DO FAMILIAL FACTORS IN ADOLESENCE PROTECT AGAINST DISORDERED EATING IN EARLY ADULTHOOD? A 15 YEAR LONGITUDINAL STUDY

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Abstract

Disordered eating is prevalent among adolescents and generally persists into adulthood. Prior research has examined the role of early behavioural and relational familial protective factors on disordered eating, but studies have mainly examined these factors independently and using cross-sectional designs. Less research has examined how aspects of family functioning interact during adolescence to protect against disordered eating behaviours in adulthood, limiting our understanding of the impact of these factors long-term. **Objectives:** The current study aimed to explore how behavioural and relational family factors in adolescence interact to influence disordered eating outcomes in early adulthood, through testing direct and indirect relationships. Two exploratory mediational pathways were assessed: one pathway tested family *relational* factors as mediators and a second pathway tested family *behavioural* factors as mediators. **Method:** Longitudinal data from the Research on Eating and Adolescent Lifestyle Study (REAL) that recruited adolescent participants between 2006 and 2013 (n = 1197), and participants who completed a 15-year follow-up (n = 269; REAL 2.0) in early adulthood, were analyzed using path analysis to study two exploratory models. Participant data were drawn from a subset of measures of a larger battery of questionnaires. **Results:** Hypothesized models did not fit the data well. However, after modifications, an exploratory model did fit the data well. A marginally significant indirect effect was also observed, between family cohesion during adolescence and emotional eating in adulthood through family meals once appearance esteem was controlled during adolescence. **Impact:** These findings extend theory on adolescent family functioning and disordered eating in adulthood by proposing a revised model that needs replication that highlights the role of appearance esteem during adolescence.

Keywords: disordered eating, family functioning, protective factors

Do Familial Factors in Adolescence Protect against Disordered Eating in Early Adulthood? A 15-Year Longitudinal Study

Disordered eating and weight-related concerns are prevalent issues around the world, especially among adolescents. A large international study shows that over 22% of young people report disordered eating symptoms (López-Gil et al., 2023). Disordered eating involves an unhealthy relationship with food, body, and weight, which results in maladaptive eating and weight-control behaviours such as purging, caloric restriction, using diet pills and/or laxatives, binge eating, skipping meals, and excessive exercise (Alhaj et al., 2022; Harrison et al., 2020; Stice et al., 1998). These behaviours are risk factors in the development of eating disorders such as anorexia nervosa (AN), binge-eating disorder (BED), bulimia nervosa (BN), and unspecified feeding and eating disorders (USFED; Pereira & Alvarenga, 2007; Stice et al., 2011). Disordered eating is consistently linked with other psychological and physical comorbidities such as depression (Kotler et al., 2001; Ortega-Luyando et al., 2015), anxiety (Touchette et al., 2011), suicidality (Kim & Kim, 2009), poor quality of life (Wu et al., 2019), substance use (Pisetsky et al., 2008), excessive weight gain (Herpertz-Dahlmann et al., 2015; Rancourt & McCullough, 2015), cardiovascular issues (Forney et al., 2016), and diabetes (Kelly et al., 2005). Understanding etiological risk and protective factors associated with disordered eating in adolescents provides opportunities for prevention efforts that could help reduce the likelihood of disordered eating, eating disorders, and the mental and physical comorbidities known to be associated with this set of symptoms (Calam & Waller, 1998; Field et al., 2003; Slane et al., 2014). The goal of this study is to explore how behavioural and relational family factors in adolescence interact to influence disordered eating outcomes in early adulthood

Disordered Eating During Adolescence & Early Adulthood

Adolescence is a vulnerable period marked by significant physical (e.g., pubertal maturation; Best & Ban, 2021), developmental (e.g., emotional stability and regulation; Best & Ban, 2021), and transitional changes (e.g., via social roles and relationships; Tyrka et al., 2000) that leave some young people at risk for poor psychological outcomes, including disordered eating (Zhang et al., 2021). Adolescents who report being preoccupied with dating (i.e., attracting potential mates), balancing societal pressures, wanting acceptance by peers (Borch et al., 2011; McVey et al., 2002), and academic stressors report more challenges with coping, self-esteem, poor body image, and disordered eating behaviours (Hsu & Raposa, 2021). Cross-sectional and longitudinal studies provide converging evidence that disordered eating remains stable or increases across adolescence for both adolescent females (Bould et al., 2018; Breton et al., 2022; Croll et al., 2002; Foster et al., 2024; Jones et al., 2001; Jung et al., 2015; Neumark-Sztainer et al., 2011; Slane et al., 2014) and males (Neumark-Sztainer et al., 2011; Pisetsky et al., 2008; Swanson et al., 2011; Tam et al., 2007) of various ethnicities and backgrounds (Breton et al., 2022; Buckingham-Howes et al., 2018; Foster et al., 2024; Swanson et al., 2011) and well into adulthood.

Disordered eating behaviours vary across the developmental period for males and females. For example, among females, restrictive eating (i.e., restriction in nutritional intake) decreases from adolescence (56.9%) to early adulthood (54%), whereas in men, restrictive eating increases over time from 31.1% to 34.2% (Simone et al., 2022). In contrast, binge eating (i.e., eating unusually large amounts of food with loss of control) for females (16.3% to 20.6%) and males (4.4% to 14.3%) increased over time (Simone et al., 2022). Evidence suggests that restrictive

eating behaviours may be more common in adolescence due to appearance-related concerns. In contrast, young adults might be more likely to engage in binge eating behaviours to cope with negative emotions (Haedt-Matt & Keel, 2011). Little research has examined how risk factors for disordered eating interact during adolescence to impact outcomes in early adulthood (Slane et al., 2014). Future research in this area will help inform our understanding of how to target and strengthen preventive interventions during adolescence to reduce the risk of disordered eating behaviours in early adulthood.

Risks and Protective Factors of Disordered Eating

Risk factors are a set of traits, characteristics or elements that increase the likelihood of an undesirable outcome (Gubbels et al., 2023; Kazdin et al., 1997), whereas protective factors are a set of factors that serve to increase the probability of a desirable outcome (e.g., well-being). According to the developmental psychopathology framework, a protective factor among adolescents is an element that mitigates the impact of vulnerability or risk factors on development, fostering adaptive growth and resilience (Masten et al., 1990; Rutter, 1987). Some researchers have argued that risk and protective factors are conceptually expressed on a continuum, suggesting that certain factors (e.g., family environment) can function as either risks or protectors, depending on their presence, absence or context in which they may emerge (Eisenberg et al., 2022). It is essential to study risk and protective factors because they help identify key predictors of adverse developmental and psychosocial outcomes, enabling the development of tailored early intervention and community strategies for adolescent populations.

A growing literature suggests a combination of risk factors contributes to the development of eating disorders and disordered eating, including biological, psychological, and

sociocultural influences (Barakat et al., 2023; Obeid et al., 2022; Pop-Jordanova et al., 2017). Findings from a rapid review reveal nine distinct risk factors that are associated with eating disorders and disordered eating: (1) genetic risk and history, (2) gastrointestinal microbiota and autoimmune disease, (3) personality and comorbid mental health challenges, (4) gender, (5) socio-economic status, (6) ethnic minority, (7) body image concerns and social influence, (8) sports, and (9) childhood and adolescent exposures (Baraket et al., 2023). Family dynamics, including parental attitudes toward food, body image, and emotional climate, play a significant role in shaping a child's relationship with eating (Baraket et al., 2023). Emphasizing protective factors and fostering strengths, in addition to addressing risks, could prove especially beneficial when creating tailored prevention and early intervention efforts (Levine & Smolak, 2016).

In line with the positive psychology movement, theorists have proposed that focusing on risk factors often neglects the positive aspect of individuals and their systems (Seligman & Csikszentmihalyi, 2000; Steck et al., 2004). In this regard, Langdon-Daly and Serpell (2017) coined the term "developmental assets" (i.e., a combination of individual and contextual factors, such as family, peers, and community) that are believed to protect against the development of risky behaviours, including disordered eating. Research on social, environmental, and behavioural factors provides some support for the role of protective factors against disordered eating and weight status. Flament and colleagues (2019) proposed a biopsychosocial framework to explain the shared pathways of eating disorders and obesity in Canadian youth. To test this model, the researchers collected data from over 3,000 students (grades 7-12) between 2004 and 2013 as part of the original Research on Eating and Adolescent Lifestyle (REAL) study (Flament, 2019). Based on these data, and using a cross-sectional model, Obeid and colleagues

(2022) found empirical support for the complex direct and indirect relationships between risk and protective factors and their influence in eating and weight-related disorders, including some familial factors. Further cross-sectional evidence generated from the REAL studies revealed significant negative relationships between family meals and body mass index (BMI; Goldfield et al., 2011) and between increased parental weight-based comments and lower appearance esteem (Valois et al., 2019) in adolescents. However, the relationships among these variables have not been tested in long-term studies or simultaneously to understand their interactive influences. Other studies examining shared risk and protective factors on disordered eating suggest that some psychological and socioenvironmental factors (i.e., less family meals, more parental weight-based comments, and drive for thinness) are associated with specific disordered eating behaviours (i.e., purging, binge eating, emotional eating; Hübner et al., 2016) for adolescent girls though not for boys (Haines et al., 2010; Neumark-Sztainer et al., 2007), suggesting sex differences between the type of familial risk factor (e.g., less family meals, more parental weight-based comments) on disordered eating patterns (e.g., purging or binge eating behaviours). Currently, no research from the REAL study database has examined the longitudinal effects of multiple familial protective factors in adolescence on disordered eating behaviours in adulthood.

Familial Factors in the Development of Disordered Eating

Given the critical role of family and parenting in adolescent psychosocial development, there has been a growing focus on familial functioning and viewing the family as a system to better understand the developmental trajectories of disordered eating (Flament et al., 2019; Minuchin, 1985; Whitchurch & Constantine, 1993). Family systems theory (Minuchin, 1985; Whitchurch & Constantine, 1993) proposes that interactions and functions within the family,

both at the overall family level and between specific members (e.g., parent/child), play a significant role in influencing family members' health behaviours, whether those behaviours are positive (e.g., increased self-esteem) or negative (e.g., engagement in disordered eating). Family functioning refers to how family members interact physically, emotionally, and psychologically (Schwab et al., 2000). It can include relational (i.e., family adaptability and cohesion) and behavioural (i.e., family meals, parental weight-based comments) factors. Findings from longitudinal studies suggest that relational and behavioural parental qualities are independently linked to the development of disordered eating among adolescents (Berge et al., 2014; Hooper et al., 2021; Hübner et al., 2016; Neumark-Sztainer et al., 2008), but less is known about how these relational and behavioural factors might interact to lead to disordered eating in adulthood.

Family Adaptability and Cohesion

In line with the family systems theory, research supports the impact of relational factors of family functioning, including family adaptability and cohesion, on disordered eating. **Family adaptability** refers to the family system's capacity to adjust its power dynamics, role relationships, and rules in response to situational and developmental stressors. **Family cohesion** refers to the emotional bond between family members, which can manifest in various forms, including disengaged, separated, connected, or highly intertwined relationships (Olson et al., 1982). A systematic review of cross-sectional findings indicated that strong levels of family adaptability and cohesion were associated with fewer disordered eating behaviours (Rienecke et al., 2024). Similarly, in community samples, adolescents who reported higher levels of family adaptability, cohesion, robust communication, warmth, connectedness, structure/rules, and unconditional support also reported fewer disordered eating outcomes (Berge et al., 2014; Croll

et al., 2002; Enten & Golan, 2009; Fonseca et al., 2002; Kluck, 2008; McVey et al., 2002) One intervention study found that targeting communication styles by fostering healthy bonds and connections with family members helped decrease disordered eating behaviours (O'Dea & Abraham, 2000).

Attachment theories have also been implicated in the role of family functioning and eating disorders (Bowlby, 1969; Bruch, 1982). Attachment theory suggests that a child's capacity to adaptively regulate their emotions, seek and accept support, and develop the ability to reflect on their own and others' mental states stems from secure attachment relationships with parental caregivers. Secure attachment was associated with positive family cohesion and adaptability, as well as lower eating disorder psychopathology, in adult samples (Münch et al., 2016). On the other hand, attachment insecurity is associated with more eating disorder symptoms among adult patients (Tasca & Balfour, 2014). This suggests that the quality of the parent-child relationship is an important element that might protect against developing disordered eating behaviours.

