Child Abuse & Neglect xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

Child Abuse & Neglect

Research article

Exposure to violence in childhood is associated with higher body mass index in adolescence

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ARTICLE INFO

Article history:
Received 1 May 2015
Received in revised form 29 July 2015
Accepted 7 August 2015
Available online xxx

Keywords:
Adolescents
Obesity
Child abuse
Violence
Body mass index

ABSTRACT

To determine whether different types of childhood adversity are associated with body mass index (BMI) in adolescence, we studied 147 adolescents aged 13–17 years, 41% of whom reported exposure to at least one adversity (maltreatment, abuse, peer victimization, or witness to community or domestic violence). We examined associations between adversity type and age- and sex-specific BMI *z*-scores using linear regression and overweight and obese status using logistic regression. We adjusted for potential socio-demographic, behavioral, and psychological confounders and tested for effect modification by gender. Adolescents with a history of sexual abuse, emotional abuse, or peer victimization did not have significantly different BMI *z*-scores than those without exposure ($p > 0.05$ for all comparisons). BMI *z*-scores were higher in adolescents who had experienced physical abuse ($\beta = 0.50$, 95% CI 0.12–0.91) or witnessed domestic violence ($\beta = 0.85$, 95% CI 0.30–1.40). Participants who witnessed domestic violence had almost 6 times the odds of being overweight or obese (95% CI: 1.09–30.7), even after adjustment for potential confounders. No gender-by-adversity interactions were found. Exposure to violence in childhood is associated with higher adolescent BMI. This finding highlights the importance of screening for violence in pediatric practice and providing obesity prevention counseling for youth.

Introduction

Adverse childhood experiences, including exposure to interpersonal violence, have been associated with obesity in children (Whitaker, Phillips, Orzol, & Burdette, 2007), adolescents (Burke, Hellman, Scott, Weems, & Carrion, 2011; Jun et al., 2012; Shin & Miller, 2012), and adults (Bentley & Widom, 2009; Boynton-Jarrett, Rosenberg, Palmer, Boggs, & Wise, 2012; Midei & Matthews, 2011; Thomas, Hypponen, & Power, 2008; Vamosi, Heitmann, & Kyvik, 2009). While there has been an increasing awareness of the impact of childhood adversity generally on adult health and chronic disease (Gilbert et al., 2015), important questions remain about the types of adversity associated with health outcomes, including obesity, and the

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http://dx.doi.org/10.1016/j.chiabu.2015.08.005
0145-2134/

varying effects across the life course and by gender. In this study we report relationships between six types of childhood adversity and weight composition in adolescents participating in a study of the effects of child maltreatment and examine for differential associations in boys and girls.

Mechanisms linking early life adversity to later life obesity are complex and are an active area of investigation (Vamosi et al., 2009). Existing conceptual frameworks explaining the lasting impact of childhood adversity on health outcomes posit that exposure to adverse and stressful environments early in development leads to lasting alterations in systems that regulate responses to the environment, including the autonomic nervous system (ANS), the hypothalamic-pituitary-adrenal (HPA) axis, the immune system, and the metabolic system (Gunnar & Quevedo, 2007; Lupien, McEwen, Gunnar, & Heim, 2009; Miller, Chen, & Parker, 2011; Shonkoff & Garner, 2012). Indeed, exposure to childhood adversity has been associated with changes in the regulation of the ANS and HPA axis and hormones involved in energy metabolism in numerous studies (Danese et al., 2014; Heim et al., 2000; Joung et al., 2014; Taylor, 2010), each of which play a role in the regulation of appetite and metabolism. Changes in these neurobiological systems might lead individuals to experience intense emotional responses to future stressors (Glaser, van Os, Portegijs, & Myin-Germeys, 2006; McLaughlin, Conron, Koenen, & Gilman, 2010; Wichers et al., 2009), which may in turn increase risk for internalizing problems (McLaughlin et al., 2010; Moylan et al., 2010) such as anxiety and depression. In order to cope with these repeated negative emotions, individuals with a history of childhood adversity may engage in emotional eating or binge eating of high-calorie foods (Dallman et al., 2003; Greenfield & Marks, 2009; Nguyen-Rodriguez, Chou, Unger, & Spruijt-Metz, 2008). Dysregulation of these systems may also lead directly to obesity via changes in body composition, including the tendency to store visceral fat (Midei & Matthews, 2011). Other behavioral factors associated with childhood adversity, including physical inactivity, generally poor dietary habits, and tobacco use (Bellis, Hughes, Leckenby, Perkins, & Lowey, 2014; Halonen et al., 2014; Kestila et al., 2006), may also be part of the maladaptive response to repeated stress or may simply be more common in environments with high adversity exposure, and thus may either contribute to or confound the relationship between childhood adversity and weight.

Adolescence is a particularly vulnerable time for the confluence of adverse childhood experiences, dysregulation in the stress response, and weight accumulation. Increased physiologic reactivity to psychosocial stressors – in both the ANS and HPA axis – occurs during adolescence (Gunnar & Quevedo, 2007; Stroud et al., 2009). There are rapid changes in growth and development occurring simultaneously with socially influenced behavior patterns that favor weight gain, including decreased physical activity (Allison, Adlaf, Dwyer, Lysy, & Irving, 2007) and increased consumption of high-calorie foods, including sugar-sweetened beverages (Berkey, Rockett, Field, Gillman, & Colditz, 2004; Taveras et al., 2005). One retrospective study of adults found that the transition from adolescence to young adulthood was a particularly sensitive time for increased weight gain in women exposed to childhood abuse (Noll, Zeller, Trickett, & Putnam, 2007).

Clarification of the types of childhood adversity most strongly associated with a higher body mass index (BMI) in adolescence is important for the design of prevention programs aimed at mitigating the effects of childhood adversity on adult obesity and chronic disease. Therefore the purpose of the current study was to investigate associations between six types of childhood adversities, including multiple forms of interpersonal violence and victimization, and BMI in adolescence. As some studies have found a stronger association between childhood adversity and obesity in women compared to men (Mamun et al., 2007), we also aimed to assess whether any associations differed by gender. We hypothesized that adolescents with a history of interpersonal violence, including sexual abuse, physical abuse, and domestic violence, would have higher BMI *z*-scores compared to adolescents without a history of interpersonal violence or those exposed only to community violence or peer victimization due to heightened perception of individual threat. We also hypothesized that these associations would be stronger in adolescent girls compared to adolescent boys based on findings from the adult literature (Mamun et al., 2007). We assessed for a number of potential confounders of any relationship between these childhood adversities and BMI, including sociodemographic factors, dietary factors (fast food and sugar sweetened beverage consumption), physical activity, smoking, and internalizing problems.

Methods

Study Population

A community-based sample of 168 adolescents aged 13–17 years was recruited from schools, after-school programs, medical clinics, and the general community in Boston and Cambridge, MA in 2010–2011. Participants were recruited for a parent study of stress reactivity after childhood maltreatment (McLaughlin, Sheridan, Alves, & Mendes, 2014). We purposefully targeted recruitment from neighborhoods with a high prevalence of violence and from clinics serving a predominantly low income area in order to identify a sample in which approximately half of participants had exposure to childhood adversity. Therefore the sample is not representative of the local population. Participants were told this was a study of emotional experiences, emotions, and health and were reimbursed $50 for their participation. No participant was currently experiencing maltreatment, and the proper authorities were contacted in cases where there were safety concerns. Informed consent was obtained from the parent/guardian who attended the session, and assent was provided by adolescents. This study was approved by the Boston Children's Hospital Office of Clinical Investigation. We report data on the 147 participants with self-reported height and weight and complete data on all demographic covariates and potential confounders.

Please cite this article in press as: Gooding, H. C., et al. Exposure to violence in childhood is associated with higher body mass index in adolescence. *Child Abuse & Neglect* (2015), http://dx.doi.org/10.1016/j.chiabu.2015.08.005