Body mass index and victimization during adolescence: The mediation role of depressive symptoms and self-esteem

Matteo Giletta\textsuperscript{a,b,*}, Ron H.J. Scholte\textsuperscript{b}, Rutger C.M.E. Engels\textsuperscript{b}, Junilla K. Larsen\textsuperscript{b}

\textsuperscript{a}Department of Psychology, University of Torino, Torino, Italy
\textsuperscript{b}Behavioural Science Institute, Radboud University Nijmegen, Nijmegen, The Netherlands

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Abstract

Objective: This study applied a multi-method approach to examine the relationship between body mass index (BMI) and the experience of victimization during adolescence by investigating the role of intrapersonal feelings. Methods: The sample consisted of 2051 adolescents (\(M=13.8\) years, S.D.=0.7; 51\% male) from seven high schools in the Netherlands. Participants’ weight and height were measured and they completed self-report questionnaires on victimization, depressive symptoms and self-esteem. Self-reported and peer-reported measures of victimization were collected and combined to create three different victimization types (i.e., self/peer-identified, self-identified, and peer-identified). Results: Hierarchical logistic regression analyses revealed that higher BMI was associated with both self/peer-identified victimization and self-identified victimization. Intrapersonal feelings (i.e., depressive symptoms and self-esteem) were found to mediate these associations. However, BMI was not associated with peer-identified victimization. Conclusion: These findings suggest that the association between BMI and victimization might be exclusively related to the self-perception of high BMI adolescents. Moreover, the mediation effects indicate that the perception of victimization might be linked to psychological difficulties of adolescents with high BMI. Thus, to fully understand the associations between weight status and victimization, intrapersonal mechanisms need to be examined. © 2010 Elsevier Inc. All rights reserved.

Keywords: Adolescence; Body mass index; Depressive symptoms; Self-esteem; Victimization

Introduction

Over the last decades, obesity and overweight status among children and adolescents have continuously been rising worldwide [1]. In the Netherlands, recent estimates suggest that more than 15\% of the school-aged children and adolescents are overweight [2]. The negative consequences of overweight are in childhood and adolescence particularly psychosocial in nature [3], and psychological and social difficulties seem to be strongly related to the negative stereotypes of having a high weight status [4,5]. Due to the increased importance attributed to physical appearance in adolescence, among adolescents overweight seems to be an undesirable feature that deviates from the prevailing cultural norms and ideals [6–8] and may be the cause of social problems in peer relations.

Recent studies suggested that weight status might be related to peer victimization. Weight categories were found to be positively associated with victimization, with overweight and obese adolescents reporting higher levels of peer victimization than their average-weight peers [5,6,9]. Thus, overweight is assumed to be a salient feature related to peer victimization.

Nonetheless, there are methodological and theoretical unresolved issues in the literature on the relation between being overweight and peer victimization. First, research largely relies on self-report measures. In some studies, the body mass index (BMI) was assessed through self-reported measures of weight and height [5,9], and none of the previous studies provided any alternative to self-reported
measures of victimization [5,6,8–10]. One disadvantage of this methodology is the risk of shared-method variance or reporter bias, whereas a multi-method approach that combines different measures may provide more clear and informative results. Moreover, research underscored the importance of using simultaneously both self and peer-rated measures when collecting data on peer victimization. Indeed, the two measures seem to identify different kinds of victims. Previous studies found barely a modest concordance between self-reports and peer-reports, which varied between .30 and .50, indicating significant discrepancies in perceptions between victims and their peers [11–13]. Therefore, to compare self- and peer-reported measures of victimization might be useful to find out whether overweight adolescents are more victimized than their average-weight peers. Indeed, it may be that the overweight adolescents themselves perceive to be more victimized than in real. Important practical and theoretical implications might result from an approach using both self-reported and peer-reported measures of victimization.

Second, the majority of previous studies that showed a relation between being overweight and victimization did not take into account other possible mechanisms that contribute to peer victimization. Indeed, these studies investigated the direct relationships between weight category and peer victimization, without considering any other psychological factors that might be involved [5,6,9]. During adolescence, a high-weight status seems to predict poorer psychological wellbeing. In particular, empirical evidence showed that overweight children and adolescents might experience higher levels of depressive feelings as well as lower levels of self-esteem compared to their average-weight peers [14–17]. Also, other studies found internalizing problems (e.g., depressive symptoms) and low self-regard to be potential predictors of peer victimization [18,19]. As a consequence, it can be assumed that psychological wellbeing mediates the link between overweight and victimization. Since overweight adolescents are more likely to experience psychological feelings of distress, they might be also more likely to be victimized by peers. Specifically, a low psychological wellbeing might increase the perception of overweight adolescents to be victimized.

