

## **Tests of an extension of the dual pathway model of bulimic symptoms to the state-based level**

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## Abstract

The dual pathway model proposes that trait body dissatisfaction leads to bulimic symptoms via two distinct pathways: dieting and trait negative affect. As many of these modelled variables have state-based equivalents, the present study evaluated the generalisability of this model to predict associations between state body dissatisfaction and instances of disordered eating. 124 women aged 18 to 40 years completed an online survey (accessed via a mobile phone device with web access) over a 7-day period. The mobile phone device prompted participants at random intervals seven times daily to self-report their state body dissatisfaction, current mood experiences, dieting attempts, and disordered eating practices. Multi-level mediation modelling revealed that both negative mood states and dieting significantly mediated the state body dissatisfaction–disordered eating relationships, although the strength of these associations depended on the aspect of disordered eating measured and individual differences in trait body dissatisfaction, internalization of appearance standards, tendency towards dieting, and BMI. Collectively, these results not only support adapting the dual pathway model to the state-level, but also suggest that several of the model implied pathways may be more relevant for individuals with more pathological eating- and body-related concerns and behaviours.

Body dissatisfaction is widespread among girls and women throughout Western cultures, with approximately 60% of 13-15 year old girls, 90% of 18-30 year old women, and 80% of middle-aged women reporting dissatisfaction with their appearance [1-3]. Of those individuals who are dissatisfied with and wish to alter their appearance, approximately one-third engage in unhealthy body change practices, such as forcing themselves to purge, deliberately abusing laxatives or diuretics, or strict dieting or fasting [4].

Surprisingly, body dissatisfaction is also related to binge eating [5-7], and this relationship is not simply driven by shared association with other eating disorder symptoms [8-9]. The act of bingeing typically occurs amid a general effort to restrict eating in order to achieve a slim figure. Because this relationship is perplexing, and also because body dissatisfaction and binge eating may perpetuate (and prolong) eating disorder symptoms, there is need to understand how and why body dissatisfaction leads to binge eating. The present study compares several proposed models (dual pathway model, escape from awareness, and objectification theory) that seek to account for this relationship.

### ***Dual Pathway Model***

As shown in the upper panel of Figure 1, the dual pathway model [10-11] reconciles this unexpected finding in two ways. First, it is proposed that body dissatisfaction prompts general and intense states of negative affect or depressed mood, which are resolved through distraction and/or comfort through food consumption. Individuals who experience difficulties regulating this emotional arousal may thus use binge eating as a means to distract themselves. Alternatively, dietary restraint may be used in attempts to reduce body dissatisfaction, but this too leads to over-eating as sustained food restriction increases hunger levels, appetitive response to food and,

ultimately, increases the likelihood of food over-consumption to restore energy levels after a period of deprivation [12].

The proposed pathways of negative affect and dietary restraint have received extensive support in both eating disordered and non-eating disordered samples of women. Negative mood, depressive symptoms, and emotional regulation difficulties have been shown to be more common among individuals with eating disorders [13-14], and in non-clinical populations, these mood disturbances are positively associated with severity of disordered eating symptomatology [7, 11, 15-18]. Body dissatisfaction and perceived weight problem (as opposed to objective measurements of weight) have also been linked to dietary restraint efforts [11, 19]. Inconsistent findings within the literature have, however, led some researchers to question the hypothesized link between dietary restraint and binge eating. Not all binge episodes result from periods of food deprivation: individuals with binge eating disorder are just as prone to binge eat on days when food intake is restricted as when it is not [20], and bulimics may also binge on days when they do not exert dietary control [21].

Moreover, while binge-eaters can acknowledge positive aspects of food consumption (such as the taste and enjoyment of eating), they are more often concerned with potential weight gain. These negative aspects typically have a prohibitive effect on the food consumption of binge-eaters and, hence, an adequate explanation of engagement in binge eating must account for this shift in attention from (or de-emphasis of) the negative aspects of food consumption.

