



The effect of low parental warmth and low monitoring on disordered eating in mid-adolescence: Findings from the Australian Temperament Project



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ABSTRACT

Objective: To investigate the interactions between low parental warmth and monitoring at age 13–14 years and disordered eating attitudes and behaviours at age 15–16 years.

Method: Data on 1300 (667 females) adolescents and their parents were drawn from *The Australian Temperament Project (ATP)*, a 30 year (15 wave) population based longitudinal study of social-emotional development. Parent participants completed surveys on parenting practices in late childhood, and adolescent participants reported disordered eating using the drive for thinness and bulimia subscales of the Eating Disorder Inventory (EDI) and an additional body dissatisfaction scale. Interaction was examined on the additive scale by estimating super-additive risk; i.e., risk in excess of the sum of individual risks.

Results: For boys, neither parental warmth or monitoring, nor their interaction, was related to disordered eating. For girls, low parental warmth (alone) was associated with bulimic behaviours. In contrast, exposure to both low monitoring and warmth was associated with ~3½-fold, ~4-fold and ~5-fold increases in the odds of reporting body dissatisfaction, drive for thinness and bulimia, respectively. For body dissatisfaction and drive for thinness, risk associated with joint exposure exceeded the sum of individual risks, suggesting an additive interaction between parenting styles.

Conclusion: Further investment in family-level interventions that focus on promoting parental monitoring behaviour and a warm parent-child relationship remain important strategies for preventing a range of disordered eating behaviours in adolescents.

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1. Introduction

Eating disorders have a complex aetiology, involving interactions between biological, social, and environmental factors at critical developmental stages (Culbert, Racine, & Klump, 2015;

Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004). Preclinical patterns of disordered eating attitudes and behaviours generally emerge during the peri-pubertal period and may subsequently develop into full eating disorders by adolescence or early adulthood (Herpertz-Dahlmann, Bühren, & Remschmidt, 2013). There remains uncertainty about the early determinants of disordered eating behaviours, because few longitudinal studies of child and adolescent development have captured eating pathology. Some studies (e.g. Agras, Bryson, Hammer, & Kraemer, 2007; Berge, Wall, Loth, &

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Neumark-Sztainer, 2010; Zubatsky, Berge, & Neumark-Sztainer, 2015) have suggested that particular parenting practices may predict subsequent eating problems. The present study uses unique developmental data from a large Australian cohort study, to examine relationships between parents' descriptions of their warmth and monitoring parenting styles and their adolescent's self-reports of disordered eating behaviours and symptoms two years later.

Parenting behaviours are commonly conceptualized on two dimensions: (a) the extent to which parents nurture their child (i.e., "responsiveness/warmth") and (b) the degree to which parents monitor their child (i.e., "aware of their child's daily activities and whereabouts") (Baumrind, 1975). The parent-child relationship, in particular, family interaction styles typified by high levels of conflict and enmeshment and low levels of cohesion and warmth, have been associated with clinical eating disorders (Tetley, Moghaddam, Dawson, & Rennoldson, 2014) and disordered eating in community samples (Horesh, Sommerfeld, Wolf, Zubery, & Zalsman, 2015; Loth, MacLehose, Fulkerson, Crow, & Neumark-Sztainer, 2014). Inconsistent findings have however also been observed, with a few studies revealing only a weak or no relationship between parenting practices and subsequent eating pathology (Hautala et al., 2011; Krug et al., 2015). It should also be noted, that most studies are cross-sectional or retrospective in design (limiting causal inference) and based on convenience samples with limited generalizability. Only a few studies, using a prospective design have implicated parenting styles, including low warmth and low monitoring, in eating pathology (Berge et al., 2010; Zubatsky et al., 2015). Yet other studies have suggested the effects of parental and family influences are as strong as other factors such as depression, peer pressure and body dissatisfaction (Lyke & Matsen, 2013; Paxton, Eisenberg, & Neumark-Sztainer, 2006).

Importantly, little is known about the interaction between parenting practices in relation to eating pathology. This is surprising given that the practices of warmth and monitoring exist in all combinations across family structures within populations (Baumrind, 1975). Neglectful-disengaged parenting has been associated with a mixture of internalizing and externalizing negative health outcomes in adolescence, including depression (Katz et al., 2014), emotional distress (Operario, Tschann, Flores, & Bridges, 2006), conduct disorder (Racz & McMahon, 2011) and eating pathology (Berge et al., 2014). However, little is known about other forms of interactions between parenting styles. Yet, identification of such interactions has the potential to define important sub-populations of those most at risk and to more accurately target preventive interventions (Berge et al., 2014).

The purpose of this study was to examine relationships between parent-reported parental warmth and monitoring, and their interaction, in early adolescence (age 13–14) and subsequent risk of disordered eating behaviours in mid-adolescence (age 15–16). Data were drawn from a large population based longitudinal study that has followed the social and emotional development of over 2000 participants and their families from birth in 1983 across 30 years (15 waves) of data collection: *The Australian Temperament Project (ATP)*.

2. Method

2.1. Participants

Data are based on 1300 parents and offspring who participated in the ATP between early and mid-adolescence. The ATP has followed the social and emotional development of a large population-based cohort from infancy (4–8 months) to adulthood (27–28-years) across three decades (15 waves) since 1983. The initial

sample comprised 2443 infants and their parents and were from urban and rural areas of the state of Victoria, Australia. Details on sample characteristics and sampling are provided in Prior, Sanson, Smart and Oberklaid (2000) and previous disordered eating specific publications (Le Grange et al., 2014; Martin et al., 2000; Wertheim, Martin, Prior, Sanson, & Smart, 2002). The ATP has sustained approximately 1% attrition per annum, which is comparable to other major cohort studies of its kind worldwide. Previous analyses (Letcher, Sanson, Smart, & Toumbourou, 2012) demonstrated that compared to the retained sample, non-participating families were more likely to be from a lower socio-demographic background or contain a non-Australian-born parent. However, there were no differences on children's temperament style or behaviour problems measured in infancy. Table 1 provides details of the socio-demographics of the study sample.

2.2. Procedure

Participant data in the current study was collected in 1996, when the adolescents were 13–14 years (Wave 11) old and also two years later in 1998 when the participants were 15–16 years (Wave 12) old. As in previous waves, two questionnaire booklets and reply paid envelopes were mailed to ATP families, one for the adolescent to complete and one for the parent. Reminder letters were sent after three weeks. The study was undertaken in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and was approved by the Human Research Ethics at a University located in Melbourne.

2.3. Parenting practices

One parent, usually the mother (~95%), completed the ATP-devised Parenting Practices Questionnaire (Prior, Smart, & Oberklaid, 2000), which comprises a total of 11 items measuring parent-adolescent relationship quality. *Parental warmth* towards their adolescent son or daughter was assessed using four items with a 5-point Likert scale (1 = Almost every day, 5 = Never), such as "I praise my child for doing a good job at home or at school" and two items with a 6-point Likert scale (1 = Always/Almost always, 6 = don't know). Scores were recoded with high scores indicating low warmth. *Parental monitoring* of their adolescent son or daughter's activities was assessed using five items with a 6-point Likert scale (1 = Always/Almost always, 6 = don't know), such as "It is difficult for me to know where my teenager is and what s/he is doing". Scores were recoded with high scores indicating low monitoring.

For binary analysis within a *sufficient causes framework* (see *Statistical Analysis* below) warmth and monitoring distributions were dichotomised for analysis. In the absence of clear thresholds, dichotomisation was based on consideration of the distribution of responses on each scale (e.g., skewness), frequency of responses above the cut-point (analytic power), and clinical relevance on the cut-point (to guide translation). Optimal dichotomisation of the warmth scale for this analysis yielded 33% of the sample in the low warmth exposure group. The monitoring scale was more skewed (positive parental reporting bias), which meant that optimal dichotomisation had to be set at a lower cut-point (≥ 4 of 15) to gain sufficient analytic power. This resulted in 15% of the sample in the low monitoring group. In both cases, the low warmth and monitor groups are at the extreme ends of the population distribution and represent clinically meaningful constructs for analysis and translation.

Table 1
Sociodemographic details of the study sample.

	Full sample			Females		Males	
	N	n	%	N	%	n	%
Sex	1300						
Males		633	48.7				
Females		667	51.3				
SES	1270						
SES (lower tertile)		454	35.8	227	35.1	227	36.4
SES (middle tertile)		443	34.9	231	35.7	212	34.0
SES (upper tertile)		373	29.4	189	29.2	184	29.5
Marital status	1270						
Married/defacto		1086	85.5	545	83.9	541	87.3
Separated/divorced		143	11.3	83	12.8	60	9.7
Single/widowed		41	3.2	22	3.4	19	3.1
Father's occupation	1205						
Professional		315	26.1	155	25.4	160	26.9
Managerial		270	22.4	137	22.5	133	22.4
Semi-skilled		543	45.1	282	46.2	261	43.9
Unemployed/pensioner/househusband		77	6.4	36	5.9	41	6.9
Mother's occupation	1247						
Professional		332	26.6	149	23.5	183	29.9
Managerial		113	9.1	63	9.9	50	8.2
Semi-skilled		462	37.1	256	40.4	206	33.6
Unemployed/pensioner/housewife		340	27.3	166	26.2	174	28.4
Father's education	1164						
Tertiary		299	25.7	148	25.0	151	26.4
Diploma/apprenticeship		190	16.3	95	16.0	95	16.6
Year 11/12		333	28.6	176	29.7	157	27.5
Year 10 or less		342	29.4	174	29.3	168	29.4
Mother's education	1234						
Tertiary		247	20	119	19.1	128	21.0
Diploma/apprenticeship		181	14.7	96	15.4	85	13.9
Year 11/12		443	35.9	238	38.1	205	33.6
Year 10 or less		363	29.4	171	27.4	192	31.5