Few studies have examined the longitudinal effects of family adaptability and cohesion on disordered eating outcomes (Berge et al., 2013; Neumark-Sztainer et al., 2008). Examining the effects of family adaptability and cohesion on disordered eating in longitudinal studies may be important for informing early intervention and prevention efforts in adolescent care.

Family Meals

Cross-sectional and longitudinal studies carried out in the past decade have found associations between behavioural factors of family functioning, such as increased number of family meals associated with fewer disordered eating behaviours during adolescence (López-Gil

et al., 2024; Neumark-Sztainer et al., 2004; Worobey, 2002), engagement in social eating behaviours (i.e., with family and friends) and healthier diets in adulthood (Larson et al., 2007; Neumark-Sztainer et al., 2008). One mechanism that may help explain the protective nature of family meals in reducing disordered eating behaviours is parental role modelling (Bandura & McDonald, 1963). According to learning theorists (Bandura & McDonald, 1963), family members can influence a child's behaviour via modelling, rewards, and punishments. For example, regular family meals provide an opportunity to model healthy eating habits and engage in positive social interactions, reinforcing a healthy lifestyle and potentially preventing disordered eating behaviours. Within this framework, adolescents may not only model behaviour but also become creative and adapt what they learn, shaping their own eating patterns in response to family influences (Faith et al., 2004). When adolescents skip family meals, family members may not detect food-related issues or inadequate diets. Thus, regular family meals may be key for the early detection of disordered eating behaviours. In adolescent females, cross-sectional, qualitative, and retrospective studies have demonstrated substantial negative associations between family meals and disordered eating behaviours (Fulkerson et al., 2006; Neumark-Sztainer et al., 2004; López-Gil et al., 2024; Loth et al., 2015; Miller et al., 1993; Worobey, 2002). However, findings from a systematic review suggest that there is less evidence for adolescent and adult males (Harrison et al., 2015; Neumark-Sztainer et al., 2004; Neumark-Sztainer et al., 2008). Understanding the role of family meals and their association with family functioning in relation to disordered eating is an important next step. Learning whether sex differences exist in these relationships is equally important, given the discordant findings between males and females in this literature.

Weight-based Comments from Parents

Behavioural influences from parents also include verbal communication, such as encouragement to diet and weight-based comments (Abraczinskas et al., 2012). For example, parental weight-based comments (i.e., negative interactions and comments such as mocking by one's parents regarding one's shape/weight; Shapiro et al., 1991) have been consistently linked with poor psychological outcomes such as poor body image (Dahill et al., 2021; Eisenberg et al., 2003; Goldfield et al., 2010; Greenleaf et al., 2014) and disordered eating among adolescents (Eisenberg et al., 2012; Haines et al., 2006). In line with a biopsychosocial model of disordered eating (Flament et al., 2019), parental weight-based comments during adolescence can be considered an environmental factor that may influence disordered eating behaviours in adulthood, via body image. The socialization process (Tholander, 2002), particularly during adolescence, involves parents explicitly guiding a young person to adopt specific values or behaviours. During this time, parents' comments about weight may reflect an attempt to shape their children's body image ideals, which might influence the formation of unhealthy eating behaviors later in life.

Previous cross-sectional (Goldfield et al., 2010; Hooper et al., 2021; Lampard et al., 2014; Olvera et al., 2013; Pearlman et al., 2019; Pötzsch et al., 2018) and prospective studies (Eisenberg et al., 2012; Haines et al., 2006) have demonstrated a link between parental/peer weight-based comments and well-being outcomes (e.g., depression, disordered eating, self-esteem) in adolescence and early adulthood. However, few longitudinal studies have examined parental weight-based comments and disordered eating from adolescence to early adulthood (Hooper et al., 2021; Hübner et al., 2016). Among the few studies, researchers found that more

parental weight-based comments predicted lower appearance esteem and weight esteem during adolescence (Valois et al., 2019) and higher levels of disordered eating (Puhl et al., 2017) for adult females. Among males, more parental weight-based comments was not predictive of disordered eating behaviours, suggesting sex differences in eating outcomes (Puhl et al., 2017). Because of the limited research evidence, opportunities remain to understand if weight-based comments from parents during adolescence contribute to different disordered eating patterns (e.g., restrictive vs emotional eating) in adulthood.

Interactive Pathways of Familial Factors on Disordered Eating

The literature suggests possible mechanisms and interactive pathways of relational and behavioural factors in family functioning that may contribute to disordered eating during adolescence. Family adaptability and cohesion may be two of several mechanisms through which family meals lead to less disordered eating outcomes. Family meals may be associated with a higher quality parent-child relationship, contributing to a more cohesive and adaptive family environment characterized by warmth, strong communication, flexibility, and fewer parental weight-based comments. Such an environment could be linked to a lower likelihood of adults engaging in disordered eating behaviours.

A possible explanation for the protective effects on disordered eating in adulthood may lie in Bandura's theory of parental role modelling (Bandura & McDonald, 1963). Following this theory, modelling positive family functioning through behaviours such as sharing family meals, fostering open communication and warmth, and fewer critical comments about weight could serve as building blocks to reinforce healthier eating habits and positive psychological traits such as resilience and openness, resulting in healthier development and choices in adulthood. Thus,

examining the structural relationships among these familial factors, both independently and as they interact, may be important in identifying the influential factors to target for preventing disordered eating during adolescence.

Previous cross-sectional studies consistently linked frequent family meals with stronger family adaptability and cohesion (Robson et al., 2020) and these relational factors are linked with fewer disordered eating behaviours (Berge et al., 2014). However, only a few longitudinal studies explored the interactive effects of familial factors in adolescence on different eating behaviors later in adulthood. One notable study found that fewer family meals and greater parental weight-based comments had a combined effect on disordered eating outcomes in adolescent girls but not boys and that the magnitude of these effects varied based on the pattern of disordered eating for both genders. However, family adaptability and cohesion were not examined (Haines et al., 2010). Aside from this study, few attempts have been made to examine the longitudinal protective effects of family meals with other family functioning variables on disordered eating in adulthood. Hence, it remains unclear how family meals, parental weight-based comments, family adaptability, and cohesion during adolescence might interact to impact disordered eating in adulthood. As such, the current study aims to address this gap to determine the mechanisms and interactive effects of familial protective factors during adolescence on disordered eating outcomes in adulthood, 15 years later.

Current Research

The purpose of this longitudinal study is to examine the structural relationships between family functioning in adolescence and disordered eating in adulthood. This study aims to 1) examine the direct effects between familial protective factors in adolescence (T1, M_{age} = 13.51

years) on restrictive eating and emotional eating 15 years later (T2, M_{age} = 30.82 years), and 2) explore a model in which the association of behavioural factors of family meals and parental weight-based comments in adolescence (T1) with disordered eating outcomes in adulthood (T2) is mediated by relational factors of family adaptability and family cohesion in adolescence (T1). See Figure 1 for the proposed model (M1).

This study hypothesized the following:

H1: Higher levels of family meals during adolescence (T1) will be directly associated with lower levels of restrictive and emotional eating in adulthood (T2).

H2: Lower levels of weight-based comments during adolescence (T1) will be directly associated with lower levels of restrictive and emotional eating in adulthood (T2).

This study also consists of examining the following exploratory questions: 1) do lower levels of weight-based comments during adolescence (T1) have an indirect effect on lower levels of restrictive and emotional eating in adulthood (T2) through increased family cohesion and adaptability measured in adolescence (T1), and 2) do higher levels of family meals during adolescence (T1) have an indirect effect on lower levels of restrictive and emotional eating in adulthood (T2) through increased family cohesion and adaptability measured during adolescence (T1)?

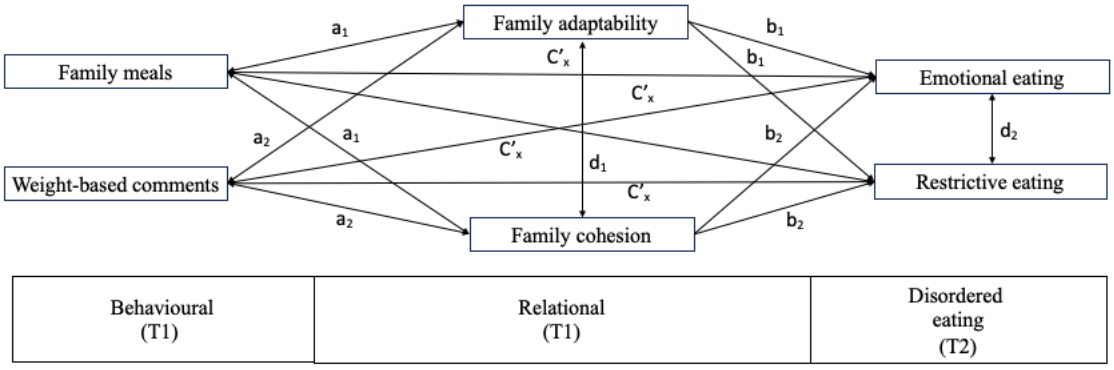
Testing Alternative Models. One could argue an alternative pathway exists, that a pre-existing high-quality parent-child relationship characterized by cohesion and adaptability naturally leads to having more family meals and fewer parental weight-based comments. One study that examined parental weight-based comments and family dysfunction (characterized by

low levels of family adaptability and cohesion) on disordered eating found that parental weight-based comments served as a mechanism by which family dysfunction influenced the development of disordered eating (Kluck, 2008). Moreover, family dysfunction may disrupt a family's ability to organize family meals, which could diminish the effect of behavioural role modelling, and in turn, be linked to more disordered eating (Berge et al., 2013; Walton et al., 2018). Based on this literature, the opposite might hold where positive family functioning during adolescence could facilitate the organization of more family meals, which might be associated with fewer disordered eating behaviours in adulthood.

Thus, this study will also propose testing an alternative competing model and explore whether a mediational model examining the relational factors of family adaptability and family cohesion in adolescence (T1) on disordered eating outcomes in adulthood (T2) via behavioural factors of family meals and parental weight-based comments in adolescence (T1) best explains the mechanisms of this relationship. See Figure 2 for the alternative model (M2).

Figure 1

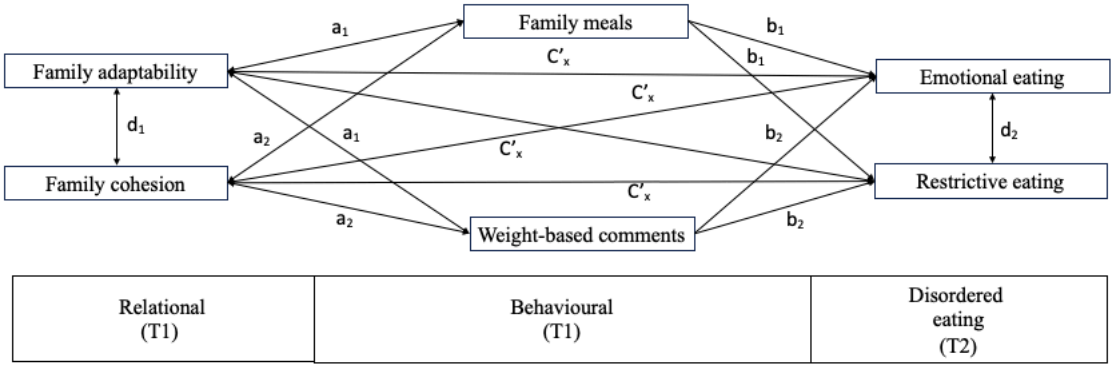
M1: Proposed Model of Behavioural Factors (T1) and their Impact on Disordered Eating in Adulthood (T2) via Relational Factors (T1).



Note. T1 is referred to as data collected at baseline during adolescence. T2 refers to data collected during the 15-year follow-up period in adulthood. Direct effects are represented by a_1 and b_1 while exploratory indirect effects are represented by C'x to indicate the multiple mediation values. The covariance between family adaptability and family cohesion is represented by d_1. The covariance between emotional and restrictive eating is represented by d_2.