### ***Escape from Awareness Model***

Whereas the dual pathway model posits that binge eating may be a means for distraction from negative mood states, Heatherton and Baumeister's [22] escape from awareness model (middle panel in Figure 1) proposes instead that binge eating is a

consequence of successful self-distraction attempts. This theory holds that, when faced with negative mood states (whether they are generic feelings of depressed mood/negative affect, or negative mood in relation to specific domains, such as body dissatisfaction), some individuals seek to resolve these negative feelings by shifting attention away from considerations of meaning and consequences, and instead move towards emphasis on concrete aspects of stimuli, such as smell, sight, feel, and taste of stimuli in their environment. The focus on these concrete aspects of food (when present) coupled with reduced consideration of the consequences of food consumption may have the effect of temporarily suspending any self-imposed prohibitions on food consumption.

Consistent with the escape from awareness model, binge episodes are typically preceded by heightened negative affect [23], and subsequent to the binge episode, individuals exhibit poor recall of amount of food consumed [24]. Individuals with body dissatisfaction are also more likely to adopt coping strategies involving self-distraction from, and avoidance of, aversive self-criticism [25].

### ***Objectification Theory***

Objectification theory [26] argues that women, particularly in Western cultures, are commonly viewed as objects by society, with their bodies being attended to in a sexual, objectifying manner. Given the pervasiveness of this objectification [27], it is argued that many women adopt a third-person perspective of their own appearance (self-objectification), which, in turn, leads to a preoccupation with outward appearance, more frequent engagement in self-monitoring, and subsequent body dissatisfaction [27]. A potential consequence of increased focus on outer appearance is limited attendance to their own internal states. This deficit in internal awareness, also termed

poor interoceptive awareness, may be a precursor to binge eating, as the individual is unaware of satiety cues that would otherwise prevent overeating [28].

Extant literature provides evidence for a link between self-objectification and interoceptive awareness, with lack of awareness being correlated with greater eating disorder symptoms [29-30]. Further, when individuals experience body dissatisfaction they are more likely to self-surveil their appearance in order to ensure their compliance with the thin ideal [31-32]. Longitudinal studies have shown that improvements in interoceptive awareness correspond with reductions in eating disorder symptomatology in patients treated for anorexia nervosa, at both post-treatment and long-term follow-up [33].

### **The Present Study**

Given the potential treatment implications of understanding the mechanisms by which body dissatisfaction promotes binge eating, further testing of these models is required. Moreover, as each of these models proposes markedly different mechanisms to account for the association between body dissatisfaction and binge eating, it is plausible to suggest that each may uniquely contribute to explanation of this main relationship. For these reasons, there is a clear need to determine the unique and combined contributions of these models for explaining the body dissatisfaction-binge eating link.

To the authors' knowledge, the present study is the first to evaluate the individual and combined predictive value of the dual pathway, escape from awareness, and objectification theory modeling of the relationship between body dissatisfaction and binge eating. Based on the above-mentioned prior research, it is hypothesized that each model would significantly mediate the direct path when tested separately.

### **Method**

## **Participants**

A convenience sample of 408 adult women, recruited from the researchers' University and aged between 18 and 40 years ( $M=25.25$ ,  $SD=5.25$ ), participated in the study. The average BMI was 24.01 ( $SD=5.25$ ). Participation was limited to English speaking women with access to a computer in order to complete the survey. Although the Eating Disorder Examination Questionnaire [34] can be used to screen for probable diagnoses of an eating disorder, participants with high scores on the EDE-Q subscales were not excluded from main analyses as their exclusion may produce distortion of parameter estimates due to range restriction [35].

## **Materials**

*Eating Disorder Symptomatology.* The present study used the following scales from the Eating Disorder Examination Questionnaire version 6 [34]: (1) Dietary restraint (“Have you been deliberately trying to limit the amount of food you eat to influence your shape and weight?”); (2) Concern with body weight (“Has your weight influenced how you think about (judge) yourself as a person?”); and (3) Concern with body shape (“How uncomfortable have you felt seeing your body (e.g. in the mirror, in shop window reflections, while undressing or taking a bath)?”). Since the measures of weight and shape concerns were highly correlated ( $r = .93$ ), the two subscales were averaged together to produce a single measure of body dissatisfaction. Other authors [36] have also performed this step on the same grounds. The EDE-Q subscales have demonstrated good test-retest reliability (following a 10-month interval) [37], and acceptable internal consistency [38].

