



Meal and snack-time eating disorder cognitions predict eating disorder behaviors and vice versa in a treatment seeking sample: A mobile technology based ecological momentary assessment study

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ABSTRACT

Individuals with eating disorders experience high anxiety when eating, which may contribute to the high relapse rates seen in the eating disorders. However, it is unknown if specific cognitions associated with such anxiety (e.g., fears of gaining weight) may lead to engagement in eating disorder behaviors (e.g., weighing oneself). Participants ($N = 66$) recently treated at a residential eating disorder facility and diagnosed with an eating disorder (primarily anorexia nervosa; $n = 40$; 60.6%) utilized a mobile application to answer questions about mealtime cognitions, anxiety, and eating disorder behaviors four times a day for one week. Hierarchical linear models using cross-lag analyses identified that there were quasi-causal (and sometimes reciprocal) within-person relationships between specific eating disorder cognitions and subsequent eating disorder behaviors. These cognitions predicted higher anxiety during the next meal and eating disorder pathology at one-month follow-up. Interventions personalized to target these specific cognitions in real time might reduce eating disorder relapse.

Individuals with eating disorders (EDs) struggle to eat during meals and snacks, which leads to significant weight loss and risk of relapse after treatment (Gianini et al., 2015; Treasure, Cardi, & Kan, 2012). The ability to eat consistently is a key component of treatment, such that in inpatient, residential, and partial hospital settings the primary intervention for anorexia nervosa (AN) and bulimia nervosa (BN) is re-feeding and establishment of regular eating patterns (Garner & Garfinkel, 1982; Guarda, 2008). Regular eating is established by eating several meals and snacks per day with the goal of restoring or achieving a healthy weight to implement healthy eating patterns (Long, Wallis, Leung, Arcelus, & Meyer, 2012). These experiences are reported as highly anxiety provoking (Long, Wallis, Leung, & Meyer, 2012).

Unfortunately, after discharge from intensive treatment, individuals with EDs continue to exhibit difficulty eating, consuming fewer calories than healthy controls (Mayer, Schebendach, Bodell, Shingleton, & Walsh, 2012). Indeed, the majority of patients discharged from intensive treatment continue to struggle around food and during meal and snack-times and report very high levels of fear of food (Levinson & Byrne, 2015). In laboratory studies, among weight-restored individuals with anorexia nervosa, anxiety before a meal is correlated with caloric

intake, showing how anxiety negatively impacts eating behaviors (Steinglass et al., 2010). It seems likely that the high relapse rates in the EDs are influenced by difficulty continuing to maintