Title: Mediating role of depressive symptoms linking insecure attachment and disordered eating in adolescents: A multi-wave longitudinal study.

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Short title: Depression links attachment and disordered eating

Abstract

Research has supported a link between insecure attachment and disordered eating in adolescents; however, how this influence is exerted remains unclear. This study explored whether depressive symptoms constitute a pathway through which insecure attachment to parents predicts subsequent development of disordered eating in the transition from childhood to adolescence. Also, whether there are differential effects regarding the attachment figure, child's gender or reciprocity between variables. A community-based sample of Spanish youth (n = 904; 49.4% girls) was followed biennially from age 10 to 16. Attachment, depressive symptoms and disordered eating were measured using the Inventory of Parental and Peer Attachment, Children's Depression Inventory and Children's Eating Attitudes Test, respectively. Prospective data were analyzed using a dynamic panel model, which accounts for unmeasured time-invariant factors. Whereas insecure attachment to the father did not predict later depression or disordered eating, higher insecure attachment to the mother at age 10 and 12 predicted more disordered eating at ages 14 and 16 via increased depressive symptoms at ages 12 and 14. No child's gender-specific or reverse mediational effects were found.This study suggests that an increase in depressive symptoms might be one mechanism by which insecure attachment exerts its influence on the development of eating disorders symptomatology in adolescence. Interventions efforts aimed at strengthening particularly the mother–child attachment relationship may reduce the vulnerability to develop depressive symptoms and disordered eating.

Keywords: Adolescents, Insecure Attachment, Depressive Symptoms, Disordered Eating, Dynamic Panel Model

Adolescence is a developmental period characterized by significant biological, psychological and social changes (e.g., Cicchetti & Toth, 2009). These complex metamorphoses, which occur more or less simultaneously, provide a developmental context of risk for the emergence of mental health problems, especially in young people with a committed capacity to cope with the many challenges of adolescence (Casey et al., 2010; Kessler et al., 2005).

Research documents striking increases in several forms of psychopathology early in adolescence, including eating disorders (EDs) (e.g., Smink, van Hoeken, & Hoek, 2012) and depression (e.g., Hankin et al., 2015). Both disorders have a strong potential to interfere with development, leading to suffering and disability among adolescents (Smink et al., 2012; Thapar, Collishaw, Pine, & Thapar, 2012). In addition to diagnosable conditions, many adolescents experience subthreshold or subclinical forms of EDs (i.e., disordered eating such as frequent dieting, weight and shape concerns, and binge eating and/or fasting, vomiting, and laxative use for weight loss; Ackard, Fulkerson, & Neumark-Sztainer, 2011; Chamay-Weber, Narring, & Michaud, 2005) and depression (Carrellas, Biederman, & Uchida, 2017; Wesselhoeft, Sørensen, Heiervang, & Bilenberg, 2013) with resulting impairment resembling that stemming from full clinical forms. In the presence of sufficient risk factors, this further increases the risk for later EDs (Chamay-Weber et al., 2005; Stice, Marti, Shaw, & Jaconis, 2009) or major depressive disorder (Lewinsohn, Solomon, Seeley, & Zeiss, 2000). While the evidence confirms that adolescence is a particularly sensitive stage for the development of these psychopathologies, little is known about the factors responsible for the emergence and maintenance of their symptoms. Ultimately, such knowledge will inform prevention and intervention efforts.

Several scholars have suggested that insecure attachment can operate as a risk factor for EDs and depression in middle childhood and adolescence (Gander, Sevecke, & Buchheim, 2015; Jewell et al., 2016; Kerns & Brumariu, 2016; Madigan, Atkinson, Laurin, & Benoit, 2013). One of the main premises of attachment theory is that early caregiving experiences form individuals' representations of themselves and others (Cassidy, 2016). According to Bowlby (1969/1982) such representations subsequently influence the development of other relationships throughout the lifespan. In the context of sensitive and responsive caregiving, children develop secure attachment representations. By contrast, children who have experienced inconsistent and unresponsive caregiving are more likely to develop insecure attachment representations, and, as a consequence, see themselves as unworthy and unlovable and others as unsupportive and unreliable (Bowlby, 1969/1982). When facing distress, these children use emotion regulation strategies such as a tendency to withdraw from important others and restrict emotions (*avoidant attachment*), or to cling to important others and to become overwhelmed by emotions (*anxious attachment*), which both are regulation strategies that increase vulnerability to psychopathology (DeKlyen & Greenberg, 2016; Gentzler, Kerns, & Keener, 2010).

Evidently, insecure attachment may be only one of the many risk factors for the development of disordered eating (e.g., Faber et al., 2018) and depressive symptoms (Malik, Wells, & Wittkowski, 2015; Morley & Moran, 2011). Contemporary attachment researchers have stressed the importance to thoughfully reconsider how and why early insecure attachment could be associated with later development using more incisive methodologies (Thompson, 2016). In particular, *longitudinal mediational models* could help elucidate the mechanisms by which insecure attachment increases the risk of negative developmental outcomes (DeKlyen & Greenberg, 2016). Although

researchers studying the link between attachment and depressive symptoms in adolescents have heeded this call (Cohen et al., 2013; Gaylord-Harden et al., 2009; Lee & Hankin, 2009), no study has tested a longitudinal attachment-based model including putative factors that may mediate the relation between attachment and disordered eating.

The present study aims to shed light on this by investigating a pathway from insecure attachment via depressive symptoms to disordered eating – and vice versa – covering the transition from middle childhood into the presumed decisive early and middle adolescent years, often overlooked (Bosmans & Kerns, 2015). We first review theories and evidence on the impact of insecure attachment on depressive symptoms, then the importance of depressive symptoms for later disordered eating, before turning to theorizing and findings suggesting a mediational pathway from insecure attachment to disordered eating via increased depressive symptoms.

The Relation between Insecure Attachment and Depressive Symptoms

The link between insecure attachment and depression has been broadly demonstrated across life span (Dagan, Facompré, & Bernard, 2018; Stovall-McClough & Dozier, 2016). According to Morley & Moran (2011), negative self-representations rooted in dysfunctional early attachment relationships influence the interpretation and response to future negative events, which is consistent with cognitive theories of vulnerability to depression (Abramson, Seligman, & Teasdale, 1978; Beck, 1987). Thus, it is assumed that the "negative interpretative lens" makes insecurely attached individuals more prone to depression.

