

ORIGINAL ARTICLE

The bidirectional associations between self-esteem and problematic eating behaviors in adolescents

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Funding information

Nederlandse Organisatie voor Wetenschappelijk Onderzoek, Grant/Award Number: Veni Grant 451-05-013

Action Editor: Ruth Striegel Weissman

Abstract

Objective: Theories propose that low self-esteem and problematic eating behaviors (PEBs) negatively impact each other. While previous studies suggested bidirectional associations between self-esteem and PEBs, they did not separate within-person from between-person associations. Therefore, this prospective study investigated the within-person bidirectional associations between self-esteem and four PEBs in adolescence, while accounting for between-person differences.

Method: We used two independent longitudinal samples of Dutch adolescents, each including three annually collected waves of data. Sample 1 consisted of 1856 adolescents (Baseline: 50.4% males; $M_{\text{age}} = 13.79$ years, $SD_{\text{age}} = 0.72$), with measures of self-esteem, emotional eating, restrained eating, and loss of control (LOC) while overeating. Sample 2 consisted of 555 adolescents (Baseline: 49.7% males; $M_{\text{age}} = 13.13$ years, $SD_{\text{age}} = 0.68$), with measures of self-esteem and LOC eating. The data were analyzed using random intercept cross-lagged panel models (CLPMs).

Results: Within persons, lower self-esteem was associated with higher emotional and restrained eating (both Sample 1) one year later, and vice versa. Self-esteem did not predict, nor was predicted by, LOC while overeating (Sample 1) or LOC eating (Sample 2). Between persons, self-esteem was negatively correlated with all PEBs (Samples 1 and 2).

Discussion: We found within-person bidirectional associations between low self-esteem and emotional and restrained eating (but not LOC while overeating/LOC eating), and between-person correlations between low self-esteem and all PEBs. These results have theoretical and practical implications. Within-person processes clarify underlying mechanisms that explain the occurrence of PEBs; between-person associations are important to identify adolescents at risk of PEBs.

Public Significance: While theories indicate that low self-esteem and PEBs are inversely associated within individuals, empirical studies have not disentangled within-person processes from between-person differences. This study addressed this disparity, finding that lower self-esteem was bidirectionally associated with higher emotional and restrained eating (but not LOC eating) within persons.

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These findings suggest that enhancing self-esteem is a viable option for prevention and intervention.

KEYWORDS

adolescence, longitudinal, problematic eating behaviors, self-esteem, within-person

1 | INTRODUCTION

Adolescence represents a critical period for the development of problematic eating behaviors (PEBs; Breton et al., 2022). PEBs include emotional eating (i.e., eating in response to negative emotions), restrained eating (i.e., the attempt to eat less than desired to reduce or maintain body weight), and loss of control (LOC) eating (i.e., the subjective experience of being unable to stop eating once started; Tanofsky-Kraff et al., 2011; van Strien et al., 1986). Many adolescents engage in one or more PEBs, with prevalence estimates as high as 57% for females and 33% for males (Croll et al., 2002; Goossens et al., 2009; Yoon et al., 2020). PEBs have been associated with adverse outcomes later in life, such as obesity, clinical eating disorders, and depressive symptoms (Neumark-Sztainer et al., 2006; Stice et al., 2000; Tanofsky-Kraff et al., 2011). Prevention of PEBs in adolescence is therefore important, and enhancing self-esteem (an individual's subjective perception of their own value or worth; Leary & Baumeister, 2000) may be an important strategy for preventing PEBs. Previous prospective studies suggest that low self-esteem is bidirectionally associated with PEBs (Krauss et al., 2023). However, it remains unclear whether these prospective links represent within-person processes, or are due to stable, between-person differences. Therefore, the goal of the current prospective study was to examine bidirectional links between self-esteem and PEBs in adolescence, disentangling within-person associations from between-person differences.

1.1 | Self-esteem and problematic eating behaviors in adolescence

Low self-esteem is considered an important contributor to the development and maintenance of PEBs. Interpersonal models of eating disorders posit that adolescents with low self-esteem engage in PEBs to enhance their self-esteem by pursuing idealized body shape (e.g., restrained eating), or to escape negative feelings (e.g., emotional or LOC eating; Rieger et al., 2010). Transdiagnostic models of eating disorders also emphasize the role of self-esteem in the maintenance of PEBs, with low self-esteem as a primary contributor to negative self-evaluations that lead to adolescents attempting to control their eating, body shape, and weight (Fairburn et al., 2003). Conversely, PEBs may trigger decreases in self-esteem (Polivy & Herman, 2005). For example, adolescents with restrained eating may feel worse about themselves when they fail to restrain their food intake, or if they feel that the results from restrained eating are not good enough. Adolescents with emotional or LOC eating may feel guilty after engaging in

PEBs (e.g., Parker et al., 2022), feel that they cannot cope with emotions constructively, and may start to feel worse about themselves because they engage in PEBs. Low self-esteem has also been bidirectionally associated with PEB-specific risk factors, including body dissatisfaction (Wichstrøm & von Soest, 2016), which may mediate the inverse link between self-esteem and PEBs. A recent meta-analysis summarizing prospective findings from clinical and non-clinical samples across the lifespan provides support for bidirectional associations between low self-esteem and PEBs (Krauss et al., 2023). These results were not moderated by participants' age or sample type (i.e., clinical vs. non-clinical; Krauss et al., 2023), suggesting that the reciprocal links between low self-esteem and PEBs may also apply to the general adolescent population.