2.4. Disordered eating behaviours

Adolescent participants completed the drive for thinness and bulimia subscales of the EDI (Garner, Olmstead, & Polivy, 1983). Minor variations were made to the wording of some items to assist understanding in young people (e.g., to reflect Australian terminology 'kilograms' was substituted for 'pounds'). The drive for thinness construct was assessed by items such as "I am preoccupied with the desire to be thinner", measuring behaviours such as restrictive dieting and fears of gaining weight. Bulimia items assessed binge-eating behaviours (overeating) using items such as "I eat moderately in front of others and stuff myself when they're gone".

A body dissatisfaction scale, assessing discontentment with overall shape and size of body regions for those with eating disorders, was specifically developed for the ATP study. It consisted of four items, which include items such as "I think I am too fat", "I feel satisfied with the shape of my body" (reversed), "I think I am not muscular enough" and "I think I am too skinny". The decision to use this subscale, rather than the original EDI body dissatisfaction subscale, was based on substantial numbers of missing items in the previous wave and negative feedback from participants, which resulted in a high level of missing data, yielding a variable unsuitable for analysis (Prior et al., 2000).

All statements for the three disordered eating scales were rated on a six-point Likert scale (1 = Never, 6 = Always), as is recommended for normative samples (such as the ATP), where the prevalence of clinical disorders is low (Schoemaker, van Strien, & van der Staak, 1994). Further details relating to the measurement characteristics of the items assessing disordered eating are described in a previous ATP publication (e.g. Le Grange et al., 2014).

For the binary analysis within a *sufficient causes framework* (see

Statistical Analysis below), in the absence of previously established and reported cut-points for dichotomising the drive for thinness and bulimia EDI subscales and the ATP-derived body dissatisfaction scale, we took the approach of comparing the top quintile (20%) with the bottom four quintiles (80%) of the distribution of scores for each of these scales.

2.5. Statistical analyses

Analyses were conducted in STATA 12 and SPSS 22. To deal with bias due to attrition, missing data was accounted for using multiple imputations (Graham, 2009). Specifically, we imputed 20 complete datasets based on the 1300 adolescents who provided complete EDI data (the primary dependant variable) at age 15–16 years. Imputations were performed at the item level (i.e., before subscales were created) and variables were log transformed prior to imputation. Data were imputed under a multivariate normal model and incorporated 9 auxiliary variables that were correlated with the variables that had missing data. Variables were subsequently back-transformed (with adaptive rounding) after imputation and subscales calculated based on the fully imputed data. Descriptive results are based on averaging across the imputations whilst all inferential analyses are based on pooled estimates combined using Rubin's rules (Rubin, 2004). Of the 32 imputed variables of interest, 11 had between 5 and 10% missing whilst the remaining variables had <5% missing. Overall, missing data represented 3.3% of the total dataset.

Modelling of main and interactive effects was done under the *sufficient causes framework*, which posits that the causal mechanisms underlying a particular pathology (such as eating disorders) are built from a finite set of modifiable and non-modifiable component causes, which assemble over time to complete a

causal mechanism (Botto, 2007; Botto & Houry, 2001). Component causes are necessary but not sufficient to create a disorder (e.g., parental warmth and monitoring in the case of eating pathology). Interaction between component causes occurs when the risk created by two component causes exceeds that of the sum of the risk of each in isolation. This can be quantified by estimating departure from the additive summation of independent effects (i.e., super-additive or 'synergistic' effect). Modelling interactions on the additive scale is a well-established methodology (VanderWeele & Knol, 2014) that has a number of advantages over the conventional multiplicative approach to interactions. Some interaction effects can be masked when using the multiple reference groups (i.e., for different levels of moderators) in multiplicative interaction models (VanderWeele & Knol, 2014). Additionally, examining interactions on the additive scale assists in interpretation, because the data are represented in an intuitive two-by-four format that is consistent with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement (von Elm et al., 2014). Importantly, when compared to multiplicative effects, understanding interactions on the additive scale are intuitively easier to interpret and more closely aligned to mechanisms found in nature.