Arguably, the sociocognitive biases of self and others may foster particular ways of relating, either in overly distancing and/or demanding ways (Abela & Hankin, 2009), increasing the risk of experiencing real or perceived negative interpersonal relationships

(Dagan et al., 2018; Hammen, 2009; Hankin, Kassel, & Abela, 2005). Such negative interpersonal experiences may disturb the acquisition of necessary social skills to thrive in relationships, and rather foster poor emotion regulation strategies (Malik et al., 2015; Rudolph, 2009). This is particularly detrimental in the transition to adolescence, when youngsters typically expand the scope of their relationships (Allen & Tan, 2016).

Insecurely attached children negative views of self and others may thus be reinforced into adolescence and increase the risk of depressive symptomatology (Brumariu & Kerns, 2010; Duggal, Carlson, Sroufe, & Egeland, 2001). Recent meta-analytic evidence has demonstrated the empirical link between attachment and depression in children and adolescents, with an overall significant moderate effect size (r = .31) (Spruit et al., 2020). Indeed, there is ample prospective evidence demonstrating that insecure attachment predicts increased depressive symptoms over the course of adolescence (Cortés-García, Wichstrøm, Viddal, & Senra, 2019; Margolese, Markiewicz, & Doyle, 2005; Sund & Wichstrøm, 2002)— the first lag in our proposed mediation.

Depressive Symptoms and Disordered Eating

Depressive symptoms and disordered eating co-occur (Puccio, Fuller-Tyszkiewicz, Ong, & Krug, 2016), possibly, to some extent, because poor emotion regulation increase the risk of both (Vögele, Lutz, & Gibson, 2018). Ultimately, emotion dysregulation might be rooted in individuals' early mental representations (Faber et al., 2018; Malik et al., 2015). However, even if depressive symptoms and disordered eating influence each other (Puccio et al., 2016) there is robust evidence that eating serves as a strategy to modify emotional states, particularly to reduce depressive symptoms, because of its immediately rewarding nature as well as its distracting elements (Haedt-Matt & Keel, 2011; Heatherton & Baumeister, 1991). As such,

overeating is thought to be instigated in order to dampen negative emotions (Vögele et al., 2018). Similarly, extreme dieting may become rewarding due to social reinforcement originating from weight loss, or, due to a sense of mastery of hunger and weight. These positive effects may alleviate negative mood, including depressive mood, related to the perception of inefficacy and reduced ability to control one's life (Froreich, Vartanian, Grisham, & Touyz, 2016). Thus, a variety of explanatory models converge in suggesting that negative affect, which is one of the core symptoms of depression, is part of the etiology of EDs (Stice, 2001; Stice et al., 2017). This is buffered by findings from a range of longitudinal studies demonstrating that depressive symptomatology precedes disordered eating in adolescents (Ferreiro, Wichstrøm, Seoane, & Senra, 2014; Ferriter, Eberhart, & Hammen, 2010; Hautala et al., 2011). Accordingly, there is substantial support for the second step of our proposed mediational pathway.

Does Insecure Attachment influence the Development of Disordered Eating via Depressive Symptoms in Adolescence?

Recent reviews have indicated that insecure attachment forecasts disordered eating during the transition to adolescence (Gander et al., 2015; Jewell et al., 2016). This assertion has been demonstrated in long term follow-up studies (Cortés-García, Hoffmann, Warschburger, & Senra, 2019; Le Grange et al., 2014; Milan & Acker, 2014). Even though the insecure attachment—EDs link is established, less is know about processes responsible for the association.

In light of the above evidence, some authors have forwarded the idea that increased depressiveness may be a candidate mechanism by which insecure attachment could put adolescents at risk for (Cortés-García et al., 2019; Jewell et al., 2016) or to maintain symptoms of EDs (Tasca, 2018; Tasca & Balfour, 2014). Thus far, only one cross-sectional study has tested this proposition in adolescents—albeit in a clinical

sample (Brochu et al., 2018), finding that negative mood and low self-esteem were mediators in the association between perceived alienation with the mother and more severe symptoms of EDs. However, the reverse influence is a distinct possibility, hence the role of depression as a mediating mechanism needs to be tested prospectively; a task heretofore not undertaken — but which we will address herein.

Although most empirical studies have emphasized insecure attachment as the predictor of psychopathology, reciprocal influences should be taken into account. Indeed, previous studies have revealed a mutual influence between attachment relationships with the mother and depressive symptoms in adolescence (e.g., Allen, Porter, McFarland, McElhaney, & Marsh, 2007; Branje, Hale, Frijns, & Meeus, 2010). Likewise, the negative influence of disordered eating on attachment, particularly to the mother, has been shown by previous research (e.g., Crespo, Kielpikowski, Jose, & Pryor, 2010; Korotana, von Ranson, Wilson, & Iacono, 2018). Conceivably, when facing difficult situations, insecurely attached children, particularly ambivalently attached, may at times turn excessively to their attachment figures for support (Margolese et al., 2005; Viejo, Monks, Sánchez-Rosa, & Ortega-Ruiz, 2019) and these clinging demands of comfort and reassurance may end up deteriorating the parent-child relationship (Allen & Tan, 2016). The present study provides the opportunity to identify such potential reverse paths.

The Relative Importance of Attachment to the Mother and the Father for Depressive Symptoms and Disordered Eating

In general, research has underscored the vital role of both parents as primary attachment figures even into young adulthood (Allen & Tan, 2016; Brumariu & Kerns, 2010). Although an attachment figure functions as both *safe haven* when children face threatened situations (i.e., providing emotional comfort and reducing distress) and

secure base from which to explore (guaranteeing reassurance, and/or assistance if they encounter difficulties), some authors suggest that parents may adopt somewhat complementary roles during middle childhood and early adolescence (Kerns et al., 2015). This statement does not preclude the fact that secure attachment entails both functions and that children could find them in both parents, but it rather indicates the possibility that children may show different preferences to fulfill their attachment needs. As such, whereas mothers tend to be more often sought out for safe haven support, fathers may be preferred for secure base support (Bretherthon, 2010; Kerns et al., 2015; Rosenthal & Kobak, 2010). Both functions are significant as children enter adolescence and must coregulate their needs for care and autonomy (Kerns & Brumariu, 2016). While the literature confirms that the formation of a secure attachment to parents promotes emotion competence, less negative mood and positive self-views (Thompson, 2016), little is known about the differential contribution of insecure attachment to the mother and to the father to the development of disordered eating and depressive symptoms. It should be pointed out that most of the research has either contemplated attachment to the mother exclusively or aggregated mother-child and father-child relationships in attachment measures (Lamb & Lewis, 2011).

