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Research paper

Overweight during childhood and internalizing symptoms in early adolescence: The mediating role of peer victimization and the desire to be thinner

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ABSTRACT

Background: Overweight is associated with depression and anxiety among adults. It is unclear whether this association begins in childhood. Overweight among children is associated with a higher risk of peer victimization, and may mediate an association between overweight and internalizing symptoms. No study has tested this hypothesis in a longitudinal population-based sample using developmental trajectories of overweight in middle childhood.

Methods: Data was drawn from the population-based Quebec Longitudinal Study of Child Development. A three-group trajectory model of overweight development (6–12 years) was previously identified using a semi-parametric group-based approach (n=1678): "early-onset" (11.0%), "late-onset" (16.6%) and "never overweight" (72.5%). Mediation models tested the link between overweight status and child-reported depression and anxiety at 13 years via peer victimization and body dissatisfaction.

Results: Children on an early-onset overweight trajectory were at increased risk for both depression (B=.318, 95% CI=.141;.496) and anxiety (B=.262, 95% CI=.09;.44) at 13 years. These direct associations were mediated by peer victimization and subsequent desire to be thinner. Children on a late-onset childhood overweight trajectory were at increased risk for both depression (B=.332, 95% CI=.187;.477) and anxiety (B=.215; 95% CI=.072;.358) at 13 years, mediated by the desire to be thinner.

Limitations: We were unable to control for previous levels of body dissatisfaction. Our measure of peer victimization was not specific to weight-based teasing.

Conclusions: Overweight during middle childhood increases risk of early adolescence internalizing symptoms. Peer victimization and body dissatisfaction are partly responsible for this link.

1. Introduction

Childhood overweight and obesity[1] has become a national public health priority for several countries worldwide, and research and intervention efforts have risen sharply in an attempt to counteract what is now documented as an extremely complex phenomenon. A large proportion of work has been aimed at the physical health problems associated with child overweight and we still lack information on its mental health impact. While several studies have shown that overweight adolescents and adults are at higher risk for depression and anxiety (Atlantis and Baker, 2008; Goldfield et al., 2010; Luppino et al., 2010; Mustillo et al., 2003; ter

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[1] Hereafter, the term "overweight" will designate overweight and obese categorizations.

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Bogt et al., 2006), studies examining this question in childhood have thus far elicited modest or mixed results, particularly among community samples (Bradley et al., 2008; Datar and Sturm, 2004; Drukker et al., 2009; Harriger and Thompson, 2012; Luppino et al., 2010; Wardle and Cooke, 2005). One potential reason behind the inconsistent findings is that studies have not often been able to evaluate the longitudinal development of weight status across childhood. There exist differential trajectories of weight status development during childhood and it is plausible that only certain overweight experiences lead to internalizing symptoms (e.g: depression and anxiety). For example, a child who becomes overweight early and persistently may be at a greater risk for negative psychosocial outcomes than a child who experiences weight problems more transiently (Mustillo et al., 2003).

Alternately, the inconclusive or modest associations identified in the literature thus far could be indicative of the existence of indirect (or mediating) pathways. That is, overweight and internalizing symptoms may be associated via a third factor, such as peer victimization. Indeed, weight-based peer victimization has been identified as one of the most prominent forms of bullying in the school setting (Bradshaw et al., 2011; Puhl et al., 2011). It is documented as a source of major distress in the lives of those who experience it (Cramer and Steinwert, 1998; MacLean et al., 2009; Puhl and Latner, 2007), with negative scars that may last into adulthood (Puhl and Latner, 2007). However, given a lack of longitudinal studies, it is still unclear whether peer victimization mediates the predictive association between childhood overweight development and subsequent internalizing symptoms among youth in community samples.

Past research informs us that it is likely not a child's weight status per se, but rather the extent to which they are dissatisfied with their weight status, that is linked to negative psychological outcomes (Mond et al., 2011). Children as young as 9 years of age with a history of being at-risk for overweight have been identified as showing signs of body dissatisfaction (Shunk and Birch, 2004). Overweight youth may exhibit such dissatisfaction because at some level the outside world has informed them their body shape or size does not fit the ideal. They may internalize societal norms and ideals of beauty, attractiveness, and health directly; or indirectly, such as when faced by teasing, bullying or other forms of rejection by peers (Bearman et al., 2006).