Previous research, including the meta-analysis by Krauss et al. (2023), has typically employed traditional cross-lagged panel models (CLPMs) to assess bidirectional associations between self-esteem and PEBs. However, these studies may have provided biased results, because traditional CLPMs do not separate within-person processes from between-person differences. In our case, some adolescents may generally have higher or lower levels of self-esteem and PEBs than others, and traditional CLPMs do not account for these stable between-person differences. Consequently, the estimates of cross-lagged associations between self-esteem and PEBs in a traditional CLPM may not accurately reflect the hypothesized within-person processes (Hamaker et al., 2015). The random intercept cross-lagged panel model (RI-CLPM) is an extension of the traditional CLPM that separates within- and between-person associations. By accounting for between-person differences, the lagged associations in RI-CLPMs solely reflect within-person processes (Hamaker et al., 2015). Distinguishing within and between-person associations has important theoretical and practical ramifications. Within-person processes clarify the underlying mechanisms that explain the occurrence of PEBs. Between-person differences are important to identify individuals at risk of PEBs.

Although there are no empirical studies of self-esteem and PEBs that separate within-person from between-person associations, some have examined within-person associations on related constructs. For example, an experimental study suggested that priming low self-esteem resulted in higher body dissatisfaction among female adults with high body dissatisfaction (Svaldi et al., 2012). In addition, a prospective observational study among adolescents found that low self-esteem and weight concerns were bidirectionally associated at the within-person level (Hochgraf et al., 2018), and another prospective study provided support for bidirectional within-person associations between appearance dissatisfaction and disordered eating during various developmental

periods, including adolescence (Cortés-García et al., 2023). This may indicate that self-esteem and PEBs are also bidirectionally associated at the within-person level, but it remains important to explicitly test this.

It is well-documented that adolescent males and females differ in self-esteem and in the prevalence of PEBs, with females reporting lower self-esteem and higher levels of PEBs than males (Bleidorn et al., 2016; Croll et al., 2002). In addition to these mean-level differences, concurrent and prospective associations between self-esteem and PEBs may also differ for males and females. Females generally experience more appearance-related social pressure than males (e.g., Helfert & Warschburger, 2013; Knauss et al., 2007), and are more likely to base their self-esteem on their physical appearance (Crocker et al., 2003). Therefore, associations between low self-esteem and PEBs may be stronger for females than males. The evidence is mixed. There are some indications that low self-esteem is only associated with PEBs among females (Sehm & Warschburger, 2018) and that targeting self-esteem may be especially effective in reducing PEBs in females (Le et al., 2017). On the other hand, no sex differences in prospective associations between self-esteem and PEBs were found in a recent meta-analysis (Krauss et al., 2023). However, this meta-analysis did not examine within-person processes, which are the topic of our study. Thus, it remains unclear whether within-person associations between self-esteem and PEBs differ by sex.

1.2 | The current study

The goal of this study was to investigate within-person associations between adolescents' self-esteem and four PEBs (emotional eating, restrained eating, and LOC while overeating in Sample 1; LOC eating in Sample 2), while accounting for between-person differences. These associations were assessed using RI-CLPMs (Hamaker et al., 2015). Within persons, we expected that, relative to their own expected scores, lower self-esteem would be associated with higher PEBs one year later, and vice versa. Between persons, we expected that adolescents with lower self-esteem would generally have higher PEBs than adolescents with higher self-esteem. We also explored whether these associations differed by sex.

2 | METHODS

This study included data from two longitudinal projects conducted in the Netherlands: the Mental Health and Health Habits project (MHHH; Sample 1) and the Kandinsky Longitudinal Study (KLS; Sample 2). The MHHH project included three PEB measures (emotional eating, restrained eating, and LOC while overeating). LOC while overeating was assessed with a single item involving overeating occasions. Therefore, the KLS project was also utilized, which includes a more comprehensive measure of LOC eating. Our hypotheses and statistical analyses were preregistered at the Open Science Framework (<https://osf.io/g4ewb>). This preregistration can also be consulted for more details about the study design and measures of both projects.

2.1 | Participants and procedure

The MHHH project (Sample 1) included three annual waves of data collection (2007–2009; Larsen et al., 2009; Larsen et al., 2012). The data were collected in seven secondary schools in the Netherlands (three located in rural areas, four in urban areas). A total of 2216 adolescents were recruited, of which 2051 participated at Time 1 (T1), 1753 at Time 2 (T2), and 1573 at Time 3 (T3). At T1, participants were in Grade 7 or 8, the first two years of secondary school in the Netherlands. We excluded 195 students from the analytic sample, because they had fewer than two waves of data on the constructs of interest. Analyses of Sample 1 were performed on 1856 adolescents (50.4% male; M_{age} at baseline = 13.79 years, SD_{age} = 0.72; 86.5% Dutch background, i.e., both parents born in the Netherlands).