As regards depressive symptoms, the majority of prospective studies including both parents have documented the influence of insecure attachment to the mother across adolescence (Agerup, Lydersen, Wallander, & Sund, 2015; Branje et al., 2010; Cortés-García et al., 2019; Duchesne & Ratelle, 2014). The importance of attachment to the father has been less consistently documented. One study found that insecure attachment to the father was associated with increases in depressive symptoms from early to late adolescence only in boys (Branje et al., 2010), another study reported an insecure attachment-depression link only during pre-adolescence after adjusting by gender

(Duchesne & Ratelle, 2014). Regarding eating symptoms, mostly prospective studies have suggested that disordered eating is more consistently related to attachment toward the mother than the father (Cortés-García et al., 2019; Goossens, Braet, Van Durme, Decaluwé, & Bosmans, 2012; Korotana et al., 2018). The evidence on attachment to the father is limited and inconclusive. For instance, whereas some studies report an influence of attachment to the father (along with the mother) in early adolescence, in both boys and girls (Goossens et al., 2012), other studies found this influence only in girls (Korotana et al., 2018; Pace, Cacioppo, & Schimmenti, 2012).

Collectively, the evidence suggests that insecure attachment to the mother may be particularly influential in the development of depressive and eating symptoms in adolescence, which may respond to the fact that boys and girls do not find reassurance and comfort in times of distress that they need from their mothers as a *safe haven* (Markiewicz, Lawford, Doyle, & Haggart, 2006; Rosenthal & Kobak, 2010; Viejo et al., 2019). However, the interplay between these factors remains unclear. There is scarce prospective research considering attachment to the father, yielding inconsistent results. Because of some overlap between attachment to the mother and the father (Boldt, Kochanska, Grekin, & Brock, 2016), to detail the effect of attachment to the father, we need to know the contribution of this relationship to disordered eating (via increased depression) over and beyond that of the mother—and *vice versa*. Hence, both attachment figures must be included in the same model.

Potential Confounders

From a methodological point of view, a range of potential confounders could influence attachment, depressive symptoms and disordered eating producing spurious relations between them. This includes common genetics (Berrettini, 2004; Trace, Baker, Peñas-Lledó, & Bulik, 2013), personality or temperamental factors (e.g., impulsivity

and perfectionism; Bardone-Cone et al., 2007; Cassin & von Ranson, 2005), problematic parenting (DeKlyen & Greenberg, 2016; Striegel-Moore et al., 2005) and response style biases (Decaluwé & Braet, 2004) – and even many others that we currently are not aware of. Such, often hard-to-measure, potential third variables make etiological interpretations from observational research uncertain. However, the Dynamic panel model (DPM)/fixed effects model (Bollen & Brand, 2010; Wichstrøm, Belsky, & Steinsbekk, 2017) is one data-analytical approach that enables one to discount one source of confounding, namely those that do not change their value over time, irrespective of whether they are known or not.

Even though DPM narrows the gap between mere prediction and causation, time-*varying* factors (e.g., stressful life-events or pubertal timing [Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Striegel-Moore et al., 2005]) could still produce a spurious relation between insecure attachment and disordered eating. Nevertheless, many time-varying factors have, in fact, also shown stability ((e.g., life-events [Rudolph, 2009], bullying [Scholte, Engels, Overbeek, de Kemp, & Haselager, 2007]), which can be accounted for in DPM, thus ruling out one obstacle to etiological interpretation. To date, no investigation has applied DPM, or other related methodological approaches, to test a prospective mediational effect of depressive symptoms in the insecure attachment–disordered eating relation; a task we will undertake herein.

The current study

Available research supports the notion that insecure attachment predicts disordered eating in adolescents and there are robust reasons to assume that depressive symptoms could mediate this link. Nevertheless, no prior study has examined this possibility prospectively. Moreover, the relative importance of attachment to mothers

and fathers in this mediation remains unexplored. To date, most of the literature concerning disordered eating has relied on female samples and overlooked its manifestation among boys, despite the fact that they constitute a substantial subset among those suffering from disordered eating (Sweeting et al., 2015). We therefore test—for the first time—(i) whether depressive symptoms mediate the predictive effect of insecure attachment on disordered eating, (ii) whether attachment to mothers and fathers are equally important in this respect, and (iii) for both genders, and finally (iv) whether reciprocal association exist, i.e. from depressive symptoms and disordered eating to insecure attachment. In line with theory and previous findings, mostly based on attachment to the mother, we predict that depressive symptoms will mediate the effect of quality of attachment to mother on disordered eating — even when adjusting for attachment to the father, initial levels of depression, disordered eating, attachment to the mother, and all unmeasured time-invariant potential confounders. As theory and previous research did not provide strong evidence, we remain open to the comparative effect of attachment to the father as well as to any differential mediational effects for girls and boys.

Methods

Participants

This study is part of a larger project on the development of diverse psychological problems in adolescence (PSI2010-19793). The participating sample was recruited from different public and government-assisted schools randomly selected as representative of coastal and inland areas in the province of [Blinded for review] (Spain). Of the 15 schools initially contacted, 3 declined to participate. Enrollment was open to all students in grades 5–6 in primary school. At baseline (T1) the sample comprised 904 students (49.4% girls; M_{age} = 10.83; SD = 0.75). These participants were

followed-up two (T2), (n = 880; 49.3% girls; M_{age} =12.85; SD = 0.77), four (T3) (n = 738; 50.5% girls; M_{age} = 14.98; SD = 0.84), and six years later (T4) (n = 473; 51.6% girls; M_{age} = 16.40; SD = 0.82). Importantly, the recruitment period covered two significant transitions in the Spanish education system — from Primary Education to Compulsory Secondary Education, which are mandatory (T1 to T2) and from Compulsory Secondary Education to upper secondary education or Baccalaureate, which is optional (T3 to T4).

Of the 904 participants included at baseline, self-report data were available for 97.2%, 81.5% and 51.2% of adolescents at T2, T3 and T4, respectively. Logistic regression analyses showed that at T4 attrition was lower among children reporting more secure attachment with the father at T1 and whose parents had higher level of education. Attrition was higher at T4 among those reporting more eating symptoms at T3 (see Supplemental Table A1). The comparatively higher dropout in T4 could be due to difficulties in contacting the older participants who, by that time, following Spanish education system, may have had completed compulsory education and therefore left school.

According to the characteristics of the sample at the study entry, the parents' educational level (measured as the highest educational level attained by either parent) was as follows: 68% primary education, 20% secondary education, and 12% higher education. The ethnic composition of the sample was 98% Caucasian, 1% Arab, and 1% "other", which is consistent with the relatively homogeneous ethnic breakdown of the population of reference (Instituto Galego de Estatística, 2017)

Measures

Children's Eating Attitudes Test (*ChEAT*; Maloney, McGuire, & Daniels, 1988). The ChEAT is a 26-item self-report scale that assesses dysfunctional eating attitudes

and behaviors among children and adolescents. Each item is rated on a 6-point scale ranging from 1 (*always*) to 6 (*never*) and scored from 0 to 3. Total sum scores range from 0 to 78. The Spanish version of the ChEAT used in this study has shown satisfactory internal consistency and concurrent validity (Senra, Seoane, Vilas, & Sánchez-Cao, 2007). Items 9 ("I vomit after I have eaten") and 26 ("I have the urge to vomit after eating") were not administered at T1 because they were deemed unsuitable for the age group studied. These items were therefore not considered at the remaining time points to maximize measurement equivalence. In the present study, α coefficients ranged from .85 to .90.

Children's Depression Inventory (*CDI*; Kovacs, 1992). The CDI is a 27-item self-report measure designed to evaluate depressive symptoms in children and adolescents. Each item has three response options that score 0 (absence of symptomatology), 1 (mild symptomatology), or 2 (severe symptomatology) (i.e., I am sad once in a while, I'm sad many times, I'm sad always). The Spanish version of the CDI used in this study has demonstrated adequate internal consistency, test–retest reliability, and concurrent and convergent validity (Del Barrio, Moreno, & López-Martínez, 1999). Total scores range from 0 to 54. In the present sample, α coefficients ranged from .84 to .86.

Inventory of Parent and Peer Attachment (*IPPA*; Armsden & Greenberg, 1987). The IPPA is a self-report measure of adolescents' perceptions of the quality of attachment towards mother, father, and peers. In the present study, we used the revised version that comprises 25 items for the mother scale, rated on a 5-point scale (from 1 = *never* to 5 = *always*). The overall score of attachment is obtained by summing responses of two subscales: degree of Mutual trust (e.g., "My mother me as I am") and Quality of communication (e.g., "I like to get my mother's point of view on things I am concerned

about"), and by subtracting the score of the subscale of anger and alienation (e.g., "I feel angry with my mother"). Higher scores on Trust and Communication and lower score on Alienation indicate higher attachment security. The Spanish-language version of the IPPA (Pardo, Pineda, Carrillo, & Castro, 2006) used in this study has shown satisfactory internal consistency and concurrent validity. In our sample, α coefficients ranged from .72 to .95.

Procedure

This research received approval from the Bioethics Committee of the University of Santiago de Compostela and the Regional Government of Galicia (Xunta de Galicia, Spain). Permission to carry out the study was obtained from the principals of all schools. Informed consent was obtained from the parents of the students who took part in the study. Participation was rewarded by inclusion in a prize draw for five laptops and four tablet computers at T3 and T4, respectively.

The data were collected in classrooms of 20–25 students. All groups were told that the purpose of the research was to explore a variety of protective and risk behaviors associated with youth wellbeing and they were given standard instructions for filling out the questionnaires. In order to answer any questions and prevent communication between the students, two trained research assistants were present in the classroom throughout the study session. In case of missing the scheduled data assessment (e.g., illness, truancy), the students were rescheduled for later evaluation in a short time.

Analysis Plan

The impact of attachment on eating problems via depression was tested using a DPM approach within a structural equation framework (Allison, Williams, & Moral-Benito, 2017; Bollen & Brand, 2010; Wichstrøm et al., 2017). The DPM consisted of a traditional autoregressive cross-lagged part and a time-invariant factor part. In the

autoregressive cross-lagged part, attachment, disordered eating, and depressive symptoms measured during the last three waves of data collection were regressed on these symptoms two years earlier. The error terms of all predictors were allowed to correlate at each time point. The time-invariant factor part consisted of three latent factors loading on the three constructs at the last three time-points, while being correlated with all initial values, which were considered exogenous.

A fixed effects DPM implies that the effects of time-varying predictors (e.g., attachment) are adjusted for the confounding effect of unmeasured time-invariant factors. Thus, in the present inquiry, the relations between attachment, depressive symptoms and disordered eating are adjusted for unmeasured time-invariant factors causing stability in attachment, depressive and eating symptoms, respectively. This approach is equivalent to the method of adjusting for confounders in ordinary regression.

A fixed effects DPM only utilizes within-person variation, i.e., participants serve as their own control. In contrast, a *random effects model* uses both within- and between-person information and thus has more statistical power than a fixed effects model. However, predictors are assumed to be uncorrelated with the time-invariant factor(s) in a random effects model. Random effects models are thus appropriate when predictors are proven to be uncorrelated with the time-invariant factor(s) and setting these correlations to 0 does not deteriorate the fit of the model.

Hybrid models consisting of both fixed and random effects are also possible (Firebaugh, Warner, & Massoglia, 2013). In hybrid models, some predictors are set to correlate with the time-invariant factor(s), whereas other predictors are not. A hybrid model retains the fixed effects advantage of adjusting for time-invariant factors (when these may influence the results) while being more parsimonious and more statistically

powerful that a pure fixed effects model (Allison, 2009; Bollen & Brand, 2010; Firebaugh et al., 2013).

To arrive at the best-fitting model, we first examined whether random or fixed effects fit the data best. The Satorra-Bentler scaled $\Delta\chi^2$ test (Satorra, 2000) is a functional equivalent to the Hausmann test (Hausman, 1978) to make such a decision. Second, if a hybrid model does not deteriorate fit, this model would be preferred for power and parsimonious reasons.