In the light of previous literature limitations, the present study aimed to test the relation between BMI and peer victimization by applying a multi-method approach that included objective measures of BMI and combined self-reported and peer-reported measures of victimization. We expected BMI to be positively related with all three different measures of victimization (i.e., self/peer-identified, self-identified, and peer-identified). Additionally, we tested whether the association between BMI and victimization was affected by intrapersonal factors. We expected that high levels of depressive symptoms and low self-esteem might partially explain the relation between BMI and victimization.

Methods

Procedure and participants

Data were obtained from the “Mental Health and Health Habits” [20]. Seven schools, three located in cities and four in suburban environments, participated in the study. A passive consent procedure was used to recruit participants: a letter describing the study was mailed to 2216 parents and they were asked to return an e-mail or phone call if they did not want their child to participate. Parents of 11 adolescents denied permission (0.5%), 145 adolescents were absent by sick leave (6.5%) and 9 had moved away (0.4%), resulting in a total of 2051 early adolescents participating (92.6%). Data were collected during spring, implying that after several months from the beginning of the school year social groups had formed within classes. During a classroom session, adolescents completed a 10-page survey.

Of the 2051 adolescents, 51% were male and 49% female, coming from 90 classes in the secondary education; 25% of them were in the first grade and 75% in the second (i.e., Grades 7 and 8 in the United States). The sample age ranged between 10 and 16 years (M=13.8, S.D.=0.7), with approximately 91% of the participants aged between 10 and 14. Most of the participants were of Dutch origin (>95%) and were living with both parents in intact, non-divorced families (87%).

Measures

Victimization

Data about victimization were collected using both self-report and peer nomination measures. In the questionnaire we first provided a clear definition of what is meant by victimization. We defined victimization as follows: “We can say a student is being victim of bullying when another student or a group of peers says malicious or hurtful things to him. The same is true when a student is being hit, kicked, threatened, or is being excluded from the group. These things can be classified as bullying when they happen frequently or regularly, and when it’s difficult for the student being bullied to defend him or herself. It is NOT bullying when two or more students who are equally strong tease each other or fight with each other” [21–24]. The self-report measure of victimization was obtained through a single-item adapted from the Dutch version of the Olweus Bully/victim Questionnaire [22,25,26], a validated instrument that has already been used in several previous studies [21–23]. Adolescents were asked on a five point scale (never, one or two times, regularly, about once a week, several times a week) how many times they were victims of bullying at school in the last year. This variable was then dichotomized into victimized (regularly, about once a week or several times a week) and not-victimized (one or two times or never) [27].
Peer reported victimization was measured through a sociometric question. This measure was similar to the widely used instrument developed by Coie et al. [28]. Each participant was asked to nominate from a list of classmates a maximum of five peers in answer to the question “Which of the students in your class is bullied by other students?” [29]. Self-nominations were not allowed. Subsequently, for each participant the number of received nominations was calculated and participants who were nominated by more than 20% of their classmates (equivalent with approximately 5 nominations in an average size class of 25 students) were classified as victims [30]. Thus, also peer-reported measure of victimization was dichotomized into victimized (if more than 20% of classmates nominated him/her as victim) and not-victimized. These cutoff points provided a prevalence rate of victims of about 7%, in line with prevalence estimations that previous research showed in same age samples [30].

**BMI z-score**

For each participant, weight and height were measured individually by trained researchers in a separate room. During measurements, standardized equipment and procedures were used: all participants were wearing only light clothes, and did not wear shoes when weight and height were measured. The BMI was calculated as weight in kilograms divided by square height in meters (kg/m²). Afterwards, BMI values were adjusted for age and sex, according to the lambda, mu, sigma curves (LMS) method based on a Dutch representative sample of 0–20-year olds [20,31]. For our analyses, the adjusted BMI measure (i.e., BMI z-scores) was used as a continuous variable, ranging from low to high levels.

**Self-esteem**

Self-esteem was measured using the Rosenberg Self-Esteem Scale [32], a widely used self-report measure of global self-esteem consisting of 10 items (e.g., “I feel that I have a number of good qualities,” “I feel that I do not have much to be proud of”). All participants rated the items on a scale from 1 (strongly agree) to 4 (strongly disagree). Total possible scores range from 10 to 40 and higher scores indicate higher level of self-esteem. Previous studies on the psychometric properties of this scale found high internal consistencies and high test-retest reliabilities [33]. This scale has been also validated in Dutch language, showing good validity and reliability proprieties [34] and has been previously used in studies with Dutch adolescent samples [35–37]. Cronbach’s alpha calculated for our sample was .86.