This project used a passive parental consent procedure. Caretakers were informed about the study via mail, and asked to respond if they did not want their child to participate. Adolescents were informed that participation was voluntary and confidential. Adolescents completed a 10-page survey during regular school hours. This project was approved by the Institutional Review Board of Radboud University (SW/OOM/AvdK/07.587).

The KLS (Sample 2) is an ongoing longitudinal project on youth well-being that started in 2010 (van den Berg et al., 2023). For this study, we used data collected at one secondary school in an urban area. Because LOC eating was only measured between 2019 and 2021, we included data collected between 2018 and 2022. We included four cohorts with three annual waves of data (Cohort 1: Grade 7 students in 2019; Cohort 2: Grade 8 students in 2019; Cohort 3: Grade 8 students in 2018; Cohort 4: Grade 7 students in 2020). Similar to Sample 1, participants were in Grade 7 or 8 at their baseline. A total of 657 adolescents participated, of whom 102 were excluded from the analytic sample because they had fewer than two waves of data on the constructs of interest. Analyses of Sample 2 were performed on 555 adolescents (49.7% male; M_{age} at baseline = 13.13 years, SD_{age} = 0.68).

Each year, the head of the school requested the research and claimed responsibility for the parental consent procedure. Until 2018 a passive consent procedure was used, and from 2019 onwards an active consent procedure. Adolescents gave assent at the start of each assessment. Both the passive (ECG2012-2505-038) and active (ECSW-2018-086) consent procedures were approved by the Institutional Review Board of Radboud University. Adolescents filled out a computerized survey during a regular 40–50-min classroom session. Further details about the data collection procedure can be found elsewhere (van den Berg et al., 2023).

2.2 | Measures

2.2.1 | Self-esteem

In both samples, self-esteem was measured with the Rosenberg Self-Esteem Scale (Rosenberg, 1979). This scale consists of 10 items (e.g., “I certainly feel useless at times.”), that are rated on a 4-point Likert scale (1 = *Strongly disagree* to 4 = *Strongly agree*). The order

and wording of items and answer categories varied slightly between the two samples due to translation. These differences are indicated in our preregistration (<https://osf.io/g4ewb>). Five items were reverse coded, so that a higher score on each item indicated higher self-esteem. If participants did not complete all items (only occurred in Sample 1), their average self-esteem score was based on the completed items. Cronbach's α was good in both samples (range: .85–.89 in Sample 1; .87–.90 in Sample 2).

2.2.2 | Emotional eating

In Sample 1, emotional eating was measured with the Dutch Eating Behavior Questionnaire – Emotional Eating subscale (van Strien et al., 1986). This scale consists of 13 items (e.g., “Do you have a desire to eat when you are irritated?”), that are rated on a 5-point Likert scale (1 = *Never* to 5 = *Very often*). If participants did not complete all items, their average emotional eating score was based on the completed items. Cronbach's α ranged from .93 to .94.

2.2.3 | Restrained eating

In Sample 1, restrained eating was measured with the Dutch Eating Behavior Questionnaire – Restrained Eating subscale (van Strien et al., 1986). This scale consists of 10 items (“Do you watch exactly what you eat?”) that are rated on a 5-point Likert scale (1 = *Never* to 5 = *Very often*). If participants did not complete all items, their average restrained eating score was based on the completed items. Cronbach's α ranged from .92 to .95.

2.2.4 | Loss of control while overeating

In Sample 1, LOC while overeating was measured with items from the revised Eating Disorder Inventory (Garner, 1991; van Strien & Ouwens, 2003). First, binges were defined (see preregistration), after which participants indicated if they had ever experienced a binge. Those answering this question with *Yes* then received the question “During such a binge, do you ever have the feeling that you cannot stop?,” which was rated on a 5-point Likert scale (1 = *Never* to 5 = *Very often*). Participants who answered *No* to the first question were given a score 1 (*Never*) for the second question. The score for the second question was used as the measure of LOC while overeating.

2.2.5 | Loss of control eating

In Sample 2, LOC eating, irrespective of the amount of food consumed, was measured with the Loss of Control over Eating Scale – Brief form (Latner et al., 2014). This instrument consists of 7 items (e.g., “I felt helpless about controlling my eating.”), that were rated on a 5-point Likert scale (1 = *Never* to 5 = *Always*). An average score for

LOC eating was computed. We used a translation/back-translation procedure to translate the questionnaire into Dutch. Cronbach's α ranged from .81 to .89.

2.3 | Statistical analyses

All analyses were performed in R (version 4.1.1; R Core Team, 2020). Data and analytic code are available at the Open Science Framework (<https://osf.io/z3fc9/>; Beckers et al., 2023). As preliminary analyses, we calculated the intraclass correlation (ICC) for each construct to determine the proportion of variance attributable to between-person differences (ICC) and to within-person fluctuations (1-ICC).