To investigate mediation, we adjusted for all relevant direct effects, e.g. when examining the potential effect of insecure attachment at age 10 on eating problems at age 16 via depression at age 12 and/or 14, we adjusted for the direct effects of depressive symptoms and attachment at age 12 as well as the direct effect of age-10 attachment. Bootstrapped asymmetric confidence intervals with 1000 draws were applied. We investigated whether identified mediations were gender-moderated by examining the 95% CIs of differences in mediation parameters between boys and girls with the Model Constraint procedure in Mplus 8.1 (Muthén & Muthén, 1998–2018). A robust maximum likelihood estimator was applied, which does not presuppose multivariate normality, and missingness was handled according to a full information maximum likelihood procedure, using all available data.

Results

Preliminary Analyses

Estimated means, standard deviations, and correlations between all study variables are presented in Table 1. As can be seen, attachment security was negatively correlated with later depressive symptoms and disordered eating at all-time points, albeit more so for attachment to the mother than to the father.

Direct Effects

Even though a random effects DPM did fit the data fairly well, $\chi 2 = 157.18$, $df = 38$, $p < .001$, RMSEA = .059, 90% CI: .050-.069, CFI = .977, TLI = .932, a fixed effect model did show a substantially better fit , $\chi 2 = 20.79$, $df = 22$, $p = .53$, RMSEA = .000, 90% CI: .000-.026, CFI = 1.000, TLI = 1.001, $\Delta \chi 2 = 220.62$, $df = 16$, $p < .001$. However, a hybrid model where non-significant correlations were set to 0, did not produce any worse fit, $\chi 2 = 30.55$, $df = 31$, $p = .49$, RMSEA = .000, 90% CI: .000-.024, CFI = 1.000, TLI = 1.000, $\Delta \chi 2 = 9.82$, $df = 9$, $p = .39$) (Supplementary Figure 1). In this hybrid model, some effects regarding attachment to the father did emerge at some time points: more secure attachment at T1 predicted less depression at T2, $\beta = -.08$, $p = .033$, and depression at T1 and T2 predicted diminished attachment two years later, at T2, $\beta = -.09$, $p < .001$ and at T3, $\beta = -.09$, $p = .031$, and more disordered eating at T1 did, anomalously, predicted more secure attachment at T2, $\beta = -.06$, $p = .013$. Acknowledging the small effects and most p-values bordering on significance, we tested whether setting paths to and from attachment to the father to zero did alter the fit of the model compared to freeing these parameters. The results revealed that the model with zero-effects for father did not prove to have a better fit, $\Delta \chi 2 = 10.42$, $df = 6$, $p = .11$. Hence, considering the number of paths involving attachment to the father (and given that we had no prior expectations), the above significant paths could equally well have been zero. In contrast, setting mother parameters to zero resulted in considerably worse fit than allowing such parameters, $\Delta \chi 2 = 73.00$, $df = 6$, $p < .001$.

Acknowledging the lack of prediction from attachment to father, further analyses were conducted with attachment to the mother only. A hybrid model of attachment to the mother where the following parameters were fixed to 0: between the time-invariant depression factor and the two other time-invariant factors; disordered

eating and attachment; and the correlation between the time-invariant depression factor and eating problems at age 10, did not produce any worse fit than a fixed effects model, $\chi 2 = 12.29$, $df = 15$, $p = .66$, RMSEA = .000, 90% CI: .000-.026, CFI = 1.000, TLI = 1.003, $\Delta \chi 2 = 1.33$, $df = 3$, $p = .72$, and for parsimonious and power reasons this model was retained (Figure 1). All autoregressive paths reached statistical significance. Cross-lagged paths indicated that higher insecure attachment to the mother predicted more depressive symptoms two years later, from T1 to T2 and from T2 to T3. More depressive symptoms at T1, T2, and T3 predicted more disordered eating at each subsequent time period (from T2 to T4). Moreover, more disordered eating at T2 and T3 predicted more depressive symptoms at T3 and T4. Finally, depressive symptoms had also a potentially detrimental effect on attachment security: more depressive symptoms at T2 and T3 predicted higher insecure attachment at T3 and T4 respectively.

Indirect Effects

To investigate mediation, we adjusted for all relevant direct effects, e.g. when examining the potential effect of insecure attachment at age 10 on eating problems at age 16 via depression at age 12 and/or 14, we adjusted for the direct effects of depressive symptoms and attachment at age 12 as well as the direct effect of age-10 attachment. Bootstrapped asymmetric confidence intervals with 1000 draws were applied. The fit for the model adjusting for direct effects provided a good fit, $\chi^2=8.12$, $df =11$, $p=.70$, RMSE =.000, 90% CI: .000-.027, CFI=1.000, TLI=1.003. The results are depicted in Figure 2; with each mediational path having its own illustrative pattern (e.g., solid, dashed, dashed-dotted, dotted, lines). Higher insecure attachment to the mother at age 10 predicted more disordered eating at age 16, via increased depressive symptoms at age 12, which in turn predicted continued increased depressive symptoms at age 14, predicting more symptoms of disordered eating at age 16, $B=-.10$, 95% CI:.01-.21

(Figure 2, path 1). This amounted to 8.2% of the effect of age-10 attachment on age-16 disordered eating. Moreover, insecure attachment at age 10 predicted disordered eating at age 16 via continued insecure attachment at age 12, and then more depressive symptoms at age 14, and in turn increased disordered eating at age 16, *B*=-.13, 95% CI:.03-.23 (Figure 2, path 2), adding 5% to the share of the explained association.

Further on, there was an effect of insecure attachment at age 10 on increased depressive symptoms at age 12, thereafter disordered eating at age 14, and then on continued disordered eating at age 16, *B*= 15, 95% CI: 02-.31 (Figure 2, path 3); a 6.8% share of the association between attachment at age 10 and disordered eating at age 16. Insecure attachment at age 12 predicted increased depressive symptoms at age 14, which in turn predicted more disordered eating at age 16, *B*=-.26, 95% CI:.06-.41 (Figure 2, path 4); amounting to 30.0% of the total effect. The same effect was also seen two years earlier, from age 10 insecure attachment to depressive symptoms at age 12, and in turn, more disordered eating age 14, *B*=.34, 95% CI: 02-.60 (Figure 2, path 5); 21.9% of the total effect.

