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**Author(s):** Corstorphine, Emma; Waller, Glenn; Ohanian, Vartouhi; Baker, Martyn.

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Corresponding author

Emma Costorphine, Outpatient Eating Disorders, Harewood House, Springfield  
University Hospital, Tooting, London SW17 7DJ, United Kingdom. Telephone: (+44)  
208-682-6747. Fax: (+44) 208-725-2618.  
E-mail: [emma.corstorphine@swlstg-tr.nhs.uk](mailto:emma.corstorphine@swlstg-tr.nhs.uk)

CHANGES IN INTERNAL STATES ACROSS THE BINGE-VOMIT CYCLE  
IN BULIMIA NERVOSA

Emma Corstorphine, BSc., ClinPsyD., (1) Glenn Waller, BA., MclinPsychol., Dphil., (1)

Vartouhi Ohanian, BSc., MclinPsychol., (2) Martyn Baker, PsyD., (3)

1. Eating Disorders Service, South West London and St. George's Mental Health NHS Trust, London, United Kingdom. Send reprint requests to Emma Corstorphine.
2. Vartouhi Ohanian, Lakeside Mental Health Unit, West Middlesex University Hospital, London, United Kingdom
3. Department of Psychology, University of East London, London, United Kingdom

## Changes in Internal States across the Binge-Vomit Cycle in Bulimia Nervosa

### Abstract

While there is considerable evidence that bulimic behaviours serve the function of modifying internal states (e.g., satiety, mood), there is less clarity over the roles of the different behaviours across the binge-purge cycle. The present study examines the impact of bingeing and vomiting upon these internal states at different time points, and evaluates the potential reinforcement of those behaviours by the changes in internal states. Twenty three women with diagnoses of bulimia nervosa completed a diary of all binge-vomit episodes over the course of seven days, rating their internal states (satiety, negative mood, positive mood) at four time points during each episode. There were substantial changes across the cycle in levels of hunger, fullness, guilt/shame, anxiety/worry and happiness/relief, but not in other states. The changes indicate that the binge-vomit cycle is maintained by the effects of both behaviours, but that the vomiting behaviour evokes the strongest pattern of reinforcement. Further research is needed to determine the levels of internal states during the binge itself.

**Keywords:** Internal states, binge, vomit, bulimia

### **Changes in Internal States across the Binge-Vomit Cycle in Bulimia Nervosa**

While early models of bulimia nervosa stress the role of cognitions and behaviours centred on food, shape and weight (e.g., Fairburn & Cooper, 1989; Polivy & Herman, 1985; Slade, 1982), there have long been suggestions that bulimic behaviours also serve the function of regulating affect (e.g., Abraham & Beumont, 1982; Lacey, 1986; Root & Fallon, 1989). There is now considerable evidence from a range of naturalistic, correlational and experimental studies that emotional states are related to bulimic behaviours (e.g., Arnow et al., 1992, 1995; Meyer et al., 1998; Patton, 1992; Wegner et al., 2002). Indeed, bulimic behaviours are best understood as a product of the interaction of a range of internal states, including affect and satiety (e.g., Agras & Telch, 1998; Grilo et al., 1994; McManus & Waller, 1995; Stice, 2001).

The majority of studies and clinical reports of the role of affect in the binge-purge cycle in bulimia nervosa have addressed the function of binge-eating (e.g., Lacey, 1986; Root & Fallon, 1989). They have suggested that bingeing serves the function of temporarily reducing awareness of negative emotional states during the eating behaviour (an 'emotional blocking' model). However, mood deteriorates significantly following a binge (e.g., Waters et al., 2001), suggesting that binge-eating in itself is unlikely to have sufficient valence to explain the binge-purge cycle. Other studies have shown that vomiting also has a substantial impact on affective state, acting as a potential negative reinforcer by reducing anxiety levels (Johnson & Larson, 1982; Kaye et al., 1986) following eating.

These studies require extension. First, many have used a general measure of negative mood (along with other internal states, such as hunger and craving), and there is no picture of how distinct moods change as a result of bingeing (e.g., Waters et al., 2001). Since researchers (e.g., Arnow et al., 1995; Patton, 1992; Waller et al., 2003) have concluded that a number of affective states might drive bingeing (e.g., loneliness, anger, anxiety, shame), the present study will consider the role of a range of specific internal states (both mood- and satiety-related) in bulimic behaviours. Second, such studies have often focused on the experience immediately

before and after binge-eating and vomiting, rather than considering the longer-term reinforcing nature of these behaviours. Finally, some studies (e.g., Waters et al., 2001) have examined episodes of bingeing following food craving, and have thus excluded a number of non-craving related binges.