Figure 2

M2: Alternative Model of Relational Factors (T1) and their Impact on Disordered Eating in Adulthood (T2) via Behavioural Factors (T



Note. T1 is referred to as data collected at baseline during adolescence. T2 refers to data collected during the 15-year follow-up period in adulthood. Direct effects are represented by a_1 and b_1 while exploratory indirect effects are represented by C'x to indicate the multiple mediation values. The covariance between family adaptability and family cohesion is represented by d_1. The covariance between emotional and restrictive eating is represented by d_2.

Method

Participants and Procedure

Participants were originally part of the Research on Eating and Adolescent Lifestyle (REAL) study (Flament et al., 2019). The longitudinal REAL study surveyed middle school and high school students from 2007 to 2013 (n = 1197) from 44 schools in the Ottawa region of Canada. Participants were based on a convenience sample. Student participants provided assent and gained parental consent to participate. The questionnaires included various validated self-report measures. Participants' height and weight were measured by trained staff in a confidential space provided by the school. Ethics approval for this study was obtained from the relevant hospital and school research ethics boards where the research was conducted. Further details of the REAL study are provided via the Open Science Framework (OSF) protocol: https://doi.org/10.31219/osf.io/x6wyt .

Current study participants were recruited from the REAL 2.0 study which is a 15-year follow-up study that was launched in June 2023 to examine how eating disorder thoughts, attitudes and behaviours experienced in adolescence influence eating disorder and mental health in early adulthood. Original participants from REAL who consented (n = 912) were re-contacted via phone, email, and social networking site (SNS) outlets to participate in a 15-year follow-up study. A total of 591 (64.8%) were successfully re-contacted, and 270 of those participated in the study (45.7%). REAL 2.0 participants were asked to complete a battery of 22 well-validated questionnaires electronically and were compensated $50 for their participation. Where possible, measures used in the original REAL study that remained developmentally appropriate were retained in the 15-year follow-up. REAL 2.0 was approved by the hospital-on-record research ethics board.

Measures

Disordered Eating Behaviours. Disordered eating behaviours were measured using the 33-item Dutch Eating Behaviour Questionnaire (DEBQ; van Strien et al., 1986; see Appendix A). The DEBQ contains three subscales: restrictive eating, emotional eating, and external eating. Restrictive eating and emotional eating subscales were used for this study. Consistent with previous REAL studies (e.g., Mougharbel et al., 2020), external eating demonstrated low internal consistency and was omitted from the analysis. The restrictive eating subscale contains 10 items (e.g., "Do you try to eat less at mealtimes than you would like to eat?") that measure the degree to which the participant restricts their food intake. The emotional eating subscale contains 13 items (e.g., "Do you have a desire to eat when you are emotionally upset?") that measure the participant's food consumption as a means of comfort or coping with stressful situations. Participants answered each question on a 5-point Likert scale ranging from 1 (never) to 5 (very often). The total subscale score is obtained by averaging the responses to the items within the subscale. A higher score reflects more disordered eating. Among adults, restrictive and emotional eating demonstrated good internal consistency (coefficient alpha = .93 and .96) in the current study.

Perceived Family Adaptability and Cohesion. Perceived family cohesion and adaptability were measured using the Family Adaptability and Cohesion Evaluation Scales (FACES II; Olson et al., 1982; see Appendix B), a 30-item questionnaire, rated on a 5-point Likert scale from 1 (almost never) to 5 (almost always). FACES II contains two subscales: family cohesion and family adaptability. The family cohesion subscale contains 16 items (e.g., "My family members consult other family members on their decisions") and measures the degree of support, connectedness, and acceptance in one's family. The family adaptability subscale

contain 14 items (e.g., “When problems arise, we compromise”) and measure the ability of the family to function and to remain stable in the face of changes in the family environment. Summed scores (ranging from 10 to 50) are obtained for each subscale, with higher scores indicating greater family adaptability and cohesion. The FACES II scale has sound internal consistency (coefficient alpha = .88 and .83) in the current sample.

Frequency of Family Meals. The Attitudes and Patterns of Eating questionnaire (APE; Baillot et al. 2012; see Appendix C) is a 29-item questionnaire that measures French and American adolescent eating habits and attitudes towards foods. In this study, question 29: “Do you eat regular meals with your family at home, sitting at the table together?” was used to assess the frequency of family meals. Participants responded to this question from 1 (never to a few times a year) to 5 (2 or more times a day). APE has demonstrated adequate internal consistency in youth samples (coefficient alpha = .68; Baillot et al. 2012).

Parental Weight-Based Comments. Weight-based comments from parents were measured using a weight-based teasing subscale from the McKnight Risk Factor Scale IV (MRFS-IV; McKnight Investigators, 2003; Shisslak et al., 1999; see Appendix D). It is a 2-item subscale used to assess comments about participants’ weight from their parents. Weight-based comments from mothers were assessed with one item (i.e., “has your mother made a comment to you about your weight or your eating that made you feel bad?”) and comments from fathers were assessed with a similar item. Participants rated each item on a 5-point Likert scale, with endpoints ranging from 1 (never) to 5 (always). Higher mean scores indicated a greater emphasis on weight-based comments. This subscale has demonstrated adequate internal consistency (coefficient alpha = .77 and AIC = .63) in the current study.

Body Esteem Scale for Adolescents and Adults. The Body Esteem Scale for Adolescents and Adults (BESAA; Cecil & Stanley, 1997; Mendelson et al., 2001; see Appendix E) is a 23-item scale, rated on 5-point Likert scale, with endpoints of 0 (never) to 4 (always). The BESAA assesses three areas of body esteem: *appearance esteem* (i.e., general feelings regarding appearance), *weight esteem* (i.e., satisfaction with their weight), and *attribution* (i.e., external evaluations from others about one's body and appearance). Higher scores reflect positive judgement and values about the body. The BESAA demonstrated good internal consistency (coefficient alpha = .86 and .85) in the current study

Body Mass Index (BMI; kg/m2). In order to calculate BMI, anthropometric measures were collected in person during the original REAL questionnaire period. A trained research assistant took participants height using a stadiometer (Seca; model 217; Ontario, Calif.) measured to the nearest 0.1 in centimeters. This was subsequently converted to meters (m). Participants weight was obtained by a digital scale (Health o meter; model 830KL; Bridgeview, Ill.) and was recorded in kilograms (kg). Participants BMI was then calculated (kg/m^2). BMI data in REAL 2.0 was self-reported. Self-reported and measured BMI have been highly correlated in previous studies (r = 0.87–0.92; Olfert et al., 2018) in young adult populations.

Socioeconomic Status (SES). Parental education is a 2-item scale that was used as a proxy for SES (see Appendix F). Self-reported parental education of mothers and fathers separately was assessed with one item (e.g., "how much school has your mother had?") where participants selected whether their mother or father 1) didn't finish high school, 2) finished high school, 3) attained college or university degree, or 4) did not know. The level of agreement between self-reported parental education and actual education has been reported to be fair (k = 0.

30 to 0.38; Lien et al., 2001) and has been significantly correlated with SES ($p < .05$; Aarø et al., 2009) in adolescent populations. The highest level of parental education was also used as a proxy in previous REAL studies (Obeid et al., 2018; Valois et al., 2019).

Covariates.

In the current study, we controlled for the effects of five covariates measured at baseline as they were found to influence disordered eating behaviours in previous REAL studies (Goldfield et al., 2011; Obeid et al., 2018; Valois et al., 2019). First, weight and appearance esteem (i.e., body esteem) have been consistently linked with disordered eating during adolescence (Baceviciene & Jankauskiene, 2020; Stice, 2002; Tabri et al., 2015). Second, higher BMI is consistently linked with fewer family meals (Goldfield et al., 2011), more weight-based comments (Hooper et al., 2021) and greater levels of disordered eating (Neumark-Sztainer et al., 2008). Third, researchers also controlled for age to isolate the effects of family meals and parental weight-based comments on disordered eating (Hooper et al., 2021; Neumark-Sztainer et al., 2008). Fourth, individuals with lower SES exhibit greater levels of disordered eating than those with higher SES (Burke et al., 2023; Larson et al., 2021). Fifth, several studies have found differences in family meals, weight-based comments, family adaptability and cohesion between adolescent males and females (Goldfield et al., 2011; Harrison et al., 2015; Neumark-Sztainer et al., 2008). Sex was explored by 1) including it as a covariate in the proposed and alternative models, and 2) when merited, running female-only analyses given the available sample size (n=183) to run adequately powered models.

Analysis Plan

The data were cleaned by examining for outliers, insufficient effort responding, and assumptions including normality, homoscedasticity, linearity, and multicollinearity (Tabachnick & Fidell, 2012) using R Studio (R Core Team, 2024). Missing data was assessed, and the appropriate data imputation method was utilized (i.e. expectation maximization algorithm; Moon, 1996). Descriptive statistics were reported on the demographic variables (e.g., age, ethnicity) to summarize the study sample at baseline and follow-up. Chi-square analyses were used to examine potential differences in demographic characteristics between the original REAL participants who participated in REAL 2.0 (N = 269) and the remaining participants in the longitudinal sample (N = 643) at time 1, for gender, ethnicity, and SES (proxied by parental education).

Path analysis and procedures established by Preacher and Hayes (2008) were used to test the direct and indirect relationships between behavioural factors of family meals and weight-based comments and the relational factors of family adaptability and cohesion on disordered eating patterns in MPlus. Path analysis is best suited to simultaneously test models with observed variables (i.e., multiple independent, mediation, and dependent variables) for relationships examining multiple mediation pathways (Meehl & Waller, 2002).

The REAL 2.0 sample included 270 responses. A sample size of 200 or more participants (Kline 2016) is appropriate for path analysis models at an alpha level of 0.05. Referring to Bentler and Chou's (1987) rule of thumb that sample size should be at least five times the number of parameters to be estimated, the model includes 11 observed variables (family meals, parental weight-based comments, family adaptability, family cohesion, restrictive eating, emotional eating, age, BMI, body esteem, SES, and gender). This model estimates a maximum

of 29 free parameters, including variances, covariances, and error terms. With the addition of five control variables pointing only to the dependent variables, the required sample size would be 145 participants to ensure model identifiability and stability. Bias-corrected bootstrap with 5000 iterations methodology (two-sided 95% CI) was used to detect mediation effects (Carrión et al., 2017). Model fit was assessed using the following indices and cutoff values– all of which are less affected by sample size and commonly referenced in literature: a comparative fit index (CFI) of .90 or greater, a non-normative fit index (NNFI) of .95 or greater (Kline, 2016) a root mean square error of approximation estimates (RMSEA) lower than .07 (Steiger, 2007), a standardized root mean square residual (SRMR; Hu & Bentler, 1995) of .08 or lower (Bryan et al., 2007). Alternative models (see Figure 1 and Figure 2) will be compared using Akaike information criterion (AIC; Akaike, 1987) and Bayesian information criterion (BIC; Schwarz, 1978) fit indices, with lower scores on both AIC and BIC representing a better fitting model. Post hoc analyses were conducted following the testing of the original alternative models and hypotheses. Modification indices indicated by a stringent modification index (MI) cut off at 10 (Tabachnick & Fidell, 2012) were examined to identify model parameters that, if freely estimated, could improve model fit.

Results

Of the 270 participants that completed the survey, 269 participants were included in the subsequent analyses. One participant was excluded as their original time point could not be found. Participants in the REAL 2.0 sample were 183 (68%) females and 80 (29.7%) males, ranging in age from 26 to 33 years (M = 28.64, SD = 1.47). The majority of participants self-identified as White (79.9%), heterosexual (77.3%), and having completed a college or university degree (60.6%). See Table 1 for more details.

Chi-square analyses indicated that there were significant differences between the REAL 2.0 participants who consented and provided data at T1 (N = 269) and the participants who consented but did not provide data at T2 (N = 643). Significant differences included gender (χ^2 (2) = 13.71, p = .001, Cramér's V = .12) and parental education (χ^2 (4) = 28.71, p < .001, Cramér's V = .18). All effects were small in magnitude. The sample that consented and provided data at T1 and T2 had a higher proportion of females and reported higher levels of both parents with a college education compared to those who consented and did not provide data at T2.

Table 1

Sociodemographic Characteristics of Participants Who Provided Data at T1 and T2 (N = 269)

Baseline characteristic	Original Real (T1)	REAL 2.0 (T2)
Gender	*n* (%)	n (%)
Female	188 (69.9)	183 (68)
Male	81 (30.1)	80 (29.7)
Non-binary	-	3 (1.1)
Transgender	-	1 (.4)
Other	-	2 (.7)
Ethnic/ Racial Identity	*n* (%)	*n* (%)
White/ European	206 (76.6)	215 (79.9)
Black	7 (2.6)	6 (2.2)
Asian	21 (7.8)	15 (5.6)
Middle Eastern	14 (5.2)	7 (2.6)
Indigenous	4 (1.5)	2 (.7)
Hispanic	5 (1.9)	1 (.4)
Other backgrounds	12 (4.5)	23 (8.6)

Sexual Identity	*n* (%)	*n* (%)
Heterosexual	-	208 (77.3)
Lesbian/Gay	-	10 (3.7)
Bisexual	-	42 (15.6)
Other	-	8 (3.0)
Skip	-	1 (.4)
Age	M (SD)	M (SD)
	13.47 (1.07)	28.64 (1.47)
BMI (kg/m2)	M (SD)	M (SD)
	20.85 (4.14)	26.25 (6.61)
Income	*n* (%)	*n* (%)
Less than 5,000 to 35,000	-	12 (4.6)
35,000 – 50,000	-	26 (9.7)
50,000 – 75,000	-	57 (21.2)
75,000 – 100,000	-	47 (17.5)
100,000 – 150,000	-	54 (20.1)
150,000 – 200,000	-	35 (13)
Greater than 200,000	-	28 (10.4)
Prefer not to respond	-	10 (3.7)
Education	*n* (%)	*n* (%)
Did not complete high school	-	3 (1.1)
High school diploma	-	23 (8.6)
College or university degree	-	163 (60.6)
Graduate degree	-	77 (28.6)
Other	-	3 (1.1)
Parental Education	*n* (%)	*n* (%)

Both parents completed college	164 (61)	-
One parent completed college	56 (20.8)	-
Neither parent completed college	17 (6.3)	-
Unknown	32 (11.9)	-
Marital Status	*n* (%)	*n* (%)
Single	-	90 (33.5)
Married	-	43 (16)
Common Law	-	64 (23.8)
Living with partner (not common law)	-	31 (11.5)
Not living with partner	-	40 (14.9)
Separated	-	1 (.4)
Children	*n* (%)	*n* (%)
Yes	-	31 (11.5)
No	-	237 (88.1)
Did not disclose	-	1 (.4)
Number of Children	*n* (%)	*n* (%)
One	-	18 (6.7)
Two	-	12 (4.5)
Three	-	1 (.4)
Not Applicable	-	238 (88.5)

Note. REAL 2.0 participants who had data points at both T1 and T2 (N = 269) who were included in the path analysis.

Relationships between Family Functioning and Disordered Eating

Correlations statistics are reported in Table 2. Parental weight-based comments were negatively associated with family cohesion and family adaptability and positively associated

with emotional eating. The correlations were small and ranged from -.20 to .14. Family meals were positively associated with family cohesion and family adaptability. The correlations were small to moderate and ranged from .17 to .27. Family cohesion was positively associated with family adaptability and the correlation was large, .72. Restrictive and emotional eating were positively associated, with a large correlation of .44. Correlation statistics for females and males separately are found in Supplementary Materials.

Table 2

Descriptive Statistics and Correlations for Study Variables (n = 269)

Variable	*M (SD)*	1	2	3	4	5	6	7	8	9	10	11
1. Parental weight-based comments	.44 (.72)	–	.03	**-.14***	**-.20****	.10	**.14***	**-.35****	**-.42****	**.25****	**.33****	-.08
2. Family meals	3.74 (1.02)	–	–	**.17****	**.27****	.02	-.08	**.15***	**.20****	**-.22****	**-.19****	**.16***
3. Family cohesion	49.45 (9.47)	–	–	–	**.72****	-.07	-.11	**.22****	**.18****	-.11	-.03	**.19****
4. Family adaptability	34.87 (7.37)	–	–	–	–	-.05	-.08	**.34****	**.31****	**-.15***	-.07	**.19****
5. Restrictive eating	2.38 (.82)	–	–	–	–	–	.44**	**-.24****	**-.26****	**.21****	-.03	.03
6. Emotional eating	2.45 (.96)	–	–	–	–	–	–	**-.26****	**-.26****	**.23****	-.05	-.06
7. Appearance esteem	2.46 (.80)	–	–	–	–	–	–	–	**.72****	**-.30****	**-.16***	.03
8. Weight esteem	2.85 (.84)	–	–	–	–	–	–	–	–	-.48**	**-.16****	.06
9. BMI	20.85 (4.14)	–	–	–	–	–	–	–	–	–	**.22****	-.05
10. Age	13.47 (1.07)	–	–	–	–	–	–	–	–	–	–	.11
11. Parental education	2.32 (1.0)	–	–	–	–	–	–	–	–	–	–	–

Note. Parental weight-based comments end points ranged from 0 to 3. Family meals end points ranged from 1 to 5. Family cohesion total scores ranged from 26 to 73 and family adaptability total scores ranged from 17 to 53. Restrictive and emotional eating end points ranged from 1 to 5. Appearance and weight esteem end points ranged from 0 to 4. Parental education end points ranged from 0 to 3. Age and BMI were continuous variables.

Notes. $^{**}p < .01$, two- tailed. $^{*}p < .05$, two tailed. Parental weight-based comments, family meals, family cohesion, family adaptability, appearance esteem, weight esteem, Body Mass Index (BMI), age, and parental education were measured at baseline (T1). Restrictive and emotional eating were measured 15-years later (T2).

Proposed and Alternative Model Fit

In both the proposed (M1) and alternative (M2) models, exogenous variables included restrictive eating and emotional eating at time 2, while endogenous variables comprised family meals, parental weight-based comments, family adaptability, and family cohesion at time 1. Sex, BMI, appearance esteem, and weight esteem were included as covariates, while age and SES (proxied by parental education) at time 1 were removed due to non-significant correlations with the outcome variables of restrictive and emotional eating.

When examining the model fit of both M1 and M2, the variance inflation factor (VIF) ranged from 1.25 to 1.03, which did not exceed the standard value of 10. The tolerance ranged from 0.36 to 0.97, which was larger than the 0.10 cut-off, indicating no multicollinearity among the study variables**.** Overall, testing of M1 did not provide good fit to the data, χ^2 (8) = 52.81, p < .001, CFI = .89, RMSEA = .15 [.11, .19]. M2 also did not provide adequate fit to the data χ^2 (17) = 136.09, p < .001, CFI = .34, RMSEA = .16 [.14, 0.19]. See Table 3 for model fit statistics. Given the poor model fit of M2, no further analyses are reported here (see supplementary materials for model exploration), and a modified model was sought with M1. M1 was retained for modification because it was more consistent with the underlying theoretical framework as proposed in Figure 1, guiding the study, and had lower AIC and BIC values than M2.

Table 3

Fit statistics from the path analysis of M1 and M2 (n = 269)

Model	χ^2 (*df*)	CFI	NNFI	RMSEA	SRMR	AIC	BIC
1	52.81(8)*	.89	.57	.15	.09	4766.87	4874.04
2	136.09 (17)*	.34	.00	.16	.16	6210.40	6332.49

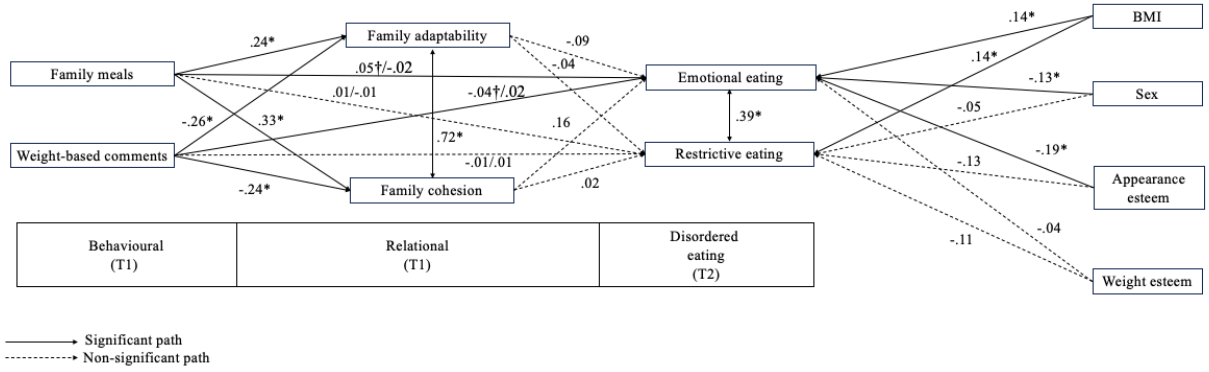
Note. M1 is represented by 1 and M2 is represented by 2. CFI = Comparative Fit Index; NNFI = Non-normative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; *p < .001.

Direct, Indirect, and Total Effects of the Proposed Model (M1)

Despite the poor model fit, twenty-five paths were estimated in the proposed model to examine the direct and indirect effects among key study variables, as shown in Figure 3.

Figure 3

Standardized Estimates of Model (M1) of Behavioural Factors (T1) and their Impact on Disordered Eating in Adulthood (T2) via Relational Factors (T1).



Note. T1 is referred to as data collected at baseline during adolescence. T2 refers to data collected during the 15-year follow-up period in adulthood. All covariates were controlled at T1.

*Significant at the 95% confidence interval range not including *0.* † Marginally significant at the 95% confidence interval range at exactly +/-0. All beta coefficients before the slash represent family cohesion while those after the slash represent family adaptability.

In the proposed model, family meals had a significant positive direct effect on family adaptability (β = .24, 95% CI [.15, .33], SE = .06) and family cohesion (β = .33, 95% CI [.24, .41], SE = .05). Parental weight-based comments had a negative direct effect on family adaptability (β = −.26, 95% CI [−.35, −.16], SE = .06) and family cohesion (β = −.24, 95% CI [−.34, −.14], SE = .06). Family adaptability had a positive direct effect on family cohesion (β = .72, 95% CI [.66, .76], SE = .03) and emotional eating had a positive direct effect on restrictive eating (β = .39, 95% CI [.29, .48], SE = .06). Family meals had a marginal, positive indirect effect on emotional eating (β = .05, 95% CI [.00, .11], SE = .03), whereas weight-based comments had a marginal negative indirect effect (β = −.04, 95% CI [−.09, −.00], SE = .03) via family cohesion (see Table 4).