To be noted, sum of all the indirect effects fully mediated effects of insecure attachment on later eating pathology, as there were no direct effects of insecure attachment at T1 on eating problems at T3, *β*=.11, *p*=.21 or insecure attachment on eating problems at T4, *β*=.04, *p*=.83. As indicated in Figure 1, there could be an effect from disordered eating at age 12 to reduced attachment to the mother at age 16 via increased depression at age 14. However, possibly due to the weakness of the disordered eating→depression link (*β*=.09, *p*=.05), the mediational effect turned out insignificant, *B*=-.02, 95% CI: -.05, .00, *p*=.23. No other reverse mediational effects—including from attachment or disordered eating to depression—were significant.

Child's Gender-specific Effects

Girls scored considerably higher than boys on depressive symptoms and disordered eating; a difference seemingly increasing with age (Table 1). To investigate whether the above indirect effects differed by gender, separate models for girls and boys were computed. Importantly, the differences in magnitude of the mediational effects were not different for the two genders (see supplemental Table A2), as the 95% CI of the difference between them always included 0.

Discussion

The present study examined, for the first time, whether depressive symptoms serve as a mechanism by which insecure attachment to parents increases disordered eating from middle childhood to adolescence. By following up a large community sample of 10-year olds with biennial assessments until the age of 16, and by adjusting for initial levels of depressive symptoms, disordered eating, attachment and invariant-time factors, we found that insecure attachment to the mother at ages 10 and 12 years predicted disordered eating four years later via increased depressive symptoms. No effects involving attachment to the father were found. Moreover, our findings did not show any child's gender-specific or reverse (i.e. from depressive symptoms and disordered eating to insecure attachment) effects.

Depressive Symptomatology as Mediator between Insecure Attachment to the Mother and Disordered Eating

First, as regards the attachment-depression link, insecurely attached children at age 10 might be more prone to develop depressive symptoms at ages 12 and 14, possibly due to the cognitive-affective representations rooted in early negative experiences with care providers (Brumariu & Kerns, 2010; DeKlyen & Greenberg, 2016). Indeed, adolescents with early negative attachment experiences tend to focus selectively on disappointing aspects of a situation, which may further consolidate their negative self-concept over time (Morley & Moran, 2011). In addition, with the

increasing cognitive capacities of early adolescence, youngsters tend to become preoccupied with what others may think of them (Somerville, 2013). Holding a negative self-concept - during this developmental period - may thus negatively bias the perception of feedback from others more strongly than during earlier or later periods (Hankin et al., 2005; Harter, 2006; Rudolph, 2009). Second, with respect to the depressive symptoms-disordered eating link, our results demonstrated that more depressive symptoms at ages 12 and 14, predicted more disordered eating at ages 14 and 16, respectively. These findings support the view that disordered eating may arise as a way to self-regulate or escape from negative emotions (Ferreiro et al., 2014; Goossens, Braet, Bosmans, & Decaluwé, 2011; Haedt-Matt & Keel, 2011).

Taken together, the aforementioned results suggest that children insecurely attached to the mother— who presumably perceive themselves negatively and without emotional support of their main attachment figure— may be extra vulnerable in the challenging transition from middle childhood to adolescence (e.g., body changes related to puberty finding themselves moving farther from the Western ideal beauty [Ricciardelli, 2012; Wertheim & Paxton, 2011], school transition [Evans, Borriello, & Field, 2018] negative interpersonal interactions [Rudolph, 2009]), resulting in increased depressive symptoms and may find refuge in abnormal eating practices (Tasca, 2018). For instance, binge eating might reduce negative affect and allow for momentary relief from reality yet, at the same time, perpetuating this maladaptive cycle through negative reinforcement (Faber et al., 2018). Similarly, as body image becomes crucial for adolescents' self-esteem (Ricciardelli, 2012; Wertheim & Paxton, 2011), boys and girls may engage in extreme dieting or in other harmful weight-control strategies (e.g., laxative use, excessive exercise) in an effort to achieve an ideal body shape and reduced

unpleasant affect related to a negative image of themselves (e.g., Calzo et al., 2015; Johnson & Wardle, 2005).

The present findings substantiate existing literature supporting the role of insecure attachment to the mother as a risk factor in the development of disordered eating (e.g., Cortés-García et al., 2019; Goossens et al., 2012), yet expands it by indicating that depressive symptoms serve as one intermediate mechanism driving this relation.

Child's Gender-Specific Effects

The present investigation demonstrates that depressive symptoms play a central role in transferring the effect of attachment insecurity to the mother on the development of disordered eating, regardless of child's gender. However, our results run counter to studies showing that these effects are stronger in adolescent girls than in boys for depressive symptoms (Allen et al., 2007; Lewis et al., 2015) as well as for disordered eating (Crespo et al., 2010). Conceivably, this discrepancy may partly be due to the fact that previous studies measured parent-child relationships (e.g., family connectedness, family conflict, lack of emotional closeness to parents) and not attachment quality per se. Moreover, these studies did not explicitly test a mediational model and did not adjust for time-invariant factors.

Nevertheless, the lack of gender specific-effects in our model possibly indicates the importance of attachment to the mother as *safe haven* in reducing the likelihood of depressive symptoms and disordered eating in girls and boys alike (e.g., Agerup et al., 2015; Goossens et al., 2012). Importantly, this result pinpoints that higher risk to develop disordered eating also pertains to boys (Sweeting et al., 2015), although their body image concerns and the magnitude of ED symptoms are lower (as echoed in our results).

In sum, based on the current findings, insecurely attached boys and girls who hold negative cognitive-affective representations, may think and behave in a manner that fosters disordered eating via an increase in depressive symptoms. Overall, however, the effect sizes reported were small to moderate.

Strengths and Limitations

We notice several strengths. First, the use of a multiwave longitudinal design with four measurement points in the transition from middle childhood to adolescence allowed for the examination of the direction of effects and for the prediction of changes in symptoms over time. Second, we included measures of attachment to both the mother and father, which made analyses of their relative importance possible. Third, the sample size made gender-specific analysis feasible. Lastly, the use of a strong analytic approach allowed for ruling out the impact of time-invariant confounding, reducing the risk of capitalizing on spurious relation between the variables.