For analysis within a *sufficient causes framework*, binary variables representing low parental warmth and low monitoring were combined to define four empirical conditions: (Group 0): neither risk (reference group), (Group 1) low monitoring only, (Group 2) low warmth only, and (Group 3) low warmth and low monitoring (joint effects). These four conditions were then stratified by a binary classification (top quintile) of each disordered eating dimension to create a 2×4 table format, which allowed comparison of risk estimates between levels of warmth and monitoring on presence or absence of eating pathology. This format also allows examination of the interaction between low parental warmth and low monitoring on risk for disordered eating.

Specifically, interaction effects were measured on the additive scale and quantified as the *excess risk due to additive interaction (ERI)*, which represents the extent to which the effect of the *observed risk for joint exposure* (i.e., Group 3) exceeds the sum of the background risk and the risks attributable to having one exposure at a time (i.e., Group 0 + Group 1 + Group 2). The *expected risk for no interaction* was also calculated by adding risks associated with low warmth (Group 2) and low monitoring (Group 3) and subtracting the background risk (Group 0). The difference between the *expected risk for no interaction* and the *observed risk for joint exposure* was then divided by the *observed risk for joint exposure* to obtain an estimate of the *attributable proportion due to interaction (AP)*, which is the proportion of the total *observed risk for joint exposure* that is attributable to the interaction effect specifically.

Standard errors for the AP effect were estimated using the delta method (Hosmer & Lemeshow, 1992). Within each exposure level, positive predictive value (PV+) and the attributable risk percent (AR%, also referred to as the attributable fraction in the exposed) was also estimated. PV+ is the probability of reporting disordered eating given exposure status and provides information of value for prediction of individual level risk. AR% is the proportion of individuals showing disordered eating symptoms within a particular exposure level that is attributable to having that exposure.

T-tests were used to assess initial gender differences in means and proportions across the variables of interest. The association between low parental warmth and low monitoring at 13–14 years on eating pathology in females and males at 15–16 years was examined using logistic regression. Since parenting styles have been found to differ according to socioeconomic status and marital status (Benson & Kersh, 2011), estimates were adjusted by these two variables measured at wave 11. A separate analysis demonstrated that there was no difference in results compared to using

wave 12, when the models were re-run using wave 10 assessments of socioeconomic status and marital status.

3. Results

3.1. Descriptive statistics for parental practices and disordered eating

The means and standard deviations (SD) and range of scores for the key variables are presented separately for males and females in Table 2. The mean value of parental warmth and monitoring was higher in males than females. Conversely, more females than males reported body dissatisfaction, drive for thinness and bulimia.

Table 3 presents frequencies for exposure (warmth and monitoring) and outcome variables (eating pathology) used in regression models. Low parental monitoring was more common in the male group compared to the female group, but there were no differences by gender for low warmth parenting. The proportion of participants scoring in the top quartile of all three disordered eating outcomes was higher for females than for males.

3.2. Associations between parenting practices and disordered eating

3.2.1. Female cohort

Table 4 presents findings for females after adjusting for marital status and socioeconomic status. Results suggest that neither low monitoring (Group 1) nor low warmth (Group 2) increased the odds of body dissatisfaction for females. However, exposure to both low warmth and low monitoring (Group 3) was associated with a 3 ½-fold increase in the odds of reporting body dissatisfaction, 58% of which was significantly attributable to the joint action of both parenting practices (additive interaction). Results further suggested that neither low monitoring (Group 1) nor low warmth (Group 2) were associated with drive for thinness in females. However, exposure to both parenting practices (Group 3) was associated with a 4-fold increase in the odds of being in the high drive for thinness group, 64% of which was attributable to the significant joint action of both parenting practices. Low warmth, but not low monitoring was associated with close to a 2-fold increase in the odds of being categorised in the bulimia group (Group 2). Exposure to both parenting practices (Group 3) was associated with a 5-fold increase in the odds of bulimic behaviour, but the joint action attributable to both parenting practices was not statistically significant, suggesting that the joint action did not contribute significant additional risk over and above that of the combined additive effect of low warmth and low monitoring.

3.2.2. Male cohort

Table 5 presents findings for males after adjusting for marital status and socioeconomic status. Results suggest that neither low monitoring (Group 1) nor low warmth (Group 2) were related to any indicator of disordered eating: body dissatisfaction, drive for thinness or bulimic behaviour. There was likewise no evidence of interaction between parenting practices; however, exposure to both parenting practices (Group 3) was related to a 2.4 fold increase in the odds of bulimic behaviour.

4. Discussion

This study examined the main and additive interaction effects of low parental warmth and low monitoring on disordered eating in a large sample of Australian adolescent girls and boys. There was little evidence that low parental warmth and monitoring in isolation increased the risk of disordered eating in either girls or boys.