*Binge Eating Symptoms.* Binge eating symptom severity was assessed by using Question 4 of the Questionnaire of Eating and Weight Patterns- Revised (QEWP) [39]. This question assesses the presence of 6 symptoms of bingeing: rapid consumption of

food, eating until uncomfortably full, eating despite not being hungry, eating large quantities of food throughout the day, eating alone, and feeling guilt and shame about a binge episode. In the current study, the responses to these 6 sub-questions were computed to produce a tally of symptoms of binge eating, ranging from 0 to all 6 symptoms, with higher scores reflecting more probable cases of binge eating. Psychometric studies comparing the QEWP with clinical interviews based on the criteria for binge eating disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM) have demonstrated adequate validity and test-retest reliability of the QEWP over a 3-week period [40].

*Interoceptive Deficits.* The Interoceptive Deficits (ID) subscale of the Eating Disorders Inventory version 3 [41] was used to measure the extent to which an individual experiences difficulty recognising and accurately identifying internal emotional states (“When I am upset, I don’t know if I am sad, frightened, or angry”) and physiological states of hunger and satiety (“I get confused as to whether or not I’m hungry”). Participants indicate their agreement with a series of 10 statements on a 6-point Likert scale ranging from 0 (*never*) to 5 (*always*), with the most maladaptive response receiving the highest score. This subscale has good internal consistency, and yields adequate convergent and discriminant validity [42].

*Emotional lability.* The two emotional lability items of the Ten Item Personality Inventory [43] were averaged to measure propensity for negative mood states (*‘I see myself as anxious, easily upset’* and *‘I see myself as calm, emotionally stable’*). Respondents are asked to rate their level of agreement with each statement using a 7-point Likert scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*), with a neutral midpoint. The emotional lability subscale of the TIPI has shown acceptable test-

retest reliability estimates across a 6-week time span [43] as well as convergent and discriminant validity [44].

*Escape from awareness.* The 4-item self-distraction subscale of the COPE Inventory [45] was used to assess a participant's tendency to escape from awareness when experiencing negative thoughts and feelings (*'I've been turning to work or other activities to take my mind off things'*). All items are rated on a 4-point Likert scale ranging from 1 (*I usually don't do this at all*) to 4 (*I usually do this a lot*). The subscales of the COPE have sound convergent and discriminant validity, good internal consistency, and acceptable test-retest reliability estimates over an 8-week interval [45].

### **Procedure**

Once ethics approval was provided by the University's Human Research Ethics Committee, participants were recruited via announcements at the beginning of tutorials and lectures in numerous classes (sampled across varying disciplines) at a large metropolitan university in Melbourne, Australia. The announcement included a weblink which interested participants were instructed to access at a time convenient to them (outside of class time). This link led them to the Plain Language Statement (PLS) about the study and, if after reading the PLS, they agreed to participate, they were directed to the questionnaire. The questionnaire was designed to be sufficiently detailed in order to capture the model implied variables, but not too long to over-burden participants. Preliminary testing by the authors suggested that the questionnaire could be completed within 25 minutes.

### **Data Analytic Strategy**

Mediation analyses were conducted to test the proposed influences of negative affect, dietary restraint, interoceptive deficits, and self-distraction for the relationship between body dissatisfaction and binge eating. These potential mediational pathways

were tested if the following conditions, as specified by Baron and Kenny [46], were met: (1) body dissatisfaction significantly correlates with binge eating, (2) body dissatisfaction significantly correlates with the assumed mediator, and (3) the assumed mediator significantly correlates with binge eating. For relationships that met these three preconditions, mediation effects were tested for significance using a bias-corrected bootstrapping resampling method [47] to more accurately estimate confidence intervals for the mediation effect. In these mediation models, age and BMI were added as covariates given their known association with both body dissatisfaction and binge eating [48-49].

Proportion reduction in variance (PRV) was calculated to determine the proportion of the total IV-DV relationship attributable to a given mediator. The PRV was calculated using the following formula:

$$PRV = ((c - c')/c)*100$$

where  $c$  is the total effect of body dissatisfaction on binge eating, and  $c'$  is the direct effect of body dissatisfaction on binge eating, controlling for the indirect effect via the mediator(s). PRV values range from 0 to 100, with 0 indicating that the mediator failed to account for any of the shared variance between body dissatisfaction and binge eating, whereas 100 indicates that the mediator(s) accounted for all shared variance.