Despite these assets, the present findings should be interpreted in light of some limitations. First, our sample consisted of Spanish children, predominantly Caucasian. Therefore, extrapolating our results to other countries and cultures should be performed with caution. Second, the study relied solely on self-reports from one source, and the implied common method bias may have inflated associations. However, as the rater did not change over time, any prospective inflation in predictions due to common methods would be adjusted for by the latent time invariant factors we included in our analyses. Third, we examined attachment dimensionally, therefore we were not able to distinguish specific associations between an organized insecure attachment style (i.e., anxious, avoidant or even disorganized attachment) and disordered eating. Fourth, we did only address potential additive effects of attachment to mothers and fathers, but not interactive ones (Dagan & Sagi-Schwartz, 2018). Fifth, as with most longitudinal

research, attrition occurred during the study (Gustavson, von Soest, Karevold, & Røysamb, 2012). The higher dropout at T4 may be due to the fact that by that time, following the Spanish education system, most adolescents had completed compulsory education and hence had left school. We also acknowledge that attrition at T4 among children whose parents had higher level of education and children with more eating symptoms at T3, may have affected both the internal and external validity of the research. Although non-random attrition affecting the results cannot be ruled out, we applied a FIML procedure, which produces less biased estimates than complete case analysis (Enders & Bandalos, 2001). Lastly, potentially relevant variables that may act as confounders (time *varying* factors such as unexpected life-events) were not included and could impact the associations between the observed variables and produce spurious relations.

Implications for Research and Practice

Future studies should test our suggested mediational model in different populations, such as clinical samples, adults, and participants from diverse ethnic backgrounds. Prospective research should also examine whether the present findings hold for other attachment figures, such as peers since some research indicates that peers may have different effects on the development of depressive symptoms and disordered eating (Gorrese, 2016; Le Grange et al., 2014). Also, future studies would benefit from inclusion of different measures such as clinical interviews and observational attachment measures. That said, a broad systematic review on different measurements of attachment specifically for children and adolescents (Jewell et al., 2019), recommends the use of the IPPA (Armsden & Greenberg, 1987) and the Child Attachment Interview (CAI; Shmueli-Goetz, Target, Fonagy, & Datta, 2008) as they have shown the best psychometric properties amongst observer-rated and self-report measures, respectively.

Further studies could also examine effects of simultaneous attachment to both mothers and fathers on later depression and ED symptoms. In this regard, a number of attachment researchers have recently called for studies adopting a more integrative, ecologically valid approach assessing attachment patterns to both parents as a unit to better understand individual's development outcomes (Cowan & Cowan, 2019; Dagan & Sagi-Schwartz, 2018). Lastly, it should be ascertained whether different insecure attachment styles relates differently to disordered eating in adolescents. For instance, some studies have reported associations between avoidant insecure attachment and dietary restriction and between anxious insecure attachment and binge/purging behaviors (Behar, 2012; Dias, Soares, Klein, Cunha, & Roisman, 2011).

The current study highlights the significant influence that insecure attachment, especially to the mother, exerts on disordered eating via depressive symptoms in adolescence. It is noteworthy to consider the ethical challenges in interpreting direct connections between attachment and eating psychopathology as there is the great risk of "blaming" primary caregivers; instead, family members, particularly the mother, should be seen as a resource and part of the solution (Le Grange, Lock, Loeb, & Nicholls, 2010; Zachrisson & Skårderud, 2010). On a general level, a more detailed understanding of the specific family dynamics involved in the suggested process is needed for effective treatment and prevention. Family wise, prevention programs that enhance interpersonal functioning by promoting better communication, cohesion, and stability in mother-child relationships could be effective in reducing the risk of both depression (Jacka et al., 2013; Sander & McCarty, 2005) and disordered eating (Faber et al., 2018). And, attachment wise, interpersonal and attachment-based interventions should address maladaptive cognitions about self and others, which may be rooted in early mental representations that foster the development of negative self-views, emotion

dysregulation and difficult interpersonal functioning in children (Rieger et al., 2010; Stark, Streusand, Arora, & Patel, 2012), especially at a time of development when they are still modifiable (Bowlby, 1973; Pinquart, Feussner, & Ahnert, 2013). This is especially important as such intervention may disrupt the mediational chain by which insecure attachment leads to disordered eating.

Conclusion

The results of this study provide evidence that, regardless of child's gender, an increase in depressive symptoms may be an essential mechanism by which insecure attachment to mother increases adolescents' vulnerability to disordered eating prospectively. As such, the promotion of secure attachment relationships, particularly with the mother, during the transition from middle childhood to adolescence in both genders, in conjunction with other intrapersonal and environmental factors, might protect youths against depressive symptoms and the subsequent development of eating problems.

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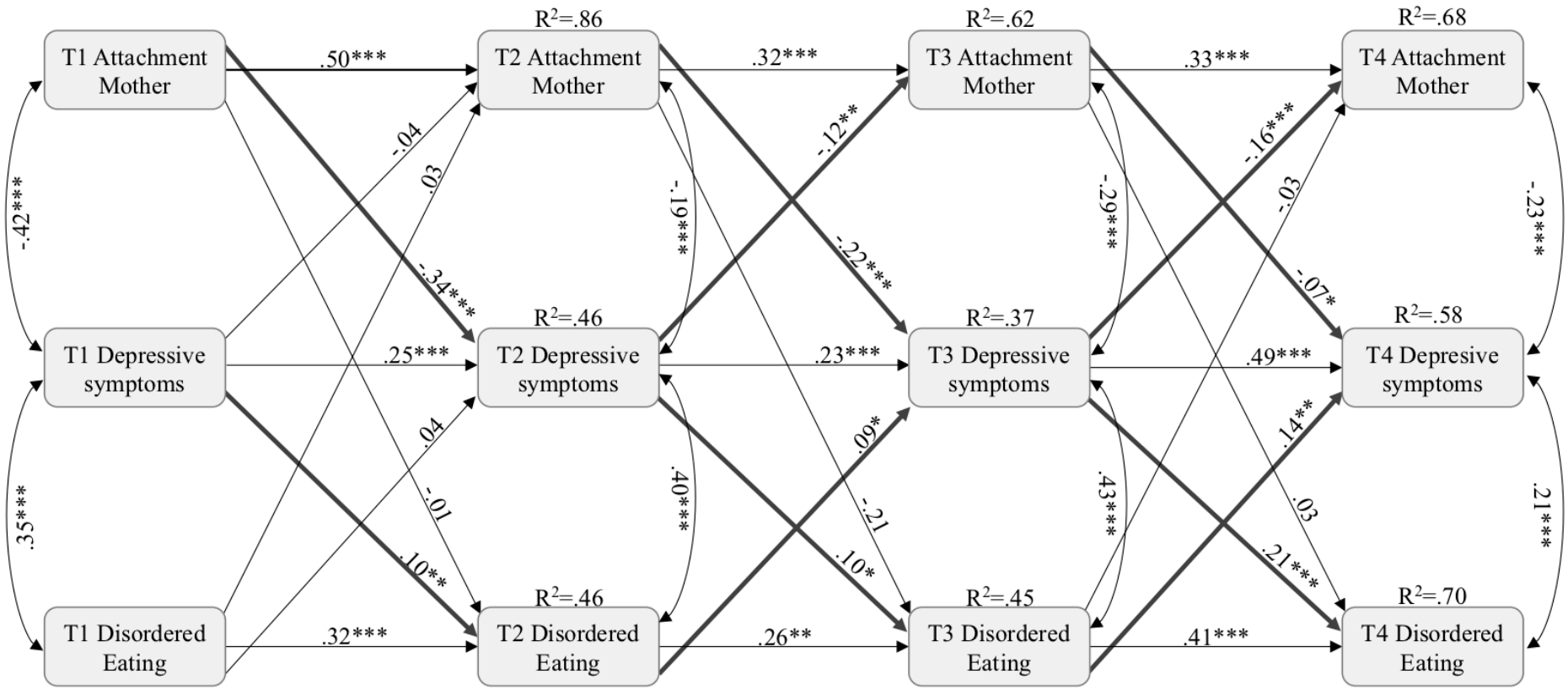

Fig. 1. Dual path model hybrid examining the association between depressive symptoms, disordered eating and attachment to mother among boys and girls. Standardized coefficients are depicted. Thick arrows = Significant cross-lag paths. FULL SAMPLE. $\chi2=12.29$, df=15, p=.66, RMSEA = .000, 90%CI:.000-.026, CFI = 1.000, TLI = 1.003, $\Delta\chi2=1.33$, df=3, p=.72. T1/T2/T3/T4 = Time 1/Time 2/Time 3/Time 4.

*** p < .001, ** p < .01, * p < .05.

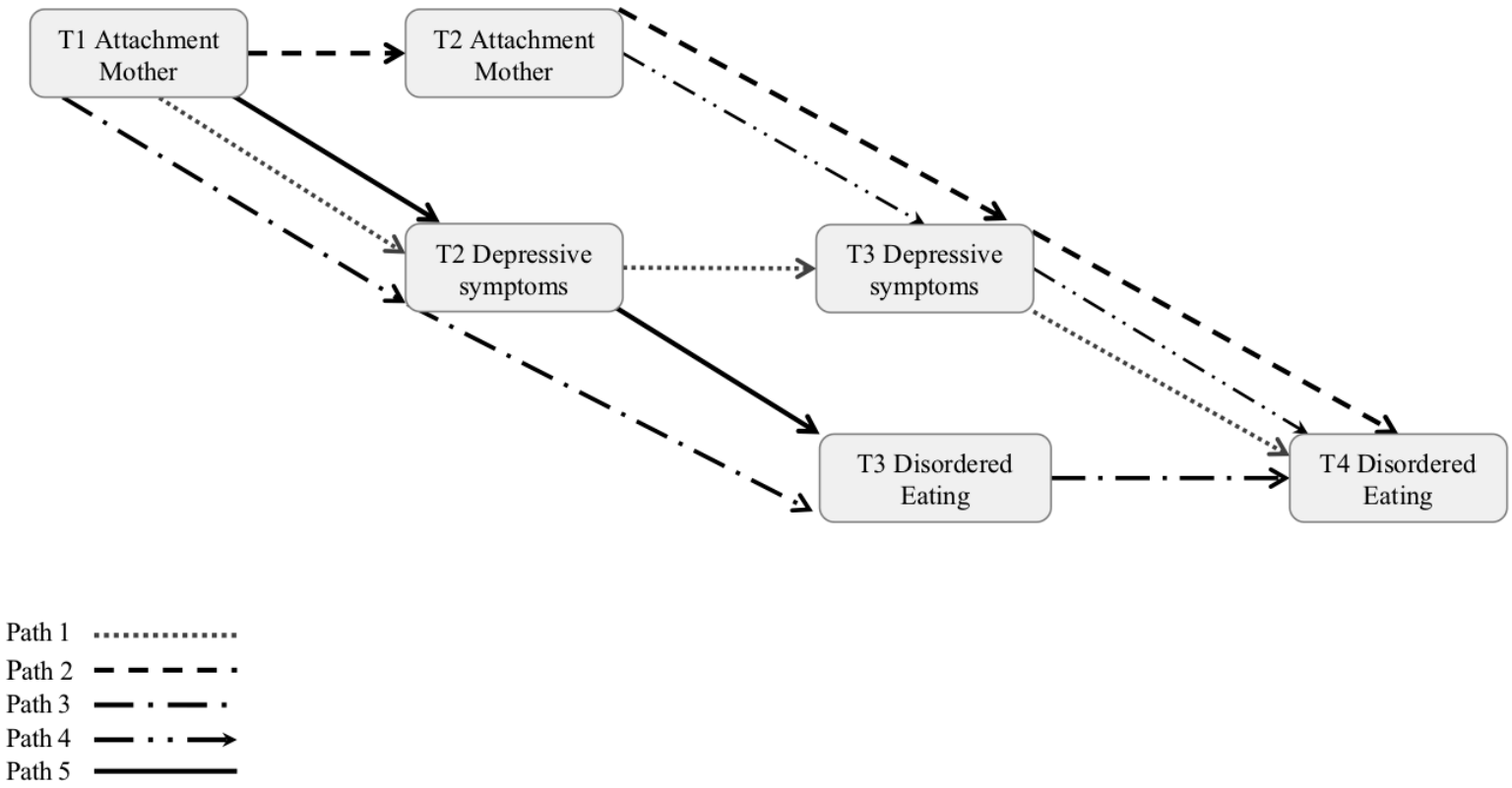

Fig. 2. Mediation model adjusted for direct effects examining the association between depressive symptoms, disordered eating and attachment to mother among the whole sample. Standardized coefficients are depicted. $\chi 2=8.12$, df=11, p=.70, RMSEA=.000, 90%CI:.000-.027, CFI=1.000, TLI=1.003. T1/T2/T3/T4 = Time 1/Time 2/Time 3/Time 4.