The present study aimed to determine patterns of changes in internal states across the binge-vomit cycle in bulimia nervosa patients, in order to clarify the function of those behaviours in maintaining that cycle. The patients monitored their internal states from before bingeing until after vomiting, using a self-report diary. The internal states investigated were those that have been indicated by the existing literature on the functions of bingeing and vomiting (e.g., Fairburn & Cooper, 1989; Lacey, 1986; Meyer et al., 1998), including indicators of level of satiety (hunger, fullness of stomach), negative mood (anxiety/worry, anger/frustration, loneliness, guilt/shame) and positive mood (happiness/relief). Although depression is associated with bulimic disorders (Levy et al., 1989), it is a relatively weak trigger of bulimic behaviours themselves, compared with other affective states (Arnow et al., 1992; 1995). Therefore, this mood state was not included in this study.

## **Method**

### Design

The study used a longitudinal within-subjects design, comparing levels of internal states at four time points across the binge-vomit cycle (immediately pre-bingeing; immediately pre-vomiting; immediately post-vomiting; one hour post-vomiting). In contrast with Waters et al. (2001), who used the binge episode as the unit of analysis (i.e., one patient could contribute a number of individual binges), the present study used the individual patient as the unit of analysis (i.e., mean responses from all binge-purge episodes over the period of one week). In addition, Waters et al. (2001) focused on binges that were associated with food cravings, whereas this study used all objective binges-vomit episodes across the time period.

### Measures and Procedure

The participants were 23 women who met strict DSM-IV criteria for bulimia nervosa (American Psychiatric Association, 1994). They were recruited from a specialist eating disorders clinic. They were diagnosed at assessment by clinicians trained in the differential diagnosis of the eating disorders, using a structured interview based on DSM-IV criteria. A further 11 bulimic women were invited to take part, but four declined and seven agreed to participate but failed to return the diary measure. The participants had a mean age of 29.9 years ( $SD = 8.52$ ; range = 17-50) and a mean body mass index ( $BMI = \text{weight}[\text{kg}]/\text{height}[\text{m}]^2$ ) of 24.5 ( $SD = 8.22$ ; range = 18.7-54.6).

As a part to their assessment, the women completed the Bulimic Investigatory Test, Edinburgh (BITE; Henderson & Freeman, 1987). The BITE is a well-validated self-report questionnaire, where the presence of bulimic symptoms and attitudes is measured by a 'Symptom' scale and the severity of behaviours is reflected in a 'Severity' scale. While it cannot be used as a diagnostic instrument (Waller, 1992), the BITE provides a clinically useful index of the presence and extent of bulimic symptoms (Henderson & Freeman, 1987). The scores on the BITE were in the normal range for a bulimia nervosa group (mean Symptom score = 23.1,  $SD = 3.55$ ; mean Severity score = 14.0,  $SD = 5.64$ ). The 11 patients who did not participate had similar ages, BMIs and BITE scores to the 23 who did take part.

Following their assessment, the women completed an internal states monitoring diary over the course of the next week. This diary allowed the women to record the strength of each of seven internal states (in order: anger/frustration; anxiety/worry; fullness of stomach; guilt/shame; happiness/ relief; hunger; loneliness) at four time points during each episode of objective bingeing and vomiting. Each internal state was rated on a 0-100 scale (units of 10), by ticking the relevant box on that scale. These seven ratings were made at the following four time points: immediately before bingeing; immediately before vomiting; immediately after vomiting; and one hour after vomiting. Where an individual was unable to complete a rating (e.g., if asleep one hour after vomiting) or where bingeing was not followed by vomiting, then that episode was discounted from subsequent consideration. The women were given a diary booklet with sufficient space for 20 binge-vomit episodes. Across the 23 women, the mean number of valid binge-vomit

episodes over the week was 4.70 (SD = 3.38; range = 1-12).

### Ethical considerations

The project was approved by the relevant local research ethics committee, working to criteria equivalent to those of the British Psychological Society and the American Psychological Association. All participants were given an information sheet, had the project explained to them, and signed a consent form if they agreed to take part.

### Data analysis

The data were initially analysed for normality of distribution, using Kolmogorov-Smirnov tests. No variable's distribution violated normality ( $\underline{P} > .05$  in all cases), so parametric tests were used. Repeated measures ANOVAs were used to compare levels of internal states across the four time points. Where there was a significant main effect, post hoc pairwise comparisons (Least Significant Difference tests;  $\underline{p} < .05$ ) were used to determine the source of the differences.