**Depressive symptoms**

The Dutch version of the Center for Epidemiological Studies-Depression scale (CES-D) [38] was used to measure current levels of depressive symptoms in our sample. The scale was self-administered: each participant was asked to fill in the 20-item questionnaire (e.g., “I enjoyed life,” “I felt hopeful about the future”), indicating on a scale from 0 (rarely or none of the time) to 3 (most of or all the time) how frequently in the past week he or she had experienced specific symptoms. The total score ranged from 0 (no depressive symptoms at all) to 60 (many depressive symptoms). The CES-D is a widely used scale to assess depression internationally and in the Netherlands [39], and it has shown high reliability and validity in both adult and adolescent populations [40,41]. Cronbach’s alpha calculated for our sample was .88.

**Statistical analyses**

First, in line with previous studies [42,43], self-reported and peer-reported victimization were combined to create three different measures of victimization. A first measure caught all participants that were categorized as victims according to both the self-reports and the peer nominations (i.e., self/peer-identified victimization). The other two measures included adolescents that were only defined as victims either by the self-reports (i.e., self-identified victimization) or the peer nominations (i.e., peer-identified victimization) respectively. Subsequently, all the analyses were run separately for the three victimization measures as dichotomous outcome variables (victim vs. not-victimized).

Baron and Kenny’s method was adopted to test whether our mediator factors (i.e., depressive symptoms, self-esteem) affected the associations between BMI z-scores and victimization [44,45]. As essential condition, we first checked whether the main predictor BMI was associated with the mediating variables and the outcomes. Afterwards, the mediators were examined separately in two parallel models. A series of logistic regression models were run, entering in a first step BMI z-scores, gender, and age, and in the next step, the selected mediator (i.e., depressive symptoms or self-esteem). Finally, to determine the statistical significance of mediation effects, Sobel tests were calculated [46].

**Results**

**Descriptive results**

Descriptive statistics for all the study variables are presented in Table 1. Less than 7% of the whole sample reported to be victimized at least regularly in the last year; also, according to the peers measure, around 7% of adolescents were classified as victims. Boys were found to be more victimized than girls in the peer report measure (χ²=6.02, df=1, P<.05). Means of BMI z-scores and self-esteem appeared to be significantly higher for boys than girls [t(2024)=2.94; P<.05 and t(2051)=9.92; P<.001, respectively for BMI z-score and self-esteem]. Girls reported higher scores on depressive symptoms than boys [t(2042)=−10.20; P<.001]. Additional t tests and chi-
square analyses were employed to test differences between the urban and suburban schools on the study variables. A significant difference emerged only on self-esteem, indicating that adolescents that attended suburban schools reported somewhat lower levels of self-esteem than adolescents attending urban schools ($M_{urban}=3.45$ vs. $M_{suburban}=3.24$; $t(2115)=2.11$, $P<.05$). No significant differences were found on BMI $z$-scores, depressive symptoms, and self- and peer-reported victimization. A fair level of agreement was found between self and peer-reported victimization ($kappa=0.33$). The concordance between the two measures of victimization was in line with the results from previous literature [11–13].

According to both self and peer-reported measures, about 88.7% ($n=1791$) of the participants were categorized as not-victimized, and 2.6% ($n=53$) as victimized (i.e., self/peer-identified victims). The peers nominated another 4.4% ($n=91$) of the adolescents as victims, while they did not report to be one (i.e., peer-identified victims), and almost 4.2% ($n=84$) of them reported to be victimized, but their peers did not (i.e., self-identified victims).

### Mediator effects on the associations between BMI $z$-scores and victimization

The first logistic regression analysis included self-identified victimization as outcome variable. Results indicated that higher BMI $z$-scores were significantly associated with greater probability to report victimization. Girls did not differ from boys, neither older from younger adolescents in level of self-reported victimization (see ORs at step, Table 2).

As essential condition to test mediation effects, we found BMI $z$-scores to be significantly associated with our mediator factors, positively with depressive symptoms ($r=0.07$, $P<.01$) and negatively with self-esteem ($r=-0.09$, $P<.01$).