Each of the proposed mediation models (dual pathway, escape from awareness, and objectification theory) was first tested separately to evaluate their total impact on the body dissatisfaction-binge eating relationship. Then, a full model containing all mediators was run to evaluate the relative contributions of each of the models.

## **Results**

### *Data screening*

Preliminary data screening revealed minimal missing values (less than 2% overall), spread at random across items and participants. Accordingly, missing values were replaced using expectation maximization [50]. All scales conformed to requirements for normality [51]. Although no univariate outliers were found which influenced regression results, four multivariate outliers were identified and deleted. The results of the subsequent analyses are for the 408 remaining cases.

#### *Bivariate correlations*

Table 1 displays the means, standard deviations, Cronbach's  $\alpha$ , range of scores, and inter-relationships for the measures of dietary restraint, body dissatisfaction, number of binge eating symptoms, interoceptive deficits, emotional stability, and self-distraction used in the present study. Cronbach's  $\alpha$  is not reported for binge symptoms because as this variable represents a tally of symptoms, Cronbach's  $\alpha$  is unsuitable. Cronbach's  $\alpha$  values range from .71 to .88 and are all within the acceptable range [52]. Comparison of the possible and actual score ranges shows that participants covered the spectrum of possible scores for these variables. The average levels of body dissatisfaction, binge eating, interoceptive deficits, and dietary restraint were moderately low, although there was considerable variability in these scores across participants. In contrast, scores on emotional lability and use of self-distraction coping strategies were in the upper half of the possible score range for these scales.

Bivariate correlations showed that body dissatisfaction had moderate positive association with binge eating symptoms. Body dissatisfaction was significantly related to all proposed mediators, with magnitude of effect ranging from small ( $r = .18$  with self-distraction) to moderate-to-large ( $r = .48$  with dietary restraint), using Cohen's [53] guidelines for interpreting correlation magnitude. All proposed mediators were significantly related to binge eating symptoms.

INSERT TABLE 1 HERE

### *Mediation Analyses*

As the three pre-conditions for mediation obtained for all models, mediation effects proceeded first individually for each model (Table 2), and then together in a full model with all proposed mediators (Table 3). When considered separately, the dual pathway model best accounted for the body dissatisfaction-binge eating relationship, with both dietary restraint ( $a*b = -.013, p < .05, 95\% \text{ CI: } -.024, -.003$ ) and emotional lability ( $a*b = -.007, p < .05, 95\% \text{ CI: } -.013, -.001$ ) making significant unique contributions to the model, and jointly accounting for a 23.83% reduction in variance in the IV-DV relationship. Objectification theory also reliably explained some variance in the IV-DV relationship ( $a*b = -.010, p < .05, 95\% \text{ CI: } -.018, -.002$ ), although the proportion reduction in variance was small (PRV = 3.85). Self-distraction (the mediator implied by the escape from awareness model) failed to mediate the body dissatisfaction-binge eating relationship ( $a*b = -.003, p > .05, 95\% \text{ CI: } -.007, .001; \text{ PRV} = 3.85$ ). When considered jointly, only dietary restraint made a significant unique contribution to the IV-DV relationship ( $a*b = -.011, p < .05, 95\% \text{ CI: } -.021, -.001$ ). Moreover, the PRV for the combined model was only marginally better than for the dual pathway model by itself (PRV complete model = 26.23 versus PRV dual pathways model = 23.83). The direct path (IV-DV) remained significant, even after accounting for the combined contributions of the IVs.

INSERT TABLES 2 AND 3 HERE

### **Discussion**

The primary aim of this study was to test the effectiveness of the dual pathway, objectification theory, and escape from awareness models of potential mediators of the

relationship between body dissatisfaction and binge eating. These models were tested individually and in combination to determine their relative contribution towards, and ability to fully mediate, the body dissatisfaction-binge eating relationship.