Our aim for the present study was to test the predictive association between various weight status trajectories during middle childhood (assessed objectively between 6 and 12 years) and internalizing symptoms in early adolescence (13 years), and whether these associations occurred via peer victimization and/or the child's desire to be thinner. We relied on a large population-based sample (n=1221) assessed 11 times over the first 13 years of the child's life.

2. Methods

2.1. Participants

Participants were from the Québec Longitudinal Study of Child Development (QLSCD; 1998–2011). A random population sample of 2940 families with a 5-month-old singleton infant in 1998 was identified through the provincial master list of birth registries. Participants were selected if they spoke English or French (official languages of Canada). The sample was reduced to 2120 due to non-response, inability to contact, or not meeting study criteria. Trained research assistants conducted home visits with the child and primary caregiver (mostly mothers) every year until age 8 and at 10, 12 and 13 years. The present sample includes 1221 children for whom height and weight data were available and who self-reported their internalizing symptoms at 13 years. Within this dataset, simple imputation based on Estimation Maximization (EM) was used to complete occasional missing data (1.3% of all values). Table 1 presents sample characteristics.

Table 1.
Sociodemographic Characteristics of Sample (n=1221).

	%	n
Sex of child (female)	54	661
Mother born outside Canada	7.1	87
Mother had a lifetime occurrence of depression	21.6	261
Mother did not obtain high school diploma	16.2	198
Parents separated between 6 and 12 years	32.3	393
Family Income (at age 6)		
<$30,000	12.6	139
$30,000–60,000	32.9	364
>60,000	54.4	601
Family had insufficient income (at least once) from 6 to 12 years	26.5	323
	Mean	SD
Mother's age when child was 5 months (in years)	29.5	5.2

We compared the socio-demographic characteristics of the 1221 families included in our sample analyses to that of the 899 families excluded from the present analyses. No significant difference was found for the proportion of non-intact families or maternal depression occurrences. Significant differences were found for maternal education (79.2% of excluded vs. 83.7% of included mothers obtained a high school diploma), family income <30 000$ at age 5 years (17.5% of excluded vs. 12.6% of included families earned <30 000$/year) and maternal immigrant status (15.8% of excluded vs. 7.1% of included were born outside Canada).

At each data collection, informed written consent was obtained from the child's primary caregiver. The study was approved by the Health Research Ethics Committees of the Québec Statistics Institute and the University of Montreal.

2.2. Measures

2.2.1. Independent variable

The independent variable (IV) was a categorical variable representing the longitudinal developmental of overweight status from 6 to 12 years. This developmental trajectory model was previously identified (Pryor et al., 2015) using a semi-parametric modelling method in the SAS Proc Traj program (Nagin and Tremblay, 1999; Nagin and Odgers, 2010) according to the following method:

Trained interviewers obtained measures of height and weight as part of a standardized protocol when children were 6, 7, 8, 10 and 12 years (Lavallée, 2004). Body Mass Index (BMI) was calculated as the child's weight in kilograms divided height in meters squared (BMI=kg/m^2). Children's weight status was classified as overweight (=1) vs. not overweight (=0) according to International Obesity Task Force BMI cut-off criteria which account for sex and age in months (Cole et al., 2000). This binary measure was used to model group-based developmental trajectories of weight status. In cases where a binary measure is modeled (in our case, weight status) using the SAS Proc Traj procedure, the technique yields a probability of being overweight at each age, for each group.

Children with at least one valid data point from 6 to 12 years were included in the analysis (n=1678). Of these 1678 children, 48.9% had data at all 5 time points, 23.4% had data for four time points, 12% had data for three time points, 7.3% for two time points and 8.2% for one time point.

Model selection was guided by a maximized Bayesian Information Criterion (BIC) (Nagin and Tremblay, 1999) and by considering groups that were large enough to maintain power in