The primary analyses consisted of four RI-CLPMs that included self-esteem and one of the PEB measures (emotional eating, restrained eating, LOC while overeating in Sample 1, LOC eating in Sample 2). The conceptual model is shown in Figure 1. Within-person stability paths (s_1 and s_2 ; t_1 and t_2) and cross-lagged associations (b_1 and b_2 ; c_1 and c_2) were constrained to be equal over time. The RI-CLPMs were estimated with the lavaan package (version 0.6.9; Rosseel, 2012), using a robust estimator (i.e., maximum likelihood with robust standard errors; MLR), and full information maximum likelihood (FIML) to account for missing values. Model fit was assessed with the Tucker–Lewis Index (TLI), Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). Adequate model fit was evaluated with TLI and CFI values above .90 and an RMSEA value below .08 (Browne & Cudeck, 1993; Hu & Bentler, 1999). Statistical significance was based on $\alpha = .01$ to adjust for multiple testing.

In addition, we conducted multi-group RI-CLPMs (Mulder & Hamaker, 2021) to explore whether within-person cross-lagged associations, within-person stability paths, and between-person correlations differed for males and females. For each type of PEB, we ran an unconstrained model (i.e., all parameters freely estimated for males and females, with stability and cross-lagged paths constrained to be equal over time). We compared this model to five other models, in which either (a) the within-person cross-lagged effect from self-esteem to PEB, (b) the within-person cross-lagged effect from PEB to self-esteem, (c) the within-person stability path of self-esteem, (d) the within-person stability path of PEB, or (e) the between-person correlation between self-esteem and PEB was constrained to be equal for males and females. Sex was considered to moderate an association or correlation if its equality constraint resulted in a significantly worse model fit compared with the fully unconstrained model (as determined by a Satorra–Bentler scaled χ^2 difference test). As sensitivity analyses, we reran all models with complete cases only to test the robustness of the findings.

3 | RESULTS

3.1 | Descriptive statistics

Table 1 presents the descriptive statistics and correlations among study variables. Self-esteem was negatively correlated with all three

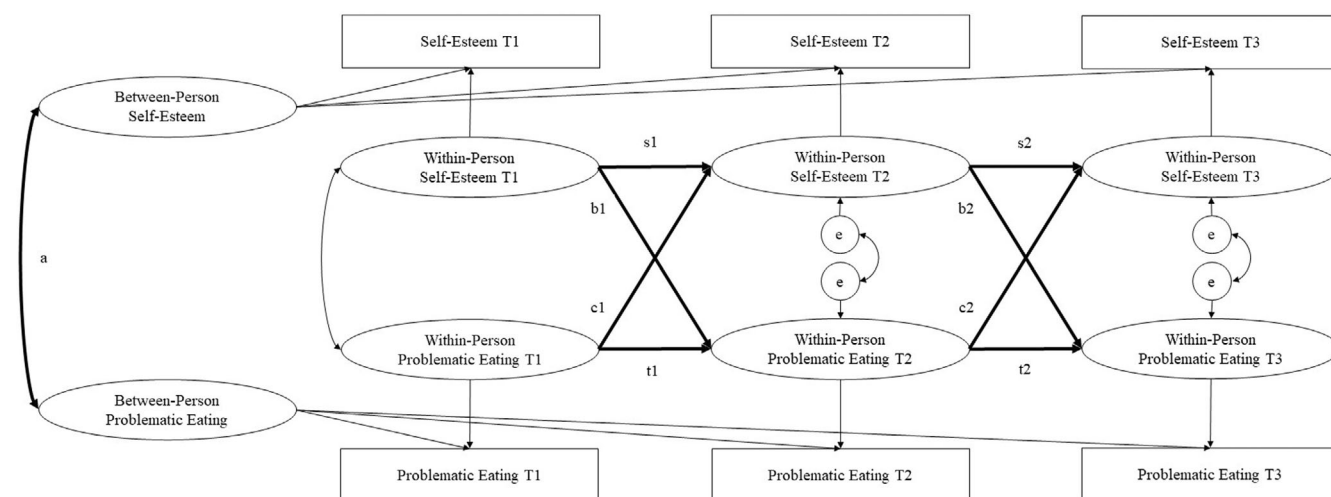


FIGURE 1 Conceptual model tested in this study. Note that the associations of main interest are depicted in bold font. a = Between-person correlation between self-esteem and problematic eating; b_1 and b_2 = Within-person cross-lagged associations from self-esteem to problematic eating; c_1 and c_2 = Within-person cross-lagged associations from problematic eating to self-esteem; s_1 and s_2 = Within-person stability paths for self-esteem; t_1 and t_2 = Within-person stability paths for problematic eating. Problematic eating behaviors were emotional eating, restrained eating, and loss of control while overeating in Sample 1, and loss of control eating in Sample 2.

PEBs in Sample 1 (emotional eating, restrained eating, LOC while overeating) and with LOC eating in Sample 2. The ICC (i.e., proportion of between-person variance) of self-esteem was .59 and .64 in Samples 1 and 2, respectively, indicating that 36–41% (i.e., 1-ICC) of the variance of self-esteem was attributable to within-person fluctuations. The ICCs of emotional eating, restrained eating, LOC while overeating (Sample 1), and LOC eating (Sample 2) were .59, .70, .36, and .52, respectively, indicating that between 30% and 64% of the variance of the PEBs was attributable to within-person fluctuations.

3.2 | Primary analyses

Four RI-CLPMs were performed to test the bidirectional associations between self-esteem and PEBs. The model fit indices indicated that each model adequately fitted the observed data (see Table 2A).

Table 3 presents the results of the models performed on both samples. For Sample 1, the within-person cross-lagged associations indicated that self-esteem was negatively associated with emotional and restrained eating, and vice versa. This indicates that, relative to their own expected scores, adolescents with lower self-esteem had higher emotional eating and restrained eating one year later, and that adolescents with higher emotional eating and restrained eating had lower self-esteem one year later. The cross-lagged associations between self-esteem and LOC while overeating were not statistically significant, indicating that adolescents' self-esteem was not related to changes in LOC while overeating one year later, nor did LOC while overeating predict changes in adolescents' self-esteem one year later. The within-person stability paths were statistically significant for self-esteem, emotional eating, and restrained eating. This indicates that adolescents' positive or negative deviations from their own expected

scores for self-esteem, emotional eating, or restrained eating persisted across annual assessments. The stability paths of LOC while overeating were not statistically significant, meaning that adolescents' LOC while overeating scores did not depend on their previous scores. Between persons, self-esteem was negatively correlated with emotional eating, restrained eating, and LOC while overeating, indicating that adolescents with lower self-esteem generally reported higher PEBs than adolescents with higher self-esteem.

For Sample 2, the within-person cross-lagged associations between self-esteem and LOC eating were not statistically significant. This indicates that adolescents' self-esteem was not related to changes in LOC eating one year later, nor did LOC eating predict changes in self-esteem one year later. Within-person stability was statistically significant for self-esteem, which indicates that adolescents' positive or negative deviations from their own expected score for self-esteem persisted across annual assessments. Within-person stability was not found for LOC eating, indicating that adolescents' scores for LOC eating did not depend on their LOC eating score one year earlier. Between persons, self-esteem correlated negatively with LOC eating, indicating that adolescents with lower self-esteem had higher LOC eating than adolescents with higher self-esteem.

3.3 | Exploratory analyses

Additional multi-group RI-CLPMs were run to test whether model estimates differed between males and females. The model fit indices indicated that fully unconstrained models adequately fitted the observed data (see Table 2B).

Table 4 presents the results regarding sex differences in the correlation and regression coefficients of the primary models. For emotional

TABLE 1 Descriptive statistics and correlation coefficients of study variables in Samples 1 and 2.

	<i>n</i>	<i>M</i>	<i>SD</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Sample 1—Mental Health and Health Habits project															
1. Self-Esteem T1	1854	3.30	0.52	—	.61**	.52**	-.19**	-.18**	-.20**	-.30**	-.24**	-.26**	-.25**	-.17**	-.20**
2. Self-Esteem T2	1748	3.29	0.54	—	—	.67**	-.15**	-.24**	-.22**	-.28**	-.33**	-.35**	-.20**	-.22**	-.20**
3. Self-Esteem T3	1566	3.35	0.53	—	—	—	-.11**	-.21**	-.27**	-.23**	-.28**	-.37**	-.19**	-.16**	-.22**
4. Emotional eating T1	1854	1.99	0.74	—	—	—	—	.60**	.52**	.15**	.08	.10**	.35**	.22**	.15**
5. Emotional eating T2	1746	1.99	0.79	—	—	—	—	—	.65**	.17**	.22**	.21**	.27**	.31**	.22**
6. Emotional eating T3	1563	1.94	0.78	—	—	—	—	—	—	.15**	.18**	.26**	.19**	.21**	.29**
7. Restrained eating T1	1854	2.07	0.85	—	—	—	—	—	—	—	.71**	.62**	.20**	.14**	.15**
8. Restrained eating T2	1745	2.03	0.92	—	—	—	—	—	—	—	—	.78**	.16**	.17**	.18**
9. Restrained eating T3	1564	1.98	0.92	—	—	—	—	—	—	—	—	—	.19**	.15**	.20**
10. LOC while overeating T1	1811	1.45	0.89	—	—	—	—	—	—	—	—	—	—	.37**	.31**
11. LOC while overeating T2	1699	1.37	0.84	—	—	—	—	—	—	—	—	—	—	—	.38**
12. LOC while overeating T3	1534	1.37	0.86	—	—	—	—	—	—	—	—	—	—	—	—
Sample 2—Kandinsky Longitudinal Study															
1. Self-Esteem T1	525	3.18	0.52	—	.63**	.59**	-.37**	-.35**	-.36**	—	—	—	—	—	—
2. Self-Esteem T2	534	3.14	0.54	—	—	.73**	-.25**	-.42**	-.34**	—	—	—	—	—	—
3. Self-Esteem T3	503	3.12	0.50	—	—	—	-.29**	-.39**	-.43**	—	—	—	—	—	—
4. LOC eating T1	380	1.34	0.47	—	—	—	—	.47**	.37**	—	—	—	—	—	—
5. LOC eating T2	534	1.32	0.54	—	—	—	—	—	.59**	—	—	—	—	—	—
6. LOC eating T3	405	1.30	0.51	—	—	—	—	—	—	—	—	—	—	—	—

Abbreviations: LOC, loss of control; T1, Time 1; T2, Time 2; T3, Time 3.

