of Hunger questionnaire and behavioral paradigm in overweight children. The International Journal of Eating Disorders. 2014; 47(3):287–295. [PubMed: 24186043]

23. Trumbo P, Schlicker S, Yates AA, Poos M. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids. Journal of the American Dietetic Association. 2002; 102(11):1621–1630. [PubMed: 12449285]
24. Wardle J, Guthrie CA, Sanderson S, Rapoport L. Development of the Children's Eating Behaviour Questionnaire. Journal of Child Psychology and Psychiatry. 2001; 42(7):963–970. [PubMed: 11693591]
25. Lansigan RK, Emond JA, Gilbert-Diamond D. Understanding eating in the absence of hunger among young children: A systematic review of existing studies. Appetite. 2015; 85:36–47. [PubMed: 25450900]
26. Braet C, Van Strien T. Assessment of emotional, externally induced and restrained eating behaviour in nine to twelve-year-old obese and non-obese children. Behaviour Research and Therapy. 1997; 35(9):863–873. [PubMed: 9299807]
27. Daniels SR, Hassink SG. The Role of the Pediatrician in Primary Prevention of Obesity. Pediatrics. 2015; 136(1):e275–e292. [PubMed: 26122812]
28. Hill SE, Prokosch ML, DelPriore DJ, Griskevicius V, Kramer A. Low childhood socioeconomic status promotes eating in the absence of energy need. Psychological Science. 2016; 27(3):354–364. [PubMed: 26842316]
29. Yau YHC, Potenza MN. Stress and eating behaviors. Minerva endocrinologica. 2013; 38(3):255–267. [PubMed: 24126546]
30. Llewellyn CH, van Jaarsveld CH, Johnson L, Carnell S, Wardle J. Nature and nurture in infant appetite: analysis of the Gemini twin birth cohort. The American Journal of Clinical Nutrition. 2010; 91(5):1172–1179. [PubMed: 20335548]
31. Reitman D, Currier RO, Hupp SD, Rhode PC, Murphy MA, O'Callaghan PM. Psychometric characteristics of the Parenting Scale in a Head Start population. Journal of Clinical Child Psychology. 2001; 30(4):514–524. [PubMed: 11708239]
32. Beavers WR, Hampson RB, Hulgus YF. Commentary: The Beavers systems approach to family assessment. Family Process. 1985; 24(3):398–405.
33. Jones Harden B, Winslow MB, Kendziora KT, Shahinfar A, Rubin KH, Fox NA, et al. Externalizing problems in Head Start children: An ecological exploration. Early Education and Development. 2000; 11(3):357–385.
34. Shahinfar A, Fox NA, Leavitt LA. Preschool children's exposure to violence: relation of behavior problems to parent and child reports. American Journal of Orthopsychiatry. 2000; 70(1):115. [PubMed: 10702856]
35. Kilmer RP, Cowen EL, Wyman PA, Work WC, Magnus KB. Differences in stressors experienced by urban African American, White, and Hispanic children. Journal of Community Psychology. 1998; 26(5):415–428.

What's New

Psychosocial stress exposure in early childhood and child age predict increases in obesogenic eating behaviors, specifically eating in the absence of hunger and emotional overeating, among low-income children longitudinally from early to middle childhood.

Table 1

Measures Contributing to Psychosocial Stress Exposure Index (n=207)