Present findings offered support for these models when tested separately. Both proposed mediators of the dual pathways model (dietary restraint and emotional lability) were significant unique contributors, and accounted for approximately one-quarter of the shared variance between body dissatisfaction and binge eating. These findings are consistent with previous research that has shown support for both pathways of dietary restraint and disturbed mood [7, 11, 18, 54]. The mediator interoceptive awareness – as proposed by objectification theory – also significantly mediated the IV-DV relationship when tested individually, although the impact of this mediator on the model was considerably smaller than the dual pathway mediators. The extant literature has been inconclusive about the extent to which interoceptive awareness mediates the body dissatisfaction-binge eating relationship. Of the studies that have successfully demonstrated this mediational effect, all have utilised an aggregate of eating disorder symptoms in their assessment of the body dissatisfaction and disordered eating relationship [55-56]. Thus, this is the first study to evaluate the mediating influence of interoceptive awareness on the body-dissatisfaction-binge eating relationship utilising binge eating as a distinct outcome measure.

Surprisingly, self-distraction – a mediator derived from the escape from awareness model – failed to reliably account for variance shared between body dissatisfaction and binge eating. One plausible explanation for the null finding is the difficulty in measuring the mechanism of distraction that is central to the escape model. The present study measured these attitudes and behaviours “in general” to determine whether the tendency towards body dissatisfaction co-occurs with the tendencies to

binge eat and engage in self-distraction. It is possible that the self-distraction effect on body dissatisfaction-binge eating is only potentiated in certain contexts (e.g., extreme stress and/or perceived inability to cope directly with a threat). In such a case, the frequency with which individuals engage in self-distraction (as measured here) is less relevant than the context(s) in which the defense mechanism is enacted. Consistent with this view, several recent studies have demonstrated that binge episodes are more likely after a prolonged build up of stress [57-58], and this effect is most pronounced for those with poor coping skills [59].

Present findings also suggest the superiority of the dual pathway model in accounting for the body dissatisfaction-binge eating relationship. In addition to the larger PRV values of this model than other tested models, when all mediators were tested in a combined model, only dietary restraint (a dual pathway proposed mediator) significantly contributed to the IV-DV relationship. Moreover, comparison of the full model versus the dual pathway model showed that inclusion of the other mediators (self-distraction and interoceptive awareness) failed to meaningfully improve the overall model. Nevertheless, the direct effect of body dissatisfaction on binge eating remained significant even after all the proposed mediators were entered into the model. This suggests the need to consider other potential mediators of the body dissatisfaction-binge eating relationship. One possible avenue for future research is to explore the motives for binge eating. It is possible that food consumption is used for self-soothing (comfort eating) in the face of intense negative emotions rather than being a consequence of self-distraction, as proposed by the escape from awareness model [60].

Present findings should be considered jointly with design limitations. In particular, the cross-sectional design means that proposed mediation pathways could equally work in a re-arranged order. For instance, binge eating may lead to body

dissatisfaction and, in turn, emotional lability and dietary restraint. Longitudinal designs, in particular approaches such as the experience sampling method [ESM; 61-62], which capture momentary changes in state-like constructs, may be usefully employed to capture the dynamic nature of the relationships between body dissatisfaction, binge eating, and proposed mediators. ESM would also help distinguish between different arrangements of these variables by establishing temporal precedence of IVs and mediators before the DV event occurs. Additionally, the use of a convenience sample means that it is possible present findings do not generalize to the community or to subpopulations characterized by body dissatisfaction and disordered eating, such as those with eating disorders [63]. Nevertheless, there was considerable variability in the present study across each of the studied variables, as would be expected in the general population, and the levels of disordered eating symptoms in the present study were consistent with findings from previous community-based sampling in Australia [64]. Future research would be useful to confirm the robustness of present findings by comparing present models in eating disorder populations.

### **Conclusions**

Despite these limitations, present findings add to existing empirical support for the dual pathway model by demonstrating its superiority over two other models that have also been previously used to explain the link between body dissatisfaction and binge eating in a sample of non-eating disordered females. Testing the effectiveness of each model/theory permits conceptualisation of the factors proposed to mediate the relationship between body dissatisfaction and binge eating. This relative exploration presents a necessary precondition for further evaluation of the perplexing relationship between body dissatisfaction and binge eating behaviours.