In the first mediation model, when the depressive symptoms variable was added into the analyses, BMI $z$-scores were no longer associated with victimization. A Sobel test revealed that the inclusion of depressive symptoms mediated the associations between BMI $z$-scores and victimization ($z=3.27$, $P<.01$). Moreover, after the introduction of depressive symptoms in the model, a sex difference

### Table 1

Descriptive statistic for all study variables

<table>
<thead>
<tr>
<th></th>
<th>Males Mean (S.D.)</th>
<th>Females Mean (S.D.)</th>
<th>Total Mean (S.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victimized (self-report)</td>
<td>7.8</td>
<td>5.7</td>
<td>6.8</td>
</tr>
<tr>
<td>Victimized (peer report)</td>
<td>8.5*</td>
<td>5.7</td>
<td>7.1</td>
</tr>
<tr>
<td>BMI</td>
<td>19.62** (2.94)</td>
<td>20.03 (2.88)</td>
<td>19.82 (2.92)</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>3.39*** (-.45)</td>
<td>3.17 (.58)</td>
<td>3.28 (.53)</td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td>7.48*** (6.07)</td>
<td>10.98 (9.20)</td>
<td>9.18 (7.94)</td>
</tr>
</tbody>
</table>

Significance of gender difference.

* $P<.05$.
** $P<.01$.
*** $P<.001$.

* BMI values are raw scores.

### Table 2

Multiple logistic regression analyses of self-identified victimization, self/peer-identified victimization, and peer-identified victimization on BMI $z$-scores, controlling for gender and age (Step 1), depressive symptoms (Step 2) and self-esteem (Alternative Step 2)

<table>
<thead>
<tr>
<th></th>
<th>Self-identified OR (95% CI)</th>
<th>Self/peer-identified OR (95% CI)</th>
<th>Peer-identified OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At step</td>
<td>Final Model 1</td>
<td>Final Model 2</td>
<td>Final Model 1</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>1.27* (1.03–1.56)</td>
<td>1.19 (0.96–1.47)</td>
<td>1.57** (1.20–2.04)</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.74 (.47–1.17)</td>
<td>.45 ** (.27–.74)</td>
<td>.48* (.24–.84)</td>
</tr>
<tr>
<td>Depressive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>symptoms</td>
<td>Step 2</td>
<td>Alternative step 2</td>
<td></td>
</tr>
<tr>
<td>Self-esteem</td>
<td>1.09*** (1.06–1.10)</td>
<td>1.05** (1.02–1.08)</td>
<td></td>
</tr>
</tbody>
</table>

Self/peer-identified victimization was created combining self-reports and peer-nominations.

* $P<.05$.
** $P<.01$.
*** $P<.001$. 
appeared, with boys reporting higher levels of victimization than girls (see Final Model 1 ORs, Table 2). The second mediator model showed self-esteem to be significantly associated with self-identified victimization. Again, the Sobel test indicated a mediation effect of self-esteem on the relationship between BMI z-scores and victimization ($z=3.97$, $P<.001$). Sex differences emerged with boys reporting to be more victimized than girls (see Final Model 2 ORs, Table 2).

The second logistic regression analysis, with the self/peer-identified victimization as outcome variable, showed that BMI z-scores were positively related with increased probability to be victimized. Sex and age were not found to be significant predictors of this victimization measure (see ORs at step, Table 2). In the next step, analyses revealed mediation effects of depressive symptoms on the associations between BMI z-scores and victimization. The effect of BMI z-scores on self/peer-identified victimization reduced significantly, and a Sobel test suggested a partial mediation effect ($z=2.43$, $P<.05$). Moreover, sex emerged to be significant, with boys being more victimized than girls (see Final Model 1 ORs, Table 2). In the second model, self-esteem was introduced into the model as a mediator variable. Although the reduction in beta for BMI z-scores was equal to the previous model (see Final Model 2 OR, Table 2), the Sobel test was not statistically significant ($z=1.13$, $ns$), indicating that self-esteem was not a mediator of the relations between BMI z-scores and victimization. However, as in the first mediator model, with the inclusion of self-esteem, boys emerged to be more victimized than girls (see Final Model 2 ORs, Table 2).

When analyzing with peer-identified victimization as an outcome variable, the findings in the first model showed that only sex was a significant predictor, with girls less likely to be involved in victimization processes than boys (see ORs Final Model, Table 2). However, no age differences were found and in particular BMI z-scores were found to be insignificantly related with peer-identified victimization (see ORs Final Model, Table 2). One of the most widely acknowledged criteria to be met when testing mediation effects consists of finding a significant association between the independent variable and the outcome variable [44]. As a consequence, since our main predictor (BMI z-score) was not related to peer-identified victimization, we did not test any mediation effects.