Construct	Measure	# items	Response Scale	Scoring	Cronbach's alpha	Possible Range	Sample range	Sample M (SD)	Exposure Criterion	% meeting exposure criterion
Proximal Parenting		N/A	N/A	Number of exposure criteria met divided by number of measures in index	N/A	0–1	0.00–1.00	0.43 (0.33)	–	–
Maternal Depression Symptoms	Center for Epidemiological Studies-Depression (CESD)[14]	20	0–3	Sum	0.89	0–60	0–52.00	13.58 (10.80)	≥ 16 [14]	28.5%
Permissive Parenting	The Parenting Scale (Lax subscale)[13]	12	1–7	Mean	0.78	1–7	1.00–6.25	2.57 (0.98)	> 2.4 [31]	55.2%
Harsh Parenting	The Parenting Scale (Harsh subscale)[13]	12	1–7	Mean	0.73	1–7	1.00–4.92	2.41 (0.76)	> 2.4 [31]	50.8%
Family-Level		N/A	N/A	Number of exposure criteria met divided by number of measures in index	N/A	0–1	0.00–1.00	0.23 (0.39)	–	–
Family Conflict	Self-Report Family Inventory (Conflict subscale)[15]	12	1–5	Mean	0.86	1–5	1.00–4.33	1.71 (0.76)	> 1.65[15, 32]	40.7%

Construct	Measure	# items	Response Scale	Scoring	Cronbach's alpha	Possible Range	Sample range	Sample M (SD)	Exposure Criterion	% meeting exposure criterion
Home Chaos	Chaos, Hubbub, and Order Scale (CHAOS)[16]	15	True/false	Sum	0.80	0–15	0.00–14.00	3.93 (3.15)	> 3.99[16]	43.3%
Social-Contextual		N/A	N/A	Number of exposure criteria met divided by number of measures in index	N/A	0–1	0.00–1.00	0.72 (0.29)	–	–
Violence Exposure	Violence Exposure Scale (VEX)[17]	12	0–3	Mean	0.76	0–3	0.00–1.75	0.44 (0.32)	≥ 2 mild or 1+ overt exposure[33, 34]	37.8%
Negative Life Events	Psychiatric Epidemiology Research Interview (PERI)[18]	49	Yes/No	Sum	0.71	0–49	1.00–16.00	4.34 (3.15)	> 4 [12, 35]	46.4%
Total Childhood Psychosocial Stress Exposure	Stress Exposure Index Score	N/A	N/A	Number of exposure criteria met divided by number of measures in index	N/A	0–1	0.00–1.00	0.52 (0.25)	–	–

Table 2

Characteristics of the sample (n=207)

Variable	N (%) or M (SD)			
Child Sex				
Female	97 (46.9)			
Male	110 (53.1)			
Child Race/Ethnicity				
White, Non-Hispanic	113 (54.6)			
Black	30 (14.5)			
American Indian/Alaskan Native	1 (0.50)			
Asian or Pacific Islander	2 (1.0)			
Biracial	40 (19.3)			
Hispanic, any race	21 (10.1)			
Child Overweight/Obese (baseline) (BMI >85%)	83 (40)			
Maternal Education				
High school or less	92 (44.4)			
More than high school	115 (55.6)			
	Baseline M (SD)	Follow-Up M (SD)	p-value	Change/yr M (SD)
Child BMI z-score	0.87(1.07)	0.97 (0.99)	.04	0.03 (0.21)
EAH/daily kcal needs (EAH%)	0.05 (0.05)	0.19 (0.08)	<.0001	0.04 (0.03)
CEBQ Emotional Overeating	1.9 (0.7)	2.2 (0.8)	<.0001	0.07 (0.2)
CEBQ Food Responsiveness	2.4 (0.8)	2.9 (0.9)	<.0001	0.1 (0.3)
CEBQ Enjoyment of Food	3.8 (0.7)	4.0 (0.7)	.0006	0.05 (0.2)

Table 3

Adjusted associations between baseline stress exposure and average rate of change per year in eating behaviors from baseline to follow up

	EAH%	Emotional Overeating	Food Responsiveness	Enjoyment of Food
Psychosocial Stress Exposure Index	0.14 (0.07) *	0.14 (0.07) *	0.06 (0.07)	−0.13 (0.07)

Note. Standardized beta coefficients from multivariate linear regression models adjusting for child sex, child race/ethnicity, and child baseline BMIz

* $p < .05$