Table 4

Standardized direct, indirect, and total effect coefficients of the Proposed Model

Endogenous variables	Predicting variables	Direct effect			Indirect effect[a]			Indirect effect[b]			Total effect		
		β	95% CI	SE	β	95% CI	SE	β	95% CI	*SE*	β	95% CI	SE
Family adaptability	Family meals	.24	.15, .33	.05	—	—	—	—	—	—	—	—	—
	Weight-based comments	-.26	-.35, -.16	.06	—	—	—	—	—	—	—	—	—
Family cohesion	Family meals	.33	.24, .41	.05	—	—	—	—	—	—	—	—	—
	Weight-based comments	-.24	-.33, -.14	.06	—	—	—	—	—	—	—	—	—
	Family adaptability	.72	.67, .77	.03	—	—	—	—	—	—	—	—	—
Emotional eating	Family meals	-.03	-.14, .09	.07	-.02	-.06, .01	.02	.05	.00, .11	.03	.00	-.10, .11	.07
	Weight-based comments	.01	-.11, .14	.08	.02	-.01, .07	.02	-.04	-.09, -.00	.03	-.00	-.12, .13	.08

	Family adaptability	-.09	-.24, .06	.09	—	—	—	—	—	—	—	—	—
	Family cohesion	.16	-.00, .32	.10	—	—	—	—	—	—	—	—	—
	Sex	-.13	-.23, -.04	.06	—	—	—	—	—	—	—	—	—
	BMI	.14	-.01, .28	.08	—	—	—	—	—	—	—	—	—
	Appearance esteem	-.19	-.34, -.03	.09	—	—	—	—	—	—	—	—	—
	Weight esteem	-.04	-.21, .12	.09	—	—	—	—	—	—	—	—	—
	Restrictive eating	.39	.29, .48	.06	—	—	—	—	—	—	—	—	—
Restrictive eating	Family meals	.06	-.03, .19	.07	-.01	-.05, .02	.02	.01	-.05, .06	.03	.09	-.02, .19	.06
	Weight-based comments	-.05	-.18, .08	.08	.01	-.03, .05	.02	-.01	-.04, .03	.02	-.04	-.18, .09	.08
	Family adaptability	-.04	-.18, .10	.09	—	—	—	—	—	—	—	—	—

Family cohesion	.02	-.14, .20	.10	—	—	—	—	—	—	—	—	—
Sex	-.06	-.15, .04	.06	—	—	—	—	—	—	—	—	—
BMI	.14	.02, .25	.07	—	—	—	—	—	—	—	—	—
Appearance esteem	-.11	-.24, .03	.08	—	—	—	—	—	—	—	—	—
Weight esteem	-.12	-.28, .03	.10	—	—	—	—	—	—	—	—	—

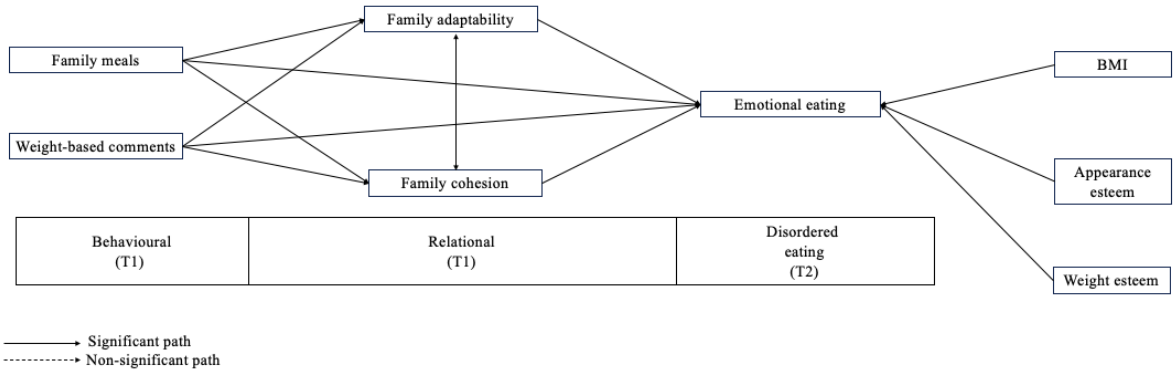
Note. CI = confidence intervals. 95% Confidence intervals were obtained via bias corrected bootstrapping = 5000. Sex, Body Mass Index (BMI), appearance esteem, and weight esteem were included as covariates. [a]Indirect effect via family adaptability. [b]Indirect effect via family cohesion.

Proposed Model (M1) Fit Statistics Among Females Only

Given the poor fit of the proposed model and known sex differences in the study parameters, the proposed model M1 was re-examined in a female-only sample (n=188) to determine whether it would provide a better fit to the data. Additionally, restrictive eating was not significantly correlated with any of the predictor variables (magnitudes ranged from -.07 to .10, ps > .05) and was subsequently removed to reduce any potential effects of model overfitting (See Figure 4; M3). Among females, M1 did not provide good fit to the data, $\chi 2$ (6) = 39.50, p < .001, CFI = .88, RMSEA = .17 [.13, .23]; however, model fit statistics improved. Model fit statistics with M3 did not improve after removing restrictive eating (See Table 6). Given the poor model fit, these models among females were not reported nor explored any further.

Figure 4

Alternative Proposed Model (M3) of Behavioural Factors (T1) and their Impact on Emotional Eating in Adulthood (T2) via Relational Factors (T1) among Females Only.



Note. T1 is referred to as data collected at baseline during adolescence. T2 refers to data collected during the 15-year follow-up period in adulthood. All covariates were controlled at T1.

Table 6

Fit statistics from the path analysis of M2 and M3 among females (n = 188)

Model	χ^2 (*df*)	CFI	NNFI	RMSEA	SRMR	AIC	BIC
1	39.50(6)*	.88	.47	.17	.11	3409. 46	3499.63
2	39.50(6)*	.86	.58	.17	.13	2977.39	3035.36

Note. Model 1 tests M1 among females. Models 2 tests the female-only M3 with restrictive eating removed as an outcome variable. CFI = Comparative Fit Index; NNFI = Non-normative Fit Index; RMSEA = Root Mean; Square Error of Approximation; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; *p < .001.

Post hoc Analyses

Modification Indices and Model Fit for Proposed Model

In an attempt to improve the model fit of the proposed model (M1) in the full sample (N = 269), modification indices (MI) produced by the Mplus program were examined. We used a stringent MI cut off of 10 (Tabachnick & Fidell, 2012). Modification indices and standardized expected parameter changes (EPC) suggested adding direct paths from restrictive eating (MI = 11.77, Standardized EPC = −.47), appearance esteem (MI = 17.78, Standardized EPC = .18) and weight esteem (MI = 13.36, Std EPC = .16) to family cohesion. Covariance between parental weight-based comments and family cohesion also had high MI and EPC scores (MI=15.37 and Std EPC = .34) and accordingly, a direct path was also added here and is referred to as model 4 (M4). Based on the literature, previous research suggests some evidence for the role of

appearance and weight esteem on both family adaptability and cohesion (KavehFarsani, 2020), and so direct paths were also added here as a second step, and is referred to as model 5 (M5). Model fit indices suggested a better fit to the data of M4 $\chi 2$ (6) = 32.26, p < .001, CFI = .94, RMSEA = .14 [.09, .17], but not all fit indices met the thresholds for good model fit. Fit indices suggested excellent fit to the data of M5 $\chi 2$ (4) = 7.00, p = .136, CFI = .99, RMSEA = .05 [.00, .12] (See Table 7).

Table 7

Post hoc model fit statistics from the path analysis of the proposed model (N = 269)

Model	χ^2 (*df*)	CFI	NNFI	RMSEA	SRMR	AIC	BIC
M4	32.26(6)*	.94	.68	.14	.07	4749.32	4863.63
M5	7.00(4)	.99	.94	.05	.02	4729.06	4850.51

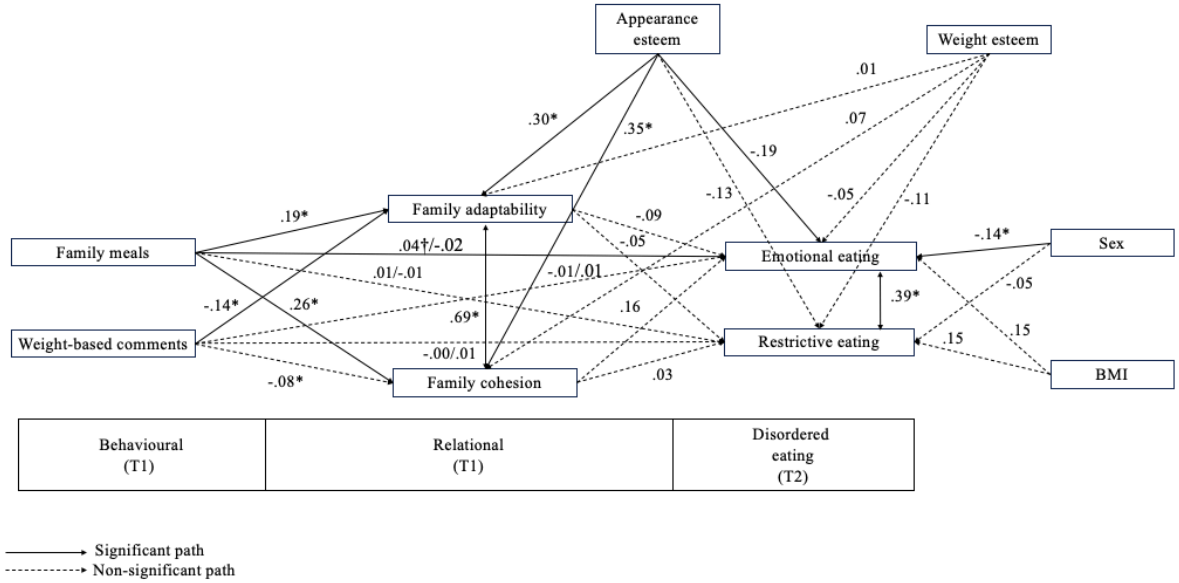
Note. M4 tests appearance and weight esteem on family cohesion. M5 tests appearance and weight esteem on family cohesion and family adaptability. CFI = Comparative Fit Index; NNFI = Non-normative Fit Index; RMSEA = Root Mean; Square Error of Approximation; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; *p < .001.

M5 Direct, Indirect, and Total Effects

In M5, exogenous variables were restrictive eating and emotional eating in adulthood, and endogenous variables were family meals, parental weight-based comments, family adaptability, and family cohesion in adolescence. Sex, BMI, appearance esteem, and weight esteem were included as covariates. Direct pathways of appearance and weight esteem were added to family adaptability and family cohesion during adolescence. See Figure 5.

Figure 5

Standardized Estimates of M5 of Behavioural Factors (T1) and their Impact on Disordered Eating in Adulthood (T2) via Relational Factors (T1)



Note. T1 refers to data collected at baseline during adolescence. T2 refers to data collected during the 15-year follow-up period in adulthood. All covariates were controlled at T1. *Significant at the 95% confidence interval range not including *0. †* Marginally significant at the 95% confidence interval range at exactly +/-0. All beta coefficients before the slash represent family cohesion and values after the slash represents family adaptability.

Family meals and appearance esteem had a positive direct effect on family adaptability and family cohesion (see Table 8). Magnitudes ranged from .19 to .69. Parental weight-based comments had a negative direct effect on family adaptability (β = −.14, 95% CI [-.25, -.04], SE = .06). Family meals had a marginal, positive indirect effect on emotional eating in adulthood (β = .04, 95% CI [.00, .09], SE = .03) via family cohesion in adolescence. Indirect effects on

restrictive eating were not significant (ps > .05). The endogenous variables (behavioural and relation factors and covariates) accounted for 12.3% of the variance in emotional eating and 9.1% in restrictive eating. Overall, post hoc analyses revealed that only family cohesion marginally mediated the relationship between family meals and emotional eating in adulthood.

Table 8

Standardized direct, indirect, and total effect coefficients of Post Hoc Proposed Adjusted Model (N = 269)

Endogenous variables	Predicting variables	Direct effect			Indirect effect[a]			Indirect effect[b]			Total effect		
		β	95% CI	SE	β	95% CI	SE	β	95% CI	*SE*	β	95% CI	SE
Family adaptability	Family meals	.19	.10, .28	.06	—	—	—	—	—	—	—	—	—
	Weight-based comments	-.14	-.25, -.04	.06	—	—	—	—	—	—	—	—	—
	Appearance esteem	.30	.15, .45	.09	—	—	—	—	—	—	—	—	—
	Weight esteem	.01	-.14, .15	.09	—	—	—	—	—	—	—	—	—
Family cohesion	Family meals	.26	.17, .34	.05	—	—	—	—	—	—	—	—	—
	Weight-based comments	-.08	-.18, .02	.06	—	—	—	—	—	—	—	—	—
	Family adaptability	.69	.62, .74	.04	—	—	—	—	—	—	—	—	—
	Appearance esteem	.35	.21, .47	.08	—	—	—	—	—	—	—	—	—

	Weight esteem	.07	-.07, .21	.08	—	—	—	—	—	—	—	—	—
Emotional eating	Family meals	-.03	-.15, .09	.07	-.02	-.05, .01	.02	.04	.00, .09	.03	-.00	-.11, .11	.07
	Weight-based comments	.01	-.11, .14	.08	.01	-.00, .05	.02	-.01	-.05, .00	.01	.01	-.10, .14	.08
	Family adaptability	-.09	-.24, .06	.09	—	—	—	—	—	—	—	—	—
	Family cohesion	.16	-.00, .33	.10	—	—	—	—	—	—	—	—	—
	Sex	-.14	-.23, -.04	.06	—	—	—	—	—	—	—	—	—
	BMI	.15	-.01, .28	.09	—	—	—	—	—	—	—	—	—
	Appearance esteem	-.19	-.34, -.03	.09	—	—	—	—	—	—	—	—	—
	Weight esteem	-.05	-.21, .12	.10	—	—	—	—	—	—	—	—	—
	Restrictive eating	.39	.29, .48	.06	—	—	—	—	—	—	—	—	—

Restrictive eating	Family meals	.09	-.02, .19	.06	-.01	-.04, .02	.02	.01	-.04, .05	.03	.09	-.02, .19	.06
	Weight-based comments	-.05	-.18, .09	.08	.01	-.01, .03	.01	-.00	-.03, .01	.01	-.05	-.17, .09	.08
	Family adaptability	-.05	-.18, .11	.09	—	—	—	—	—	—	—	—	—
	Family cohesion	.03	-.14, .19	.10	—	—	—	—	—	—	—	—	—
	Sex	-.05	-.15, .04	.06	—	—	—	—	—	—	—	—	—
	BMI	.15	.02, .26	.07	—	—	—	—	—	—	—	—	—
	Appearance esteem	-.13	-.27, .02	.09	—	—	—	—	—	—	—	—	—
	Weight esteem	-.11	-.29, .05	.10	—	—	—	—	—	—	—	—	—

Note. CI = confidence intervals. 95% Confidence intervals were obtained via bias corrected bootstrapping =5000. Sex, Body Mass Index (BMI), appearance esteem, and weight esteem were included as covariates. [a]Indirect effect via family adaptability. [b]Indirect effect via family cohesion.

Discussion

Previous research examined some behavioural and relational factors of family functioning during adolescence and its impact on disordered eating in adulthood (Haines et al., 2010; Neumark-Sztainer et al., 2010). This study attempted to go further by examining how protective behavioural factors of family meals and fewer weight-based comments from parents during adolescence influenced disordered eating behaviours in early adulthood through relational factors–family cohesion and family adaptability. It also explored whether relational factors of family cohesion and adaptability during adolescence explain disordered eating behaviours in early adulthood through their influence on family meals and weight-based comments in a comprehensive model. Both hypothesized models (M1 and M2) were not supported; however, a post-hoc modified model (M5), suggested that appearance esteem was associated with both family cohesion and adaptability during adolescence. A marginally significant indirect effect was also observed, suggesting that family cohesion may partially mediate the association between family meals during adolescence and emotional eating in adulthood once appearance esteem was controlled. The strength of this mediation may vary depending on levels of appearance esteem during adolescence, raising the possibility of a moderated mediation process. In this context, appearance esteem may not only directly influence family functioning during adolescence but may also influence the extent to which relational factors mediate the impact of behavioural protective factors on disordered eating outcomes in adulthood.

While studies examined behavioural and relational aspects of family functioning on disordered eating, few have examined the effects of family meals, weight-based comments, family adaptability and family cohesion during adolescence on disordered eating in adulthood in a comprehensive model. Contrary to previous studies (López-Gil et al., 2024), higher levels of

family meals during adolescence were not associated with lower levels of restrictive or emotional eating in adulthood (H1), nor were lower levels of weight-based comments during adolescence directly associated with emotional or restrictive eating (H2). Neither behavioural nor relational factors predicted restrictive eating 15-years later. Prior research highlighted gender differences (Harrison et al., 2015; López-Gil et al., 2024; Puhl et al., 2017), with females showing stronger protective associations between family meals and disordered eating and reported higher levels of parental weight-based comments, suggesting a potential female-specific relationship that could impact the model.

The non-significant associations may be explained by the 15-year gap between the behavioural and relational factors during adolescence and disordered eating in adulthood. Temporal patterns may weaken over time as disordered eating behaviours fluctuate in adulthood. Additionally, the protective influence of early familial factors during adolescence may not persist into early adulthood, as individuals undergo new developmental challenges and are exposed to novel social and environmental influences that may shape eating behaviours, including having family meals with their own children and family. Further, previous longitudinal studies (e.g., Haines et al., 2010; Neumark-Sztainer et al., 2007) utilized larger sample sizes, shorter data collection frame (i.e., 3-5 years) different analytic methods and self-report questionnaires to measure similar constructs (e.g., disordered eating), which may also help explain the differing findings from the current study.

Exploration of Female-only Relationships

The first model, M1, was run among females as prior research suggested that family meals (López-Gil et al., 2024) and fewer weight-based comments (Puhl et al., 2017) are more

protective for adolescent females than males. Although the model fit improved in the sample of females, overall, the model still demonstrated a poor fit to the data, which may be attributed to the small sample size (N = 188), the loss of temporal patterns over the 15-year period, or model overfitting. This suggests that this model may not reflect associations specifically for females, which led us to continue analyses with the full sample.

The Role of Emotional Eating among Females

In model M3, behavioural and relational aspects of family functioning during adolescence was associated with emotional eating in adulthood, but not with restrictive eating. This aligns with prior research showing that restrictive eating tends to decline from adolescence into adulthood, as individuals increasingly turn to emotional eating to cope with stress and negative affect (Haedt-Matt & Keel, 2011; Simone et al., 2022). Restrictive eating has also been linked more strongly to individual-level traits, such as perfectionism and low self-esteem, than to family functioning (Neumark-Sztainer et al., 2011). According to the sociocultural model (Thompson, 1999), pressures to attain unrealistic body ideals are transmitted through family, peers, and media, contributing to body dissatisfaction and disordered eating (Rodgers et al., 2022). However, while familial factors play a key role during adolescence, their influence on restrictive eating in adulthood may weaken over time as broader sociocultural forces—such as media exposure and peer norms—become more dominant (Rodgers et al., 2011). Taken together, these findings suggest that familial factors during adolescence may be more strongly linked to emotional eating than to restrictive eating in adulthood.

Although overfitting was initially considered a possible explanation for the poor model fit, excluding restrictive eating among females did not lead to substantial improvement,

indicating that overfitting may not be the primary issue. Additionally, 12.3% of the variance in emotional eating and 9.1% in restrictive eating was accounted for at time 2, a small effect. One possible explanation is that the model did not capture key influences on emotional or restrictive eating in adulthood, which may be shaped by a broader range of individual factors during adolescence—including depressive symptoms, stress, self-esteem, coping styles, or peer influences—that were not included. For example, one study found that high self-esteem and lower depressive symptoms during adolescence predicted fewer binge eating behaviours in adulthood (Goldschmidt et all., 2014). Cross-sectional evidence also suggests that mild stress and depressive symptoms are strongly associated with emotional eating outcomes during adolescence (Sze et al., 2021). Additionally, developmental changes over the 15 years, combined with a modest sample size, may have contributed to instability in the model. Thus, this revised model was also rejected, and post hoc analyses were conducted to identify alternative specifications using modification indices.

Post Hoc Analyses of M5

In M5, model fit significantly improved following post hoc modifications that added direct paths from appearance and weight esteem to family adaptability and family cohesion in adolescence (Figure 5). However, only appearance esteem showed significant positive associations with both family adaptability and family cohesion during adolescence. These findings suggest that adolescents' self-perceptions of their physical appearance may be meaningfully related to how they experience and perceive these family dynamics. This aligns with Family Systems Theory (Minuchin, 1985; Whitchurch & Constantine, 1993), which emphasizes the reciprocal influence between individual-level self-concept (e.g., body esteem)

and family-level relational functioning. For instance, one study found that high school students who report higher body-esteem also report greater support, flexibility, and emotional closeness within the family (KavehFarsani, 2020), which is similar to the present findings.

These associations can also be contextualized through Attachment Theory (Bowlby, 1969), which argues that internal working models of the self, shaped by early relational experiences, influence how individuals perceive and engage in close relationships. Adolescents with higher body esteem—reflecting a more positive self-concept—may be more likely to experience their families as emotionally cohesive and responsive to change. This aligns with evidence suggesting that individuals with a more secure attachment orientation often report greater self-worth and body image (Pinquart, 2023) and stronger family connectedness and adaptability (Kaveh Farsani, 2020). As such, appearance esteem may be related to how adolescents experience their family dynamics, particularly in terms of emotional closeness and flexibility. While direct effects of family functioning variables during adolescence on disordered eating in adulthood were largely non-significant, these nuanced associations point toward the importance of considering appearance esteem as a contributor to family relational processes during adolescence and subsequent eating behaviours in adulthood. In M5, a marginally significant positive indirect effect of family meals during adolescence on emotional eating in adulthood was mediated by family cohesion in adolescence; however, the effect was small and potentially attributable to measurement error.

Although the hypothesized model (M1) did not achieve good fit despite multiple iterations—including subgroup analyses, the removal of uncorrelated variables, and theory-driven post hoc adjustments—the findings of the post hoc model (M5) provide insight into potential developmental process that may influence disordered eating in adulthood. Notably, we

learned that appearance esteem emerged as significantly related to both family adaptability and cohesion in adolescence and to emotional eating in adulthood. This points to the possible role of body image in adolescence as another significant correlate of disordered eating in adulthood, in addition to family relational factors in adolescence.

A New Proposed Model on Family Functioning and Disordered Eating via Body Image

Prior research has identified body image as a key mediator between family dynamics and eating pathology (Rodgers et al., 2015; Culbert et al., 2015; Kluck, 2010). However, it may not be general family functioning—such as cohesion or adaptability—that plays the most salient role in experiencing eating outcomes, but rather the underlying attitude within the family about appearance. Specifically, family emphasis on thinness for females and muscularity for males (Berge et al., 2013) may represent a more salient influence on adolescents' body image and eating patterns (Kluck, 2010; Kluck, 2008). Longitudinal studies (e.g., Project EAT) demonstrated that parental dieting attitudes and frequent weight-based comments during adolescence predicted increased body dissatisfaction, which in turn was associated with elevated risk for emotional eating behaviours in young adulthood (Eisenberg et al., 2012; Neumark-Sztainer et al., 2010). Additionally, parents own body dissatisfaction and dieting was also associated with adolescent's body image concerns and disordered eating behaviours later in life (Cerea et al., 2024; Klein et al., 2017) suggesting that parents may model body image behaviours for their children. The findings of these studies highlight how body image during adolescence may serve as a developmental bridge through which weight-related family environments in adolescence can influence disordered eating over time.

Taken together, this suggests that body image in adolescence may be a more robust and enduring mechanism linking early familial environments during adolescence to disordered eating trajectories in adulthood than general relational family processes alone. Future research should explore the role of body image in adolescence as a developmental mediator between relational family functioning in adolescence and later disordered eating. This research may focus on how appearance-related family norms and commentary are linked with adolescents' self-concept over time and eating behaviours in adulthood.

Do Familial Factors in Adolescence Protect against Disordered Eating in Early Adulthood?

Although the study sought to examine whether familial factors during adolescence—such as family meals, fewer weight-based comments, and higher family cohesion and adaptability—interact to protect against disordered eating in early adulthood, the findings only partially supported these objectives. In the final post-hoc model (M5), neither behavioural nor relational family factors during adolescence demonstrated direct significant associations with restrictive or emotional eating 15 years later, limiting conclusions about their long-term protective effects. However, a marginally significant indirect effect emerged, suggesting that family meals during adolescence may influence emotional eating in adulthood through their impact on family cohesion during adolescence. Additionally, appearance esteem was significantly associated with both family cohesion and adaptability in adolescence, highlighting the potential moderating role of this individual-level trait. These findings underscore the importance of considering adolescent body image as a developmental mechanism linking family functioning to later eating behaviours. Ultimately, behavioural aspects such as family meals during adolescence alone were not found to be robust protective factors against emotional eating in adulthood. Further research is needed to

clarify how adolescent family functioning and body image jointly influence disordered eating trajectories in adulthood.

Strengths, Limitations, and Future Directions

This study has several strengths that should be highlighted, including its novel exploratory aims and the use of a 15-year Canadian longitudinal dataset, offering insights into the long-term developmental patterns of eating behaviours. Further, this study is the first Canadian study to examine possible interactive pathways of family meals, parental weight-based comments, family adaptability and family cohesion during adolescence on disordered eating behaviours in adulthood. In addition, this study advances the literature by proposing a theoretically informed model that can guide future research and refinement in understanding complex family-level factors on disordered eating behaviours over time.

This study is not without limitations. First, the hypothesized model (M1) was not supported; therefore, theory-based modifications may need to be considered when examining the longitudinal effects of family functioning during adolescence on disordered eating in adulthood. Future research should consider the interactive mechanisms of body esteem on family functioning during adolescence and its complex relationship with disordered eating outcomes in adulthood.

Second, many direct and indirect effects were not observed across both initial models, which may be attributed to the 15-year interval between the time points. Research suggests that when measurement intervals are either too short or too long, the ability to detect meaningful change may be reduced (Zhao et al., 2024), potentially weakening temporal patterns and limiting the detection of effects. Future studies can replicate the exploratory models using more frequent

assessment points (e.g., every 3–5 years) to better track changes over time. Third, there may have been limitations in the measurement of some constructs. For example, measurement error—particularly due to the use of self-reported variables and scales with few items (e.g., a single-item measure of family meals and a two-item measure of weight-based comments)—may have reduced the precision of parameter estimates and contributed to the model's poor fit (Bogaert et al., 2024). Additionally, unmeasured constructs (e.g., psychological stress, depressive symptoms, self-esteem) were not included due to sample size constraints and the complexity of the proposed model may have further limited the detection of significant effects. Few studies have examined the longitudinal effects of individual level factors during adolescence on disordered eating in adulthood (Goldschmidt et all., 2014; Sze et al., 2021). As such future research should examine if individual level factors during adolescence such as depressive symptoms or self-esteem would account for more of the variance in emotional and restrictive eating in adulthood. Fourth, the majority of the sample were women and self-identified as White. Thus, it is unclear whether the results may generalize to the broader population and people living with an eating disorder. Therefore, future research should replicate and extend the findings in a clinical sample of individuals with an eating disorder and a sample that more broadly represents the community's diverse ethnicities. Fifth, although the sample size was adequate given the number of study parameters, future research may benefit from larger sample sizes to improve statistical power for sex-based analyses and testing of alternative theories. Finally, the final model (M5) was developed through post-hoc modifications and may not be reliable in another sample. Thus, future research should replicate this model in a larger longitudinal sample.

Conclusion

The proposed study is the first Canadian 15-year prospective study to examine the interactive pathways of familial protective factors during adolescence and disordered eating behaviours in adulthood together in a comprehensive model. While relational and behavioural factors of family functioning during adolescence were not directly predictive of disordered eating in adulthood, body image—particularly appearance esteem during adolescence—emerged as a key factor associated with family dynamics during adolescence and emotional eating in adulthood. These findings point toward the need for future models to consider how body image in adolescence may be related to disordered eating in adulthood through familial and sociocultural influences.

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Appendix A

Dutch Eating Behaviour Questionnaire (DEBQ; van Strien et al., 1986)

When and how do you eat? Indicate the number that shows how often the statement is true for you.

1. If you put on weight, do you eat less than you usually do?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

2. Do you try to eat less at mealtimes than you would like to eat?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

3. How often do you refuse food or drink offered because you are concerned about your weight?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

4. Do you watch exactly what you eat?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

5. Do you deliberately eat foods that are slimming?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

6. When you have eaten too much, do you eat less than usual the following days?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

7. Do you deliberately eat less in order to not become heavier?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

8. How often do you try not to eat between meals because you are watching your weight?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

9. How often in the evening do you try not to eat because you are watching your weight?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

10. Do you take into account your weight with what you eat?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

11. Do you have the desire to eat when you are irritated?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

12. Do you have a desire to eat when you have nothing to do?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

13. Do you have a desire to eat when you are depressed or discouraged?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

14. Do you have a desire to eat when you are feeling lonely?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

15. Do you have a desire to eat when somebody lets you down?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

16. Do you have a desire to eat when you are cross/angry?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

17. Do you have a desire to eat when you are approaching something unpleasant to happen?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

18. Do you have a desire to eat when you are anxious, worried or tense?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

19. Do you have a desire to eat when things are going against you or when things have gone wrong?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

20. Do you have a desire to eat when you are frightened?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

21. Do you have a desire to eat when you are disappointed?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

22. Do you have a desire to eat when you are emotionally upset?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

23. Do you have a desire to eat when you are bored or restless?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

24. If food tastes good to you, do you eat more than usual?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

25. If food smells and looks good, do you eat more than usual?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

26. If you see or smell something delicious, do you have the desire to eat it?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

27. If you have something delicious to eat, do you eat it straight away?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

28. If you walk past the bakery, do you have a desire to buy something delicious?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

29. If you walk past a snack bar or a cafe, do you have a desire to buy something delicious?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

30. If you see others eating, do you also have a desire to eat?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

31. Can you resist eating delicious foods?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

32. Do you eat more than usual when you see others eating?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

33. When preparing a meal, are you inclined to eat something?

(1) Never (2) Seldom (3) Sometimes (4) Often (5) Very

Appendix B

Family Adaptability and Cohesion Evaluation Scales (FACES II; Olson et al., 1982

Describe YOUR FAMILY					
	Almost never	Once in a while	Some-times	Frequently	Almost always
1. Family members are supportive of each other during difficult times	1	2	3	4	5
2. In our family, it is easy for everyone to express his/her opinion	1	2	3	4	5
3. It is easier to discuss problems with people outside the family than with other family members	1	2	3	4	5
4. Each family member has input in major family decisions	1	2	3	4	5
5. Our family gathers together in the same room	1	2	3	4	5
6. Children have a say in their discipline	1	2	3	4	5
7. Our family does things together	1	2	3	4	5
8. Family members discuss problems and feel good about the solutions	1	2	3	4	5
9. In our family, everyone goes his/her way	1	2	3	4	5
10. We shift household responsibilities from person to person	1	2	3	4	5
11. Family members know each other's close friends	1	2	3	4	5
12. It is hard to know what the rules are in our family	1	2	3	4	5
13. Family members consult other family members on their decisions	1	2	3	4	5
14. Family members say what they want	1	2	3	4	5
15. We have difficulty thinking of things to do as a family	1	2	3	4	5
16. In solving problems, the children's suggestions are followed	1	2	3	4	5
17. Family members feel very close to each other	1	2	3	4	5

18. Discipline is fair in our family	1	2	3	4	5
19. Family members feel closer to people outside the family than to other family members	1	2	3	4	5
20. Our family tries new ways of dealing with problems	1	2	3	4	5
21. Family members go along with what the family decides to do	1	2	3	4	5
22. In our family, everyone shares responsibilities	1	2	3	4	5
23. Family members like to spend their free time with each other	1	2	3	4	5
24. It is difficult to get a rule changed in our family	1	2	3	4	5
25. Family members avoid each other at home	1	2	3	4	5
26. When problems arise, we compromise	1	2	3	4	5
27. We approve of each other's friends	1	2	3	4	5
28. Family members are afraid to say what is on their minds	1	2	3	4	5
29. Family members pair up rather than do things as a total family	1	2	3	4	5
30. Family members share interests and hobbies with each other	1	2	3	4	5

11 FACES

Appendix C

Attitudes and Patterns of Eating questionnaire (APE; Baillot et al. 2012)

YOUR EATING HABITS, and EATING HABITS IN YOUR FAMILY…

29. Do you eat regular meals with your immediate family at home, sitting at the table together?

1. never to a few times a year
2. once or several times a month
3. once or several times a week
4. once a day
5. two or more times a day

Appendix D

Weight Based Teasing McKnight Risk Factor Scale IV (MRFS-IV; McKnight Investigators, 2003; Shisslak et al., 1999)

The questions below ask about what it is like to be a teenager today. Please circle the number that BEST APPLIES TO YOU

In the past year, how often…

	Never	Rarely	Sometimes	Often	Always
4. has your father made a comment to you about your weight or your eating that made you feel bad? *("father" refers to the adult man in your life who acts most like a father to you)*	1	2	3	4	5
** I do not have any contact with anyone that I think of as a "father"	0				
19. has your mother made a comment to you about your weight or your eating that made you feel bad? *("mother" refers to the adult woman in your life who acts most like a mother to you)*	1	2	3	4	5
** I do not have any contact with anyone that I think of as a "mother"	0				

Appendix E

Body Esteem Scale for Adolescents and Adults (BESAA; Cecil & Stanley, 1997; Mendelson, Mendelson, & White, 2001)

Indicate HOW OFTEN YOU AGREE with the following statements ABOUT YOURSELF by circling the appropriate number

	Never	Seldom	Sometimes	Often	Always
1. I like what I look like in pictures	0	1	2	3	4
2. Other people consider me good looking	0	1	2	3	4
3. I'm proud of my body	0	1	2	3	4
4. I am preoccupied with trying to change my body weight	0	1	2	3	4
5. I think my appearance would help me get a job	0	1	2	3	4
6. I like what I see when I look in the mirror	0	1	2	3	4
7. There are lots of things I'd change about my looks if I could	0	1	2	3	4
8. I am satisfied with my weight	0	1	2	3	4
9. I wish I looked better	0	1	2	3	4
10. I really like what I weigh	0	1	2	3	4
11. I wish I looked like someone else	0	1	2	3	4
12. People my own age like my looks	0	1	2	3	4
13. My looks upset me	0	1	2	3	4
14. I'm as nice looking as most people	0	1	2	3	4
15. I'm pretty happy about the way I look	0	1	2	3	4
16. I feel I weigh the right amount for my height	0	1	2	3	4
17. I feel ashamed of how I look	0	1	2	3	4
18. Weighing myself depresses me	0	1	2	3	4
19. My weight makes me unhappy	0	1	2	3	4
20. My looks help me to get dates	0	1	2	3	4
21. I worry about the way I look	0	1	2	3	4
22. I think I have a good body	0	1	2	3	4
23. I'm looking as nice as I'd like to	0	1	2	3	4

Appendix F

Socioeconomic Status (SES)

Please give ONE answer for each question by circling the corresponding number and/or filling in the blanks (grey zones)

4. How much school has your mother had?

   1. She didn't finish High School 2. High School diploma 3. College or University degree 4. I don't know

5. How much school has your father had?

   1. He didn't finish High School 2. High School diploma 3. College or University degree 4. I don't know

Supplementary Results

Relationships between Family Functioning and Disordered Eating by Sex

Table S1 represents correlation matrix of the study variables for females and males respectively. Parental weight-based comments were negatively associated with family cohesion and family adaptability for both females and males. The magnitudes ranged from -.19 to .29. Family meals were positively associated with family cohesion and family adaptability both females and males. The magnitudes ranged from .21 to .37. Family cohesion was strongly associated with family adaptability. Restrictive and emotional eating were positively correlated, with a magnitude of .41 and .49 for females and males respectively.

Table S1.

Descriptive Statistics and Correlations for Study Variables among Females and Males (n = 269)

Variable	*M(SD)*	1	2	3	4	5	6	7	8	9	10	11
1. Parental weight-based comments	.48 (.73)/ .33(.67)	–	.04/ .06	**-.19****/ **-.29****	**-.24****/ **-.24***	.09/ .10	.10/ .17	**-.30****/ **-.47****	**-.40****/ **-.46****	**.18***/ **.45***	**.31****/ **.35****	-.12/ .03
2. Family meals	3.67 (1.03)/ 3.90 (1.00)	–	–	**.31****/ **.37****	**.21****/ **.33****	.00/ .08	-.08/ -.00	.11/ .21	**.20****/ .14	**-.26****/ -.07	**-.22****/ -.07	**.15***/ .17
3. Family cohesion	49.18 (9.98)/ 50.08 (8.19)	–	–	–	**.78****/ **.65****	**-.14***/ .05	-.08/ .06	**.48****/ **.50****	**.44****/ **.29****	**-.17***/ -.16	-.02/ **-.26***	**.19****/ .13
4. Family adaptability	34.56 (7.66)/ 35. 60 (6.67)	–	–	–	–	-.13/ .06	-.10/ .03	**.39****/ **.35****	**.36****/ .14	-.13/ -.04	-.01/ -.12	**.21****/ .20
5. Restrictive eating	2.44 (.83)/ 2.25 (.78)	–	–	–	–	–	**.41****/ **.49****	**-.27****/ -.06	**-.28****/ -.13	**.17****/ **.31****	-.05/ -.05	.03/ .05
6. Emotional eating	2.58 (.97)/ 2.16 (.87)	–	–	–	–	–	–	**-.24****/ -.16	**-.26***/ -.11	.20**/ **.29****	-.10/ -.03	-.09/ .05
7. Appearance esteem	2.33 (.84)/ 2.77 (.61)	–	–	–	–	–	–	–	**.72****/ **.64****	**-.28****/ **-.36****	-.08/ **-.25***	.03/ .01
8. Weight esteem	2.74 (.89)/ 3.13 (.65)	–	–	–	–	–	–	–	–	**-.49****/ **-.43****	-.10/ **-.23***	.08/ .01
9. BMI	20.99 (4.35)/	–	–	–	–	–	–	–	–	–	**.20****/ **.25***	-.12/ .14

10. Age	20.52 (3.62) 13.60 (1.07)/ 13. 17 (1.01)	–	–	–	–	–	–	–	–	–	–	.08/ .21
11. Parental education	2.30 (1.02)/ 2.3 6 (1.02)	–	–	–	–	–	–	–	–	–	–	–

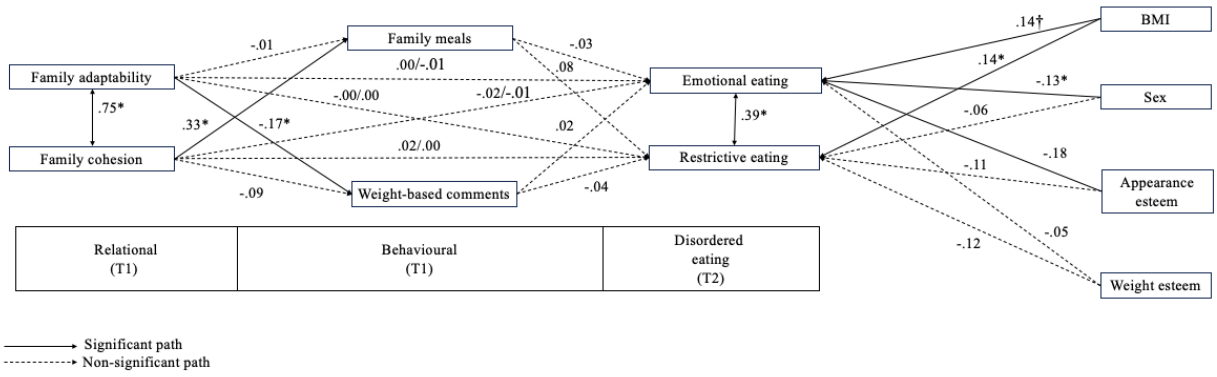
Note. $^{**}p < .01$, two- tailed. $^{*}p < .05$, two tailed. Parental weight-based comments, family meals, family cohesion, family adaptability, appearance esteem, weight esteem, Body Mass Index (BMI), age, and parental education were measured at baseline (T1). Restrictive and emotional eating were measured 15-years later (T2). Values before the slash are for females (n = 188) and after the slash are for males (n = 81). Parental weight-based comments end points ranged from 0 to 3. Family meals end points ranged from 1 to 5. Family cohesion total scores ranged from 26 to 73 and family adaptability total scores ranged from 17 to 53. Restrictive and emotional eating end points ranged from 1 to 5. Appearance and weight esteem end points ranged from 0 to 4. Parental education end points ranged from 0 to 3. Age and BMI were continuous variables.

Alternative Model (M2) Direct, Indirect, and Total Effects

Twenty-five paths were estimated in the alternative model to examine the direct and indirect effects among key study variables, as shown in Figure S1. In M2, family cohesion had a positive direct effect on family meals (β = .33, 95% CI [.18, .47], SE = .09). Family adaptability had a significant negative direct effect on weight-based comments (β = −.17, 95% CI [−.34, −.04], SE = .09). Direct and indirect effects were not observed (see Table S2).

Figure S1

M2: Standardized Estimates of Relational Factors (T1) and their Impact on Disordered Eating in Adulthood (T2) via Behavioural Factors (T1).



Note. T1 is referred to as data collected at baseline during adolescence. T2 refers to data collected during the 15-year follow-up period in adulthood. All covariates were controlled at T1. *Significant at the 95% confidence interval, including 0. † Marginally significant at the 95% interval at +/-0. All beta coefficients before the slash represent family meals while those after the slash represent parental weight-based comments.

Table S2

Standardized direct, indirect, and total effect coefficients of M2

Endogenous variables	Predicting variables	Direct effect			Indirect effect[a]			Indirect effect[b]			Total effect		
		β	95% CI	SE	β	95% CI	SE	β	95% CI	*SE*	β	95% CI	SE
Family meals	Family adaptability	-.01	-.15, .14	.09	—	—	—	—	—	—	—	—	—
	Family cohesion	.33	.18, .47	.09	—	—	—	—	—	—	—	—	—
Weight-based comments	Family adaptability	-.17	-.33, -.03	.09	—	—	—	—	—	—	—	—	—
	Family cohesion	-.09	-.24, .07	.09	—	—	—	—	—	—	—	—	—
	Family meals	—	—	—	—	—	—	—	—	—	—	—	—
Family adaptability	Family cohesion	.75	.70, .79	.03	—	—	—	—	—	—	—	—	—
Emotional eating	Family adaptability	-.07	-.21, .07	.09	.00	-.01, .01	.01	-.01	-.03, .01	.02	-.07	-.22, .05	.08
	Family cohesion	.15	-.01, .30	.09	-.02	-.05, .03	.03	-.01	-.03, .01	.01	.13	-.01, .29	.09

	Family meals	-.03	-.14, .09	.07	—	—	—	—	—	—	—	—	—
	Weight-based comments	.02	-.10, .15	.07	—	—	—	—	—	—	—	—	—
	Sex	-.13	-.22, -.04	.06	—	—	—	—	—	—	—	—	—
	BMI	.14	.00, .28	.08	—	—	—	—	—	—	—	—	—
	Beliefs about appearance	-.18	-.31, -.03	.09	—	—	—	—	—	—	—	—	—
	Beliefs about weight	-.05	-.21, .10	.09	—	—	—	—	—	—	—	—	—
	Restrained eating	.39	.29, .48	.06	—	—	—	—	—	—	—	—	—
Restrained eating	Family adaptability	-.05	-.19, .09	.09	-.00	-.02, .01	.01	.00	-.01, .04	.01	-.05	-.18, .11	.09
	Family cohesion	.03	-.13, .18	.10	.02	-.00, .07	.02	.00	-.01, .04	.01	.04	-.13, .19	.09
	Family meals	.08	-.02, .18	.06	—	—	—	—	—	—	—	—	—

Weight-based comments	-.04	-.17, .09	.08	—	—	—	—	—	—	—	—	—
Sex	-.06	-.15, .04	.06	—	—	—	—	—	—	—	—	—
BMI	.14	.02, .25	.07	—	—	—	—	—	—	—	—	—
Beliefs about appearance	-.11	-.24, .03	.08	—	—	—	—	—	—	—	—	—
Beliefs about weight	-.12	-.28, .03	.10	—	—	—	—	—	—	—	—	—

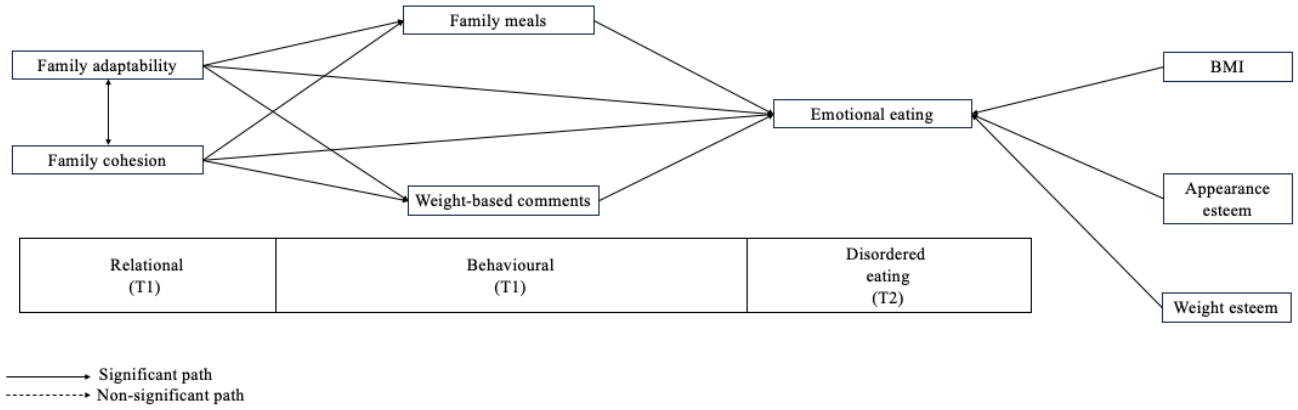
Note. CI = confidence intervals. 95% Confidence intervals were obtained via bias corrected bootstrapping = 5000. Sex, Body Mass Index (BMI), appearance esteem, and weight esteem were included as covariates [a]Indirect effect via family meals. [b]Indirect effect via weight-based comments.

M2 Fit Statistics Among Females

Given the poor fit of the proposed alternative and known sex differences in the study parameters, M2 was re-examined to determine whether it provided a better fit among females (M2.1). Additionally, restrictive eating was not significantly correlated with any of the predictor variables; magnitudes ranged from -.07 to .10 (ps > .05). To assess potential model overfitting, an alternative model without restrictive eating (M2.2) was also analyzed (See Figure S2). Among females, M2.1 did not provide good fit to the data, $\chi 2$ (13) = 92.85, p < .001, CFI = .24, RMSEA = .18 [.15, 0.22]. Model fit statistics did not improve after removing restrictive eating (See Table S3). These models were rejected, and relationships were not examined further.

Figure S2

M2.2: Relational Factors (T1) and their Impact on Emotional Eating in Adulthood (T2) via Behavioural Factors (T1) among Females.



Note. T1 is referred to as data collected at baseline during adolescence. T2 refers to data collected during the 15-year follow-up period in adulthood. All covariates were controlled at T1.

Table S3

Fit statistics from the path analysis of alternative models among females (n = 188)

Model	χ^2 (*df*)	CFI	NNFI	RMSEA	SRMR	AIC	BIC
M2.1	92.85 (13)*	.24	.00	.18	.17	4395.98	4499.38
M2.2	92.88(13)*	.00	.00	.18	.19	3960.41	4031.50

Note. Model 2.1 tested the alternative model among females. Models 2.2 tested the alternative model with restrictive eating removed as an outcome variable. CFI = Comparative Fit Index; NNFI = Non-normative Fit Index; RMSEA = Root Mean; Square Error of Approximation; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; *p < .001.

Post hoc Analyses

Modification Indices and Model Fit for Proposed Model

To improve model fit of the proposed model (N = 269), modification indices were examined, and sex was included as a covariate due to sample size. Modification indices (N = 269) and standardized expected parameter changes (EPC) suggested adding direct paths from restrictive eating (MI = 31.82, Standardized EPC = .88), emotional eating (MI = 22.45, Standardized EPC = .58), appearance esteem (MI = 16.71, Standardized EPC = -.22), weight esteem (MI = 30.61, Std EPC = -.28), and BMI (MI = 13.05, Standardized EPC = .04) on parental weight-based comments.

Appearance esteem, weight esteem and BMI were further explored as parameters (see Table S4). Model fit indices provided better fit to M2 $\chi 2$ (15) = 95.82, p < .01, CFI = .55, RMSEA = .14 [.12, .17] after appearance and weight esteem paths were added on parental weight-based comments (M2a). After accounting for BMI along with appearance and weight

esteem on parental weight-based comments, model (M2b) had slightly poorer fit $\chi 2$ (14) = 94.49, p < .01, CFI = .56, RMSEA = .15 [.12, .17] to the data. Both M2a and M2b were rejected, and no further relationships were explored.

Table S4

Post hoc fit statistics from the path analysis of M2 (N = 269)

Model	χ^2 (*df*)	CFI	NNFI	RMSEA	SRMR	AIC	BIC
2a	95.82(15)*	.55	.11	.14	.14	6174.13	6303.40
2b	94.49(14)*	.56	.05	.15	.14	6174.80	6307.67

Note. Model 2a tests appearance and weight esteem on parental weight-based comments. Model 2b tests appearance and weight esteem, and BMI on parental weight-based comments. CFI = Comparative Fit Index; NNFI = Non-normative Fit Index; RMSEA = Root Mean; Square Error of Approximation; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; *p < .001.

Note. Model 2a tests appearance and weight esteem on parental weight-based comments. Model 2b tests appearance and weight esteem, and BMI on parental weight-based comments.