Discussion

This study aimed to examine the association between BMI and victimization among adolescents, accounting for salient intrapersonal related mechanisms. A first innovative feature was the use of the peer-reported measure of victimization in combination with the self-report measure, that yielded three distinct measures of victimization. Overall, our results seemed to confirm the positive associations between BMI and self-perceived victimization (i.e., self-identified and self/peer-identified victimization). In addition, they suggested the existence of specific pathways in relation to the different measures of peer victimization.

The use of the self/peer-identified measure indicated that the probability to be identified as a victim by one self and by the peers was related to higher levels of BMI. Interestingly, differences emerged from the comparison of the self and peer-identified victimization. In line with previous research [5,6,9], our findings suggest that adolescents with higher BMI scores reported more victimization than their lower BMI peers, but this relation disappeared when using the peer-identified victimization. Although some studies have revealed high correlations between self-reported and peer-reported victimization [47,48], much empirical evidence showed discrepancies between the two measures. For instance, in Perry et al. [13], a small group of children described themselves as being extremely victimized by their peers or by their teachers, while others did not perceive them to be [47]. Specifically, previous studies have suggested that self-reported and peer-reported victimization are different constructs that link to specific correlates [49]. Self-reported victimization emerged to be mainly related to self-reported maladjustment (e.g., depressive feelings, low self-esteem), while peer-reported victimization was related to peer-reported maladjustment (e.g., peer rejection). However, it has been argued that these findings may be some kind of artifact because they reflect shared method variance [50]. Our results go a step further, showing self/peer-identified and self-identified victimization to be significantly related to objective measures of BMI, thus avoiding shared method variance. Contrary, the absence of association between peer-identified victimization and BMI suggests that the link between BMI and victimization may be strongly related to personal feelings of adolescents with high BMI.

A possible mechanism behind these results may be related to a difference in perception of adolescents with high BMIs. Being aware of and influenced by the negative stereotypes about overweight, adolescents with a higher BMI may perceive their physical appearance to being treated negatively by their peers. Thus, they may overestimate their involvement in victimization processes and misunderstand their peers’ behaviors, giving them negative connotations. At the same time, the majority of adolescents might refuse to see systematic teasing of their higher weight peers as victimization. If overweight adolescents feel to be victimized, this could have negative outcomes for their psychological wellbeing; thus, it is necessary to help them deal with their negative perceptions, to focus specific interventions on the adolescents’ social cognitions and improve their self-concept and mental health [5,51].

Our findings concerning the mediation role of intrapersonal factors on the associations between BMI and self experience of victimization seem to go into the same direction, by showing that the association between BMI and victimization tended to decrease when accounting for
overweight, predicted low psychological wellbeing [55,56]. These findings suggest the importance of replicating results. For example, in our study objective BMI within these processes. In a similar way, the inclusion of a concern or body satisfaction that might play salient roles concerning or the cern concerns and the feeling to be overweight, more than actually being overweight, predicted low psychological wellbeing [55,56]. These findings suggest the importance of replicating our study, including other factors, such as weight concerns or body satisfaction that might play salient roles within these processes. In a similar way, the inclusion of a BMI self-report measure might provide interesting comparative results. For example, in our study objective BMI and self-reported body satisfaction correlated only marginally ($r = -0.29$), suggesting that different associations might have been found when using self-reports.

Despite the innovative features, limitations should be addressed. First, the cross-sectional design did not allow addressing any question concerning causality. As we have underlined earlier, perceiving to be victimized by peers might be a consequence as well as a cause for overweight during adolescence. At the same time, the relations between BMI, mediators, and peer victimization might even be the other way round. The intrapersonal factors we assumed to be psychological outcomes of overweight might instead represent potential predictors for an overweight status. Further research analyzing these mechanisms longitudinally is needed. Second, the low number of overweight participants within our sample prevented us from using weight categories. The continuous measure of BMI (i.e., BMI z-score) we employed did not allow us identifying whether the associations between weight status and victimization might assume specific characteristics for those adolescents defined as being overweight according to the specific cutoff points. Specifically, we were not able to investigate whether a higher weight category (i.e., obese) was related with higher levels of victimization.

In conclusion, the findings of this study suggest that the relations between high BMI and victimization have to be interpreted in the light of specific intrapersonal factors. The absence of a significant association between peer reported victimization and BMI, indicates that the association between BMI and victimization may be exclusively related to the self-perception of high BMI adolescents. At the same time, the revealed mediator mechanisms on the relation between BMI and self-perceived victimization (i.e., self-identified and self/peer-identified victimization), provide further evidence that the problem might be more related to psychological difficulties of overweight adolescents.

Acknowledgments

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