Table 2
Means and standard deviations of measured variables.

Variables	Score range	Females		Males		(Pooled <i>t</i> -tests)
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Parental practices						
Parental warmth	6–26	10.56	3.40	11.07	3.61	$t(1298) = -2.54, p = 0.011$
Parental monitoring	5–20	6.31	1.78	6.82	2.00	$t(1298) = -4.70, p < 0.001$
Disordered eating						
Body dissatisfaction	4–18	11.02	3.51	8.77	3.28	$t(1298) = 11.93, p < 0.001$
Drive for thinness	7–42	19.65	8.46	11.3	4.86	$t(1298) = 21.65, p < 0.001$
Bulimia	7–37	13.36	5.08	11.15	3.81	$t(1298) = 8.83, p < 0.001$

Table 3
Observed frequencies and prevalence rates for parental practices and disordered eating.

	Total sample (<i>N</i> = 1300)		Females (<i>n</i> = 667)		Males (<i>n</i> = 633)		(Pooled <i>t</i> -tests)
	<i>n</i>	%	<i>n</i>	%	<i>N</i>	%	
Parental practices (exposure)							
Low parental warmth	360	28	169	25	191	30	$t(1298) = -1.91, p = 0.056$
Low parental monitoring	190	15	75	11	116	18	$t(1298) = -3.50, p < 0.001$
Disordered eating (outcome)							
Body dissatisfaction	226	17	164	25	62	10	$t(1298) = -7.21, p < 0.001$
Drive for thinness	255	20	229	34	26	4	$t(1298) = -14.80, p < 0.001$
Bulimia	243	19	170	25	72	11	$t(1298) = -6.61, p < 0.001$

Note: Frequencies represent average (rounded) over the 20 imputed datasets.

For girls, the only significant main effect was found for low parental warmth in relation to bulimic behaviour. There were no main effects for boys. However, there was evidence of interaction between parenting styles in the female, but not male sample. Parents reporting a combination of low warmth and low monitoring increased the odds of all disordered eating behaviours and symptoms in girls, with significant additive interaction effects for both body dissatisfaction and drive for thinness, but not bulimia. A joint effect was observed in boys for bulimic behaviours; however, this did not reach statistical significance.

4.1. Main effects of parenting styles on disordered eating

The fact that this study found little evidence of direct parental effects, with only low parental warmth being related to bulimic symptoms in the female sample, is somewhat surprising given that various previous studies have found low parental warmth and monitoring to be associated with overall eating pathology in community (Haycraft & Blissett, 2010; Mellin, Neumark-Sztainer, Story, Ireland, & Resnick, 2002) and clinical eating disorder samples (Bulik, Sullivan, Fear, & Pickering, 2000; Canetti, Kanyas, Lerer, Latzer, & Bachar, 2008). Consistent with our findings, there is some evidence suggesting that individuals with bulimic symptoms, reported more parental rejection (Stuart, Laraia, Ballenger, & Lydiard, 1990) and less parental warmth (Herraiz-Serrano et al., 2015) than controls. Looking at individual aspects of parenting behaviours such as parental warmth is imperative to be able to characterise modifiable parenting practices, rather than grouping parents into a specific style (e.g., authoritative, permissive etc.), which has been found to be less amenable to change, given its more “trait” like connotations (Blodgett Salafia, Gondoli, Corning, Bucchianeri, & Godinez, 2009).

4.2. Interaction effects of parenting styles on disordered eating

The main message from our study is, however, that interactions between parenting practices may be of more relevance to disordered eating than individual parenting practices alone. The

presence of both parenting practices (low monitoring and low warmth) for females in this study was associated with a notable increase in risk of reporting body dissatisfaction and drive for thinness, respectively. Moreover, as much as 58% and 64% of this effect was directly attributable to the additive interaction effect in predicting body dissatisfaction and drive for thinness, respectively. Under the *sufficient causes framework*, a super-additive effect can be interpreted as suggesting that both exposures (in this case low parental warmth and low monitoring), are in the same causal chain for a unique risk for body dissatisfaction and drive for thinness outcomes (Botto, 2007). In other words, having both maladaptive parenting styles concurrently, leads to a super-additive risk (i.e., a synergistic effect) for body dissatisfaction and drive for thinness in girls. These findings are consistent with previous research, showing that similar combinations of parenting practices were related to disordered eating behaviours (Berge et al., 2014; Zubatsky et al., 2015), as well as other problematic externalizing (e.g. illicit drug use, delinquency, anger etc.) (Operario et al., 2006) and internalizing (e.g. poor emotional regulation, depression, anxiety, social withdrawal etc.) behaviours (Racz & McMahon, 2011). Our findings are also in accordance with the assumptions of family systems theory, in which dyadic level (e.g., parent/child) interactions, are influencing other family members' adaptive and maladaptive health behaviours (in our case, the child's eating pathology) (Forsberg & Lock, 2015).