* $p < .01$; ** $p < .01$.

TABLE 2 Model fit indices of the random intercept cross lagged panel models.

	TLI	CFI	RMSEA
A—Primary analyses			
Sample 1			
Emotional eating	.991	.997	.034
Restrained eating	.992	.997	.037
Loss of control while overeating	.991	.997	.028
Sample 2			
Loss of control eating	.996	.999	.024
B—Exploratory analyses: Assessing sex differences			
Sample 1			
Emotional eating	.989	.996	.035
Restrained eating	.990	.997	.038
Loss of control while overeating	.989	.996	.029
Sample 2			
Loss of control eating	1.011	1.000	.000

Abbreviations: CFI, Comparative Fit Index; RMSEA, Root Mean Square Error of Approximation; TLI, Tucker–Lewis Index.

eating, restrained eating, and LOC eating none of the model estimates were found to statistically differ for males and females. There were two statistically significant sex differences in the model for LOC while overeating. First, the within-person stability path of self-esteem was positive for females, but not statistically significant for males (see Table 4). Second, the between-person correlation between self-esteem and LOC while overeating was negative for females, but not statistically significant for males (see Table 4). None of the sex differences in within-person cross-lagged associations were statistically significant.

3.4 | Sensitivity analyses

To test the robustness of our findings, we performed additional models with complete cases only ($n = 1451$ in Sample 1, $n = 209$ in Sample 2). The pattern of statistical significance was identical to the primary analyses, with one exception. In the model for emotional eating (Sample 1), the primary analysis yielded a negative within-person cross-lagged association from emotional eating to self-esteem one year later, but this association was not statistically significant in the sensitivity analyses (see Tables S1A and S2).

Regarding sex differences, the complete case analyses provided a comparable pattern as the exploratory analyses, with two exceptions. In the primary analyses of Sample 1, the within-person stability path for self-esteem statistically differed by sex in the model for LOC while overeating, but not in the models for emotional and restrained eating. In the sensitivity analyses, the within-person stability path differed by sex in all three models for Sample 1, with these links being statistically significant for females only (see Tables S1B and S3).

4 | DISCUSSION

This study used two longitudinal samples to investigate the bidirectional associations between self-esteem and four PEBs

(emotional eating, restrained eating, LOC while overeating in Sample 1, LOC eating in Sample 2). Importantly, we examined within-person processes, while accounting for between-person differences. Within-persons, lower self-esteem was bidirectionally associated with higher emotional and restrained eating one year later. We did not find support for within-person associations between self-esteem and LOC while overeating or LOC eating. Between persons, all PEBs were negatively correlated with self-esteem. We found no support for sex differences in the within-person cross-lagged associations, and only limited support for sex differences in the between-person correlation.

Our finding that, within persons, lower self-esteem was bidirectionally associated with higher emotional and restrained eating one year later, was in line with our hypotheses and theoretical models (Polivy & Herman, 2005; Rieger et al., 2010). Adolescents may respond to decreases in self-esteem with emotional eating to cope with the negative feelings stemming from their negative self-views. They may also respond with restrained eating to pursue idealized body shape, as an attempt to improve their self-views. In turn, higher emotional and restrained eating predicted decreases in self-esteem, indicating that adolescents may get caught in a vicious cycle in which emotional and restrained eating also adversely impact self-esteem. These findings add to the current literature on this topic, because we explicitly disentangled within-person processes from stable between-person differences. As such, our findings provide more direct support for hypothesized within-person processes than previous empirical research (see Krauss et al., 2023).

We found no support for within-person associations between self-esteem and LOC while overeating or LOC eating. While low self-esteem seems to be a precursor of emotional and restrained eating, other factors, such as (food related) impulsivity (Schag et al., 2013) or body dissatisfaction (Goldschmidt et al., 2018), may play a more prominent role in the development of LOC eating than self-esteem. Further research is needed to examine other risk factors

TABLE 3 Random intercept cross-lagged panel models on self-esteem and problematic eating behaviors.