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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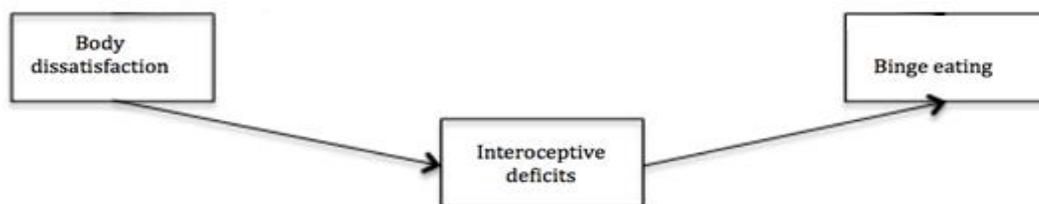
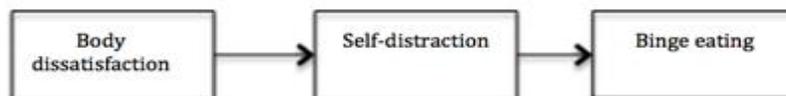
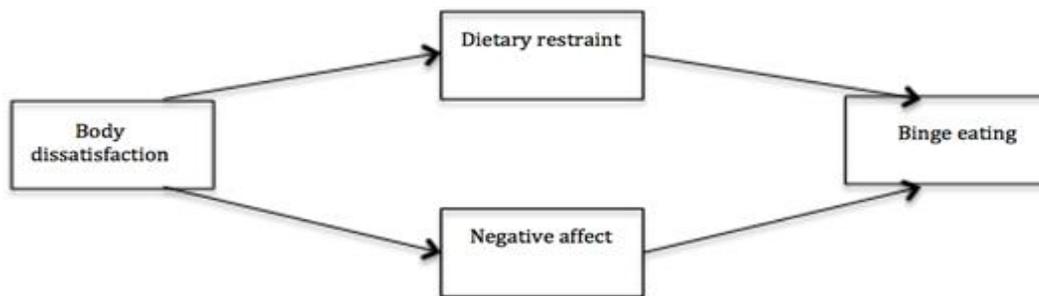


Figure 1. Upper panel: dual pathway model; Middle panel: escape from awareness model; Lower panel: objectification model

Table 1. *Bivariate correlations (Pearson's r values are reported)*

	1	2	3	4	5	6
1. Body dissatisfaction	<b>.88</b>					
2. Binge symptoms	.39**	<b>n/a</b>				
3. Dietary restraint	.48**	.26**	<b>.82</b>			
4. Interoceptive deficits	.34**	.25**	.32**	<b>.84</b>		
5. Emotional stability	.28**	-.20**	-.27**	-.59**	<b>.76</b>	
6. Self-distraction	.18**	.19**	.19**	.35**	-.16*	<b>.71</b>
Mean	33.78	1.60	9.73	15.26	4.28	9.62
SD	19.22	2.16	6.93	7.65	1.52	2.98
Possible range of scores	0-78	0-6	0-30	0-50	1-7	4-16
Actual range of scores	0-73	0-6	0-25	0-45	1-7	4-16

Notes: \* $p < .01$ , \*\* $p < .001$ ), n/a = not applicable. Numbers presented in bold along the main diagonal represent internal consistency values (i.e., Cronbach's  $\alpha$ ) for these variables.

Table 2. *Testing the mediation models individually*

	a*b	c	c'	PRV
Dual pathway model				
Dietary restraint	-.0133*	-.0831	-.0633	23.83
Emotional stability	-.0065*			
Escape from awareness				
Self-distraction	-.0032	-.0831	-.0799	3.85
Objectification theory				
Interoceptive deficits	-.0102*	-.0831	-.0729	12.27

Note: \*p<.05, \*\*p<.01, \*\*\*p<.001.

Table 3. *Testing the mediation models together*

	a*b	c	c'	PRV
Dietary restraint	-.0108*	-.0831	-.0613	26.23
Emotional stability	-.0034			
Self-distraction	-.0022			
Interoceptive deficits	-.0053			

Note: \* $p < .05$