## **Results**

Preliminary correlational analyses (Pearson's  $r$ ) were carried out, to determine whether there were associations between individual patient characteristics (age and BMI) and the experience of internal states at each time point. Given the number of correlations involved, a relatively conservative alpha was adopted ( $\underline{P} < .01$ ) to reduce the risk of Type I errors. There were only two significant associations. The first was a positive correlation between BMI and level of pre-binge anger ( $r = .454$ ,  $\underline{P} = .009$ ), indicating that women with higher weight for height had higher levels of anger prior to a binge. The second was a negative correlation between age and feelings of fullness immediately after the binge ( $r = -.453$ ,  $\underline{P} = .009$ ), showing that younger women felt fuller after bingeing.

Table 1 shows the women's internal state ratings (Mean + SD) at each of the four time points. It shows the results of the repeated measures ANOVAs and the post hoc tests used to determine significant pairwise differences. All indicated differences were significant at the  $\underline{P} < .05$  level. There are no comparison data against which to judge the ratings immediately before the binge-purge cycle. However, the data at the first time point had considerable face validity -



indicating high levels of hunger and negative mood, but low levels of satiety (fullness) and positive mood. Taking the broad comparison between the point immediately before bingeing and an hour after vomiting, the only significant differences were that the women felt less hunger and more guilt (LSD tests). However, the pattern was more complex within that time envelope.

When considering changes in the women's physical states over time, hunger and fullness followed the anticipated pattern. Hunger was reduced immediately after the binge, and began to rise again significantly in the hour following vomiting (although it remained reliably below its initial level). In contrast, there was a strong and reliable increase in the sensation of fullness immediately after bingeing, which returned to its earlier levels immediately after vomiting and for the following hour.

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Insert Table 1 about here

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The pattern of change in mood levels varied across affective states. Having been at relatively high levels prior to the binge, levels of anger/frustration and loneliness remained at the same level throughout the binge-vomit cycle. Levels of guilt/shame rose substantially immediately after the binge, and remained reliably higher thereafter. The other two affective states showed a more complex pattern of change across the cycle. Anxiety/worry levels rose significantly immediately after bingeing, then fell again immediately after vomiting, and stayed at a low level. In contrast, happiness levels did not change after the binge part of the cycle, but rose substantially after the vomiting episode. Although the happiness rating fell over the following hour, it remained higher at the end point than it had been immediately before vomiting.

To summarize, the data suggest that there were short-term effects of bingeing upon internal states, including reduced levels of hunger and higher levels of fullness, guilt/shame and anxiety. While the sensation of fullness was reversed immediately following vomiting, the other

changes were maintained (guilt/shame), partially reversed (hunger) or wholly reversed (anxiety/worry) by the end of an hour. In contrast, levels of happiness rose only after the vomiting episode, and remained at a raised level even after an hour. Finally, while their rated levels were relatively high at the outset of the binge-vomit cycle, it is noteworthy that levels of anger/frustration and loneliness did not change at any of the later time points.

### Discussion

This study has monitored changes in a range of internal states (satiety and mood states) across the binge-vomit cycle, determining whether the changes in those states might help to explain the maintenance of the binge-vomit cycle. In behavioural terms, the findings suggest that the bingeing phase is maintained by the reinforcing effect of reduced hunger, but is subject to the punishment effect of elevated levels of guilt/shame and anxiety. In contrast, the vomiting phase would be maintained by reinforcing effects of increased levels of happiness/relief, lowered levels of fullness and lowered levels of anxiety/worry.

These findings support and extend the conclusions of earlier researchers (e.g., Johnson & Larson, 1982; Kaye et al., 1986), who have suggested that the binge-vomit cycle may be maintained by the reinforcing anxiolytic qualities of the vomiting behaviour. The principal maintaining factor behind the binge per se appears to be the achievement of homeostasis through reduction in levels of hunger (e.g., Polivy & Herman, 1985; Slade, 1982). At an affective level, there was a similar deterioration of mood post- binge to that shown by Waters et al. (2001). However, the present study is not a true test of the 'emotional blocking' model of bingeing (Lacey 1986; McManus & Waller, 1995), which argues that affect should be reduced during the bingeing, rather than afterwards. Testing that model would require a much more detailed micro-analysis of the changes in mood across the period of the binge itself. Such an analysis should include particular consideration of the potential changes in anger and loneliness during the binge (e.g., Patton, 1982; Root & Fallon, 1989), in order to determine whether those affects are more pertinent to the maintenance of this behaviour than this study has been able to show. It might

also consider the role of other internal states (e.g., social anxiety, jealousy, craving, thirst). It will also be important to assess each of these internal states at times when the individual is not about to engage in the bulimic behaviours. A time-sampling method of doing this would establish a baseline against which the ratings made here can be compared, to determine which internal states (or combination of states) are most likely to trigger the binge-vomit episode.