	Sample 1										Sample 2									
	Emotional eating (n = 1856)					Restrained eating (n = 1856)					LOC while overeating (n = 1838)					LOC eating (n = 555)				
	b	SE	p	β		b	SE	p	β		b	SE	p	β		b	SE	p	β	
Between-person																				
Correlation	-.034	0.012	.006	-.199		-.080	0.017	<.001	.392		-.081	0.014	<.001	-.507		-.077	0.019	<.001	-.683	
Within-person																				
Stability paths																				
SE T1 → SE T2	.397	0.054	<.001	.366		.372	0.052	<.001	.342		.404	0.055	<.001	.372		.418	0.072	<.001	.374	
SE T2 → SE T3	.397	0.054	<.001	.423		.372	0.052	<.001	.393		.404	0.055	<.001	.432		.418	0.072	<.001	.499	
PEB T1 → PEB T2	.322	0.053	<.001	.282		.552	0.043	<.001	.466		.115	0.062	.063	.124		.231	0.139	.095	.197	
PEB T2 → PEB T3	.322	0.053	<.001	.336		.552	0.043	<.001	.571		.115	0.062	.063	.114		.231	0.139	.095	.257	
Cross-lagged associations																				
SE T1 → PEB T2	-.176	0.055	.001	-.117		-.153	0.052	.003	-.085		.001	0.075	.991	.000		-.063	0.080	.433	-.056	
SE T2 → PEB T3	-.176	0.055	.001	-.132		-.153	0.052	.003	-.095		.001	0.075	.991	.000		-.063	0.080	.433	-.070	
PEB T1 → SE T2	-.069	0.026	.008	-.084		-.068	0.025	.006	-.095		.010	0.020	.621	.017		-.010	0.063	.870	-.009	
PEB T2 → SE T3	-.069	0.026	.008	-.102		-.068	0.025	.006	-.119		.010	0.020	.621	.017		-.010	0.063	.870	-.012	
R ²																				
Within-person SE T2	.151					.140					.137					.141				
Within-person SE T3	.213					.198					.185					.252				
Within-person PEB T2	.104					.242					.015					.045				
Within-person PEB T3	.155					.369					.013					.080				

Note: Bold font indicates statistical significance, based on $\alpha = .01$.

Abbreviations: LOC, loss of control; SE, self-esteem; PEB, problematic eating behavior (as specified in the columns); T1, Time 1; T2, Time 2; T3, Time 3.

TABLE 4 Exploratory: Testing sex differences in the random intercept cross-lagged panel models.

	Sample 1						Sample 2	
	Emotional eating (<i>n</i> = 1856)		Restrained eating (<i>n</i> = 1856)		LOC while overeating (<i>n</i> = 1838)		LOC eating (<i>n</i> = 555)	
	$\Delta\chi^2(1)$	<i>p</i>	$\Delta\chi^2(1)$	<i>p</i>	$\Delta\chi^2(1)$	<i>p</i>	$\Delta\chi^2(1)$	<i>p</i>
Between-person								
Constr.: Correlation	2.728	.099	2.411	.121	10.331^a	.001	2.187	.139
Within-person								
Stability paths								
Constr.: SE → SE	6.153	.013	5.984	.014	8.888^b	.003	0.026	.871
Constr.: PEB → PEB	1.141	.285	1.920	.166	2.896	.089	3.022	.082
Cross-lagged associations								
Constr.: SE → PEB	0.622	.430	0.015	.902	0.485	.486	1.014	.314
Constr.: PEB → SE	1.524	.217	0.389	.533	2.648	.104	4.864	.027

Note: Satorra-Bentler scaled χ^2 difference test statistics are presented. Bold font indicates statistical significance, based on $\alpha = .01$.

Abbreviations: Constr., constrained; LOC, loss of control; PEB, problematic eating behavior (as specified in the columns); SE; self-esteem.

^aMales: $b = -0.025$, $SE = 0.012$, $p = .033$, $\beta = -.274$; Females: $b = -0.111$, $SE = 0.025$, $p < .001$, $\beta = -.588$.

^bMales: $b = 0.196$, $SE = 0.090$, $p = .029$, $\beta = .179-.205$; Females: $b = 0.494$, $SE = 0.065$, $p < .001$, $\beta = .441-.560$.

of the development of LOC eating. Moreover, self-esteem might be an important predictor of LOC eating for subgroups, such as adolescents who believe that eating will help them cope with negative self-evaluations. Future research should assess potential moderators of the links between self-esteem and LOC eating (e.g., eating expectancies; Hohlstein et al., 1998). Finally, our null-findings on LOC eating may also result from a low prevalence of LOC eating in our samples. Compared with emotional and restrained eating, the distribution of LOC eating was more skewed, with a substantial proportion of participants indicating that they did not experience any LOC while overeating or LOC eating across all waves. This lack of variation may make it difficult to identify within-person processes. Future research is needed to examine whether results may differ in at-risk or clinical samples.

Our finding that lower self-esteem preceded higher emotional and restrained eating at the within-person level suggests that enhancing self-esteem may be a viable option for PEBs preventions. There is some support that self-esteem-focused preventions are effective in reducing PEBs and the onset of eating disorders (Le et al., 2017; Stice et al., 2021), but only few high-quality studies have assessed the effectiveness of these programs. More research is needed to understand how self-esteem can be improved, and how this can be incorporated in prevention programs. More research is also needed to understand for whom focusing on self-esteem might be particularly effective in reducing PEBs. Low self-esteem is a transdiagnostic risk factor that has also been prospectively associated with higher anxiety and depressive symptoms at the within-person level (Li et al., 2023; Masselink et al., 2018). Thus, programs improving self-esteem may also inhibit the development of other mental health problems. The between-person findings that lower self-esteem was correlated with higher PEBs are useful for screening purposes; lower self-esteem in general may identify adolescents who struggle with eating behaviors or other adjustment problems.

