

# Investigating the Reinforcing Value of Binge Anticipation

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Binge eating is a hallmark feature of several types of eating disorders, including bulimia nervosa, anorexia nervosa (binge/purge type), and binge-eating disorder, and is associated with numerous harmful consequences. For decades, researchers have sought to understand what maintains and reinforces this behavior in the face of such profound negative consequences. In this context, researchers have focused on the binge-eating behavior itself, and given little con-

sideration to what may be a crucial part of the process: anticipating or planning binge-eating episodes. In this article, we discuss binge anticipation, its potential reinforcing value, and methodologies which would allow researchers to investigate this potentially critical process in individuals who binge eat. © 2016 Wiley Periodicals, Inc.

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## Introduction

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## State of Research on Binge Anticipation and Planning

To date, very few studies have focused on the anticipation or planning of binge-eating episodes. However, studies of cue responsivity suggest that the smell or sight of food may induce incentive

salience (e.g., “wanting” of that cue/reward, which commands attention, induces approach behavior, and ultimately leads to the seeking out of the reward<sup>1</sup>) in people who binge eat. In this sense, “wanting” is akin to anticipation and may ultimately drive binge-eating behavior. It has been suggested that merely the imagining of foods may trigger sudden urges and thoughts to binge eat.<sup>1</sup> It is not surprising then that about 75% of individuals who binge eat often plan their binge-eating episodes ahead of time.<sup>2</sup> Similarly, in one unpublished study involving intensive, qualitative interviews with women with bulimia nervosa (BN), the majority of the participants described experiencing an increasing urge to binge eat in the time preceding the episode and subsequently planning their binges.<sup>3</sup> For example, during the workday, they planned what foods they would eat, and also when and where they would binge eat. Although research has not yet focused on this specific phenomenon, it is widely acknowledged, accepted, and targeted in clinical settings. In fact, eating disorder assessment and treatment manuals often focus specifically on the anticipation and planning of binges.<sup>4</sup> However, very little is known about the functional role of anticipation in binge eating. We believe, and limited findings suggest, that anticipation has a key role in the reward and reinforcement processes that maintain binge-eating behavior. However, more research is needed to elucidate this process.

## The Role of Binge Anticipation

Some of the most prominent contemporary theories for understanding the function and maintenance of

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binge eating involve emotion regulation. These models suggest that individuals who binge eat do so in the context of negative emotions and that binge eating serves as a way to distract individuals from, or alleviate, distress. Empirical evidence implies that one way in which binge eating may be maintained is through negative reinforcement or a reduction in negative affect.<sup>5-7</sup>

However, we do not yet understand the role that anticipation and planning play in this reinforcement process. Generally, it appears that anticipation depends highly on dopaminergic transmission in areas of the brain associated with reward (e.g., subcortical mesolimbic areas),<sup>1</sup> suggesting the potential reinforcing value of binge anticipation and planning. That is, often individuals experience negative affect but environmental constraints (e.g., work, the presence of others) prevent them from binge eating in that moment. Perhaps, then, the anticipation serves a similar function as the binge-eating behavior: cognitive resources are shifted toward food selection for a later binge-eating episode, and away from sources of distress, thereby reducing negative affect.

One recent pilot study assessed reinforcement-related processes occurring during the binge planning stage in women with BN.<sup>8</sup> While in the functional magnetic resonance imaging scanner, women with BN were placed in a negative mood and brain activity was compared when they were planning a binge by selecting pictures of food on which to binge versus planning a future apartment by selecting pictures of furniture. The authors found a large drop in amygdala activation when women with BN planned a binge, but virtually no change in amygdala activation when they selected furniture. This pattern of amygdala-related change has been found to be associated with a decrease in negative affect.<sup>9</sup> The results also revealed increased activation in the caudate, which may indicate positive reinforcement, appetitive reward, and negative reinforcement through the reduction of distress when planning a binge while distressed.<sup>8</sup>

These data suggest that reward and/or negative reinforcement occur immediately, during the planning itself, as BN individuals are focused on selecting foods and planning when and where they will binge eat. Although there were limitations to this pilot work (e.g., the sample size of nine reduced statistical power), the effect sizes were all large ( $d > 1.0$ ), suggesting that there is utility to researching the function of binge planning and anticipation.<sup>8</sup>

Moreover, these findings are substantiated by one other, larger study, which found that, for indi-

viduals with BN, compared to controls, as individuals' levels of self-reported negative affect increased, so did responsivity of reward regions (i.e., putamen, caudate, and pallidum) in anticipation of drinking a milkshake, but not in the actual receipt of the milkshake.<sup>6</sup> The authors argued that heightened negative affect may enhance the reward value of food for individuals with BN. We extend that and propose that the anticipation (including planning) of binge eating may in fact be as, or more, potent than the actual behavior itself. This is consistent with the substance use literature regarding concepts such as incentive salience and "wanting" that have recently been broadly applied to eating disorders<sup>1</sup> and suggest that the "wanting" of food may be a significant source of reward in eating disorders. Taken together, we believe that anticipating, imagining, or planning a binge-eating episode may in fact be a significant cognitive process in the evolution of eating-disorder episodes.

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## Examining the Reward Process of Anticipation

By researching the anticipation and planning of a binge-eating episode, we may enhance our understanding of binge eating and how it is maintained. It is of course important to first research the basic prevalence and self-reported function of binge anticipation/planning. Additionally, we suggest three primary research methodologies that would allow researchers to investigate the complex value of anticipation in binge eating.

### *Mood Inductions in Laboratory Studies*

We suggest incorporating mood induction methods into binge-eating research. To date, the majority of laboratory and neuroimaging studies that examine reinforcement and reward in binge eating do not incorporate mood manipulation. Researchers are unable to study a negative reinforcement model without the presence of negative mood. More specifically, if binge anticipation or binge planning occur in the context of negative mood and function as a means of distracting or alleviating that negative mood, then it is imperative to include a mood induction to accurately assess the reinforcing value of binge anticipation/binge planning.

### *Ecological Momentary Assessment*

Ecological momentary assessment research is a highly effective tool for studying functional relationships and thus far has not focused on the anticipation or planning of binge eating. This

methodology would allow researchers to test the proposed negative reinforcement model by investigating the temporal relationships of possible antecedents and consequences (e.g., affect) of anticipation/planning. This assessment approach would also enhance our understanding of the temporal relationship between binge anticipation and binge-eating behavior, which would increase our understanding of the entire reinforcement process.

### ***Longitudinal Brain Imaging Studies***

Brain imaging studies is an important tool for studying reward and reinforcement. Although two studies have examined anticipation in the context of negative mood,<sup>6,8</sup> more research is clearly needed. We argue that longitudinal studies utilizing neuroimaging are necessary to elucidate the reinforcing value of binge anticipation and/or planning. If anticipating or planning a binge is indeed negatively reinforcing, presumably through the reduction of negative mood, the behavior should be maintained over time. For example, we suggest that one way to evaluate this is to conduct a neuroimaging study similar to that by Pearson et al.<sup>8</sup> or Bohon and Stice<sup>6</sup> and to follow subjects over time. We anticipate that those individuals who display more negative reinforcement (e.g., drop in amygdala activity when anticipating a binge in a negative mood) will go on to have greater frequencies of binge eating and more psychosocial difficulties.

### **Possible Clinical Implications**

Understanding the reinforcing value of binge anticipation may have important clinical implications and allow researchers to develop more effective, targeted intervention techniques. If the binge anticipation or planning is indeed as, or more, reinforcing than the behavior itself, then treatment may beneficially target anticipating and planning of binge-eating episodes. For example, strategies focused on

identifying and interrupting the binge anticipation cycle may enhance treatment outcome.

### **Conclusion**

In conclusion, anticipating or planning binge-eating episodes is an important part of binge-eating behavior and may in fact be highly reinforcing. To enhance our understanding of how binge eating is maintained, researchers may benefit from investigations of the anticipation of binge-eating episodes, particularly their potential reinforcing properties.

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