4.3. The impact of parenting across development

One question that requires further clarification relates to how low warmth and low monitoring parenting styles emerge across development. In some cases, parents may be unaware or unable to provide their children with the necessary emotional and instrumental support, due to their own mental health problems and psychosocial stress (Haycraft, Farrow, & Blissett, 2013; Micali, De Stavola, Ploubidis, Simonoff, & Treasure, 2014). It is possible that low warmth and low monitoring hinder the development of adaptive responses to internalized distress and create a developmental space within which, non-adaptive responses may emerge,

Table 4
Logistic regression models for the disordered eating for females (n = 667).

Group	Low parent warmth	Low parent monitoring			OR [†]	95% CI [†]	PV	AR%
			Non-BD	BD				
<i>Body dissatisfaction 15–16 years</i>								
0	No	no	349	100	OR _{reference}	1.0		
1	No	yes	38	12	OR _{monitor} [†]	1.1	24%	4%
2	Yes	no	104	41	OR _{warm} [†]	1.4	28%	27%
3	Yes	yes	13	12	OR _{monitor+warm} [†]	3.4	49%	71%
Additive model of interaction					Expected OR assuming no joint action (E)	Departure from expected (DE)	% of OR attributable to joint action (low warm & monitor) DE/ OR _{warm-monitor}	
					OR _{warm} + OR _{monitor} ⁻¹	OR _{warm-monitor} ^{-E}	58%, t = 2.56, p = 0.011 (95%CI 1%, 14%)	
					1.4	2.0		
<i>EDI drive for thinness 15–16 years</i>								
0	No	no	307	142	OR _{reference}	1.0		
1	No	yes	31	19	OR _{monitor} [†]	1.3	39%	23%
2	Yes	no	93	51	OR _{warm} [†]	1.2	36%	17%
3	Yes	yes	8	16	OR _{monitor+warm} [†]	4.3	66%	77%
Additive model of interaction					Expected OR assuming no joint action (E)	Departure from expected (DE)	% of OR attributable to joint action (low warm & monitor) DE/ OR _{warm-monitor}	
					OR _{warm} + OR _{monitor} ⁻¹	OR _{warm-monitor} ^{-E}	65%, t = 3.22, p = 0.001 (95%CI 25%, 105%)	
					1.5	2.8		
<i>EDI Bulimia 15–16 years</i>								
0	No	no	355	94	OR _{reference}	1.0		
1	No	yes	33	17	OR _{monitor} [†]	1.9	34%	48%
2	Yes	no	99	46	OR _{warm} [†]	1.7	32%	43%
3	Yes	yes	11	14	OR _{monitor+warm} [†]	5.1	57%	80%
Additive model of interaction					Expected OR assuming no joint action (E)	Departure from expected (DE)	% of OR attributable to joint action (low warm & monitor) DE/ OR _{warm-monitor}	
					OR _{warm} + OR _{monitor} ⁻¹	OR _{warm-monitor} ^{-E}	47%, t = 1.69, p = 0.093 (95%CI -8%, 102%)	
					2.7	2.4		

Note. †OR = Odds Ratio, 95%CI = 95% Confidence Interval; †OR_{monitor} = low parental monitoring (only), †OR_{warm} = low parental warmth (only), OR_{warm-monitor} = joint effect of low parent warmth and monitoring; †OR_{reference} = neither exposure; PPV = Positive Predictive Value; AR% = Attributable Risk Percent. Estimates are adjusted for parent's marital status and family socioeconomic status.

one expression of which could be excessive dieting and/or over-eating behaviours and subsequent eating pathology (e.g. [Blodgett Salafia et al., 2009](#); [Hughes, Power, Liu, Sharp, & Nicklas, 2015](#); [McEwen & Flouri, 2009](#)). Accordingly, research has demonstrated that maladaptive parenting styles were associated with low affect in youngsters, which in turn has been found to set the foundation for some children to develop eating problems and/or body concerns

([Dakanalis et al., 2014](#); [Katz et al., 2014](#)). Research has also shown that parental negative commentary about weight and shape and encouragement to diet are associated with body and eating concerns ([Rodgers & Chabrol, 2009](#)). It is therefore also possible that the effects of maladaptive parenting styles may be mediated by parental negative weight-related commentary and lack of assistance (monitoring and positive discussion) in promoting positive

Table 5

Logistic regression models for the disordered eating for males (n = 633).