Further, low self-esteem is related to other well-established risk factors of PEBs in adolescence (e.g., body dissatisfaction; van den Berg et al., 2010). Future research should assess the unique role of various risk factors in the link between self-esteem and PEBs to better understand the underlying explanatory mechanism. For example, body dissatisfaction may mediate the link between self-esteem and PEBs (Gianini & Smith, 2007), or the links between self-esteem and PEBs may be stronger for adolescents whose self-worth is largely based on their physical appearance (Zeigler-Hill & Noser, 2015). A more nuanced understanding of how and for whom self-esteem is associated with PEBs will contribute to the efficacy of intervention and prevention programs.

We found no support for sex differences in the within-person cross-lagged associations. Between persons, sex differences were only found in the correlation between self-esteem and LOC while overeating, with lower self-esteem correlating to higher LOC while overeating among females only. Thus, although females generally experience lower self-esteem and higher PEBs than males (Bleidorn et al., 2016; Croll et al., 2002), our findings suggest that the associations between self-esteem and PEBs generally do not differ between males and females. As we can only draw conclusions for the PEBs that we included, future research should examine other PEBs, including behaviors that are particularly common in males, such as muscularity-oriented PEBs (Murray et al., 2017).

4.1 | Strengths and limitations

This study had several strengths, including the use of RI-CLPMs to disentangle within-person associations from between-person differences, examining four PEBs, and testing sex differences. This study also had some limitations. First, our analyses assessed average within-person associations that may not generalize to all participants. Future research

should identify moderators of these associations (e.g., eating expectancies; Hohlstein et al., 1998), to identify for whom these processes are most prominent. Second, our samples were relatively homogeneous (e.g., similar age, mostly highly educated, and a Dutch background). We should be cautious to generalize these findings to adolescents in the Netherlands or in other cultures and countries, or youth at different developmental stages. Third, we examined associations of trait-like characteristics with annual intervals. This does not give insight into the moment-to-moment associations between (state) self-esteem and PEBs. Ecological momentary assessment studies can clarify such micro-processes. Fourth, the sample size of Sample 2 was relatively small for a RI-CLPM (Mulder, 2022), and the null-findings in associations between self-esteem and LOC eating may be due to a lack of power. However, Sample 1—which is more highly powered—did not provide support for within-person associations between self-esteem and LOC while overeating. Fifth, we elected to use RI-CLPMs in this study due to their advantage of separating between- and within-person associations, but future research may consider utilizing alternative modeling techniques that offer additional methodological advantages, such as autoregressive latent trajectory models (ALTs: Curran & Bollen, 2001), state-trait models (STARTs: Kenny & Zautra, 1995), or latent curve models with structured residuals (LCM-SRs: Curran et al., 2014). As these alternatives need more than three waves of data, we could not utilize them in this study.

4.2 | Conclusion

This prospective study on the links between self-esteem and PEBs found support for within-person bidirectional associations and between-person correlations. Specifically, we found that within-person lower self-esteem preceded higher emotional and restrained eating (but not for LOC while overeating or LOC eating), and vice versa. This suggests that emotional and restrained eating prevention programs may benefit from targeting adolescents' self-esteem. We also found that, between persons, adolescents with lower self-esteem generally had higher PEBs, suggesting that screening for low self-esteem may be useful to identify adolescents who need help. Future research should address how prevention and intervention programs could enhance self-esteem to prevent the development of emotional and restrained eating, and for whom such an approach is (most) effective.

AUTHOR CONTRIBUTIONS

Desi Beckers: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; writing—original draft; writing—review and editing. **William J. Burk:** Conceptualization; methodology; supervision; writing—review and editing. **Junilla K. Larsen:** Data curation; funding acquisition; investigation; project administration; supervision; writing—review and editing. **Antonius H. N. Cillessen:** Supervision; writing—review and editing.

FUNDING INFORMATION

The Mental Health and Health Habits study was financed by the Netherlands Organization for Scientific Research (NWO Veni Grant 451-05-013).

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest.

OPEN RESEARCH BADGES



This article has earned Open Data and Preregistered Research Designs badges. Data and the preregistered design and analysis plan are available at <https://doi.org/10.17605/OSF.IO/Z3FC9>.

DATA AVAILABILITY STATEMENT

Data and analytic code are publicly available at the Open Science Framework (<https://osf.io/z3fc9/>).

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How to cite this article: Beckers, D., Burk, W. J., Larsen, J. K., & Cillessen, A. H. N. (2023). The bidirectional associations between self-esteem and problematic eating behaviors in adolescents. *International Journal of Eating Disorders*, 1–12. <https://doi.org/10.1002/eat.24083>