This study has a number of implications for the methodology used in future research in this area. First, there is a need for more detailed micro-analysis of the antecedents and consequences of bulimic behaviours, over a longer time period than the behaviour itself. Second, clinically useful information about internal states can be collected using simple paper and pencil tasks, rather than requiring more 'high-technology' methods (Wegner et al., 2002). Finally, it demonstrates that changes in internal states across the binge-vomit cycle do not follow a common pattern, indicating that such states should be considered separately rather than being grouped under broader categories (e.g., negative emotion).

This study is limited in its generalizability by the fact that the patients were recruited from a specialist eating disorders service. Since such patients are not necessarily representative of those in the community (e.g., Fairburn & Beglin, 1990), it is possible that these findings are not representative of the internal states of all women with bulimia nervosa. In addition, it will be important to determine whether similar patterns apply among other women who use bingeing and/or vomiting (e.g., anorexia nervosa of the binge/purge subtype; binge-eating disorder). Finally, it will be necessary to adapt this design in order to investigate the function of other purging behaviours. Since vomiting is a relatively immediate means of reducing the impact of food intake, its affective impact is likely to have an entirely different time frame to that of behaviours such as laxative and diuretic abuse. This change in time frame might mean that different purging behaviours have an impact on different forms of emotional consequence. For example, while vomiting might have its greatest anxiolytic effect on immediate anxiety states, laxative abuse might be expected to reduce levels of more chronic anxiety states (e.g., generalized anxiety, social anxiety). These other purging behaviours might also be relevant to

the level of other affects, such as guilt/shame.

These findings suggest that the clinician should address the full complexity of the reinforcing nature of the binge-purge cycle, considering the potential role of a range of internal states. Exposure and response prevention might be suggested as a means of reducing the reinforcement of the vomiting episodes, but has not proven to be very effective in past research, offering little therapeutic advantage over cognitive-behavioural therapy (Bulik et al., 1998). Therefore, the reinforcing nature of the reductions in anxiety and the increase in happiness/relief may need to be addressed using cognitive-behavioural interventions, where the individual is asked to challenge the value of the full behavioural cycle. Thus, the bulimia nervosa patient might be asked to decide on whether or not to binge by taking account of the overall consequences from before the binge to an hour later - a reduction in hunger, which is offset by a lack of positive mood changes and a substantial elevation of guilt/shame.

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Table 1

Mean level of internal states (range = 0-100) across the binge-vomit cycle in bulimia nervosa patients (N = 23).

Internal state	Time point				F (3,20)	ANOVA (P < .05)	LSD tests
	Immediately before binge (1)	Immediately before vomiting (2)	Immediately after vomiting (3)	One hour after vomiting (4)			
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)			
<u>Physical</u>							
Hungry	40.3 (24.3)	5.84 (9.49)	6.61 (7.97)	23.2 (13.9)	20.9**	1 > 4 > 2 = 3	
Full stomach	16.1 (13.7)	82.0 (14.8)	17.4 (26.9)	14.9 (22.6)	88.3**	2 > 1 = 3 = 4	
<u>Affective</u>							
Angry/frustrated	45.2 (30.0)	51.4 (27.8)	47.8 (29.6)	48.6 (27.2)	0.50	-	
Anxious/worried	51.7 (24.4)	63.7 (24.5)	40.5 (29.4)	45.7 (27.6)	4.22*	2 > 1 = 3; 2 > 4	
Guilty/ashamed	24.8 (17.6)	59.7 (33.4)	58.7 (35.0)	61.1 (29.9)	14.5**	1 < 2 = 3 = 4	
Lonely	45.9 (25.7)	50.7 (27.7)	51.2 (35.1)	53.6 (32.8)	1.32	-	
Happy/relieved	15.2 (19.5)	11.0 (13.9)	47.7 (27.6)	25.0 (26.2)	22.9**	3 > 1 = 4; 4 > 2	

\* P < .05; \*\* P < .001