Group	Low parent warmth	Low parent monitoring			OR [†]	95% CI [†]	PV	AR%
<i>Body dissatisfaction 15–16 years</i>			Non-BD	BD				
0	No	no	338	39	OR _{reference}	1.0		
1	No	yes	56	9	OR _{monitor} [†]	1.37 (0.60, –3.1)	14%	27%
2	Yes	no	130	10	OR _{warm} [†]	0.66 (0.31, –1.4)	7%	–50%
3	Yes	yes	48	3	OR _{monitor+warm} [†]	0.56 (0.17, –1.9)	6%	–78%
			Additive model of interaction		No significant associations in any exposure strata (Not calculated)			
<i>EDI drive for thinness 15–16 years</i>			Non-DT	DT				
0	No	no	364	14	OR _{reference}	1.0		
1	No	yes	60	4	OR _{monitor} [†]	1.6 (0.49, –5.5)	7%	39%
2	Yes	no	134	6	OR _{warm} [†]	1.1 (0.41, –3.2)	4%	12%
3	Yes	yes	50	2	OR _{monitor+warm} [†]	0.62 (0.08, –4.9)	3%	–62%
			Additive model of interaction		No significant associations in any exposure strata (Not calculated)			
<i>EDI Bulimia 15–16 years</i>			Non-Bulimia	Bulimia				
0	No	no	343	35	OR _{reference}	1.0		
1	No	yes	57	7	OR _{monitor} [†]	1.19 (0.48, –3.0)	11%	16%
2	Yes	no	119	20	OR _{warm} [†]	1.7 (0.90, –3.1)	15%	40%
3	Yes	yes	41	10	OR _{monitor+warm} [†]	2.4 (1.0, –5.3)	20%	57%
			Additive model of interaction		Expected OR assuming no joint action (E)	Departure from expected (DE)	% of OR attributable to joint action (low warm & monitor)	
					OR _{warm} + OR _{monitor} – 1	OR _{warm-monitor} – E	DE/OR _{warm-monitor}	
					1.9	0.5	21%, t = 0.50, p = 0.61 (95%CI –61%, 102%)	

Note. †OR = Odds Ratio, 95%CI = 95% Confidence Interval; †OR_{monitor} = low parental monitoring (only), †OR_{warm} = low parental warmth (only), OR_{warm-monitor} = joint effect of low parent warmth and monitoring; †OR_{reference} = neither exposure; PPV = Positive Predictive Value; AR% = Attributable Risk Percent. Estimates are adjusted for parent's marital status and family socioeconomic status.

body image and healthy approaches to eating. Finally the possibility of other influencing variables such as individual predisposing factors (e.g. genetics, parental and child temperament) and more personal characteristics (e.g. parental divorce, economic pressures) also needs to be taken into consideration, when assessing the relationship between parenting styles and maladaptive eating behaviours (e.g. Sherkow, Kamens, Megyes, & Loewenthal, 2009; Zohar, Giladi, & Givati, 2007). Further research is necessary to replicate the current findings and to disentangle the exact causes and motivations of maladaptive parenting practices.

4.4. Gender differences in individual and interactive parenting styles

The more pronounced effects of low parental warmth and monitoring on disordered eating found in girls compared with boys, is consistent with previous studies, outlining that the most common risk factors for eating disturbances include female gender and body dissatisfaction (Culbert et al., 2015; Jacobi et al., 2004). This may be attributable to the higher levels of depressive symptoms commonly reported in girls compared to boys, which have been found to emerge as a potential risk factor in the prediction of body dissatisfaction (e.g. Dakanalis et al., 2014; Etu & Gray, 2010). Future research is warranted to assess whether depressive symptoms in the context of parenting styles, have more enduring effects on girls' rather than boys' body image and how body dissatisfaction ultimately leads to eating pathology in both genders.

Conversely, for the male sample, we found that joint exposure to both low parental warmth and low monitoring was related to an increase in risk for bulimic behaviours, even though the main and additive interaction effects of both parental risk factors were not significant. The overall increased risk of bulimia in boys may indicate that boys cope differently than girls with a parenting style characterized by low warmth and low monitoring, a finding supported by previous studies (Haycraft, Goodwin, & Meyer, 2014; Loth et al., 2014; Vincent & McCabe, 2000). Boys may respond to such maladaptive parenting practices in terms of overeating and purging behaviour, rather than restriction, which may lead to overweight, as shown in earlier studies (Akgul et al., 2016; Nunez-Navarro et al., 2012). Conversely, when children are overweight, parents report greater use of pressuring their child to restrict food intake, which may alter self-regulative responses to internal cues of hunger and satiety, and may therefore ultimately lead to more bulimic behaviours and increased weight gain. Given that most interventions are based on female eating pathology, further research on adolescent boys is needed to inform interventions that are appropriate for both genders (Field et al., 2014).

4.5. Study limitations

There are several limitations to this study that should be taken into account when interpreting the findings. Primarily, given that the parents reported on their own parenting styles, a social desirability effect might have occurred, which could have biased the current results. Secondly, given that mother and father reports of parenting were not both assessed in the current study, but have both been found to be implicated in eating pathology (Horesh et al., 2015; Matton, Goossens, Braet, & Van Durme, 2012), we were not able to test whether paternal and maternal parenting styles were differently related to the disordered eating symptoms and behaviours assessed in the current study. Thirdly, a bidirectional view on parent–child relations cannot be ruled out, as we do not know whether the child-rearing characteristics had been influenced by earlier eating pathology or other problem behaviours (e.g. depressive symptoms) of the adolescent. Fourthly, measuring the

outcomes in mid-adolescence may be too late to pick up risk arising from parenting behaviours. Finally, our study may not have fully accounted for possible gender differences in eating pathology, because the same disordered eating instrument was used for male and female participants. This may have led to underreporting of certain disordered eating behaviours and symptoms especially in males, which may potentially explain the low frequency of males scoring in the top quintile on the body dissatisfaction and the drive for thinness scales. Notwithstanding these limitations, the current study included various noteworthy strengths including a large and diverse community-based sample of male and female adolescents, a longitudinal design and the use of a novel way of assessing interactions between the parental-bond and eating pathology.

4.6. Implications and contributions

Understanding an individual's parenting style and its interactions with other parenting styles, provides greater insight into parental characteristics that maintain the child's eating pathology. If eating disorders occur due to the build-up of the entire complement of sufficient causes, deactivating any of these components may prevent or possibly even treat eating pathology (e.g. Botto, 2007). Our results therefore suggest that preventive interventions may be particularly effective if they involve parents, as the agents of change. Examples of such interventions include the Tripe-P-Positive parenting program (Bodenmann, Cina, Ledermann, & Sanders, 2008). This program aims to educate parents about the negative effects of poor parent-adolescent relationship quality, teach age-specific parenting strategies including appropriate monitoring and warmth (e.g., closeness and empathy), provide conflict-resolution skills in the parent–child relationship and improve the parents' emotional states, in order to empower parents to feel more positive about their role as caregivers (Bodenmann et al., 2008; Saltzman, Liechty, Bost, Fiese & STRONG Kids Program, 2016). The development of methods for modelling protective parenting effects and/or other social factors capable of moderating possible genetic risk for eating pathology and eating disorders, within an additive model of interaction would be especially helpful. It could also be helpful to combine such approaches with more specific parental eating disorder prevention programmes. Confident Body, Confident Child, for example, is a recently developed intervention aimed at parents of children as young as two years of age, which through a range of resources (e.g. booklets, posters, a children's book and a website), aims to educate parents to appropriately communicate with their children about body image and eating behaviours (Hart, Damiano, & Paxton, 2016). Finally, it is also worth mentioning that there are currently a range of interventions offered through new mobile apps, such as Habit Changer: Feeding Your Kids, which incorporate parenting training techniques and social networking possibilities for parents. These apps may be used as an additional tool to the above outlined preventative efforts (Mitchell, Farrow, Haycraft, & Meyer, 2013).

5. Conclusions

Using unique data from a large population based cohort study (the ATP), this study aimed to provide a deeper understanding of how parenting practices may be related to risk for disordered eating attitudes and behaviours in female and male adolescents. Our results suggest that for girls, risk for bulimic behaviour is increased in those living with a low warmth parent and that risk for body dissatisfaction and drive for thinness is increased in those living with a low warmth and low monitoring parent. Conversely, there were no main or interactive effects of parenting for boys. However, the current findings need to be interpreted keeping in

mind the limitations previously described. In order to be able to overcome some of these limitations, future studies should therefore try to: 1) incorporate the perceptions of parenting of both the adolescents and the parents; 2) assess differences in parenting styles between fathers and mothers; 3) assess the bi-directional effect of both parenting practices and disordered eating symptoms, by collecting data longitudinally, starting preferably in early childhood when parenting practices might be more pertinent and 4) employ eating disorder-related and body dissatisfaction measures that are appropriate for both males and females.

Authors contributions

IK, RK, AS and CO drafted the manuscript and conceptualized the aims and hypotheses. GY conducted the analyses and helped revise the manuscript. CO, and PL set up data collection and obtained funding for the project. EW contributed to measurement selection related to body dissatisfaction and disordered eating. EW, DLG and EH provided feedback on different versions of the manuscripts. All authors read and approved the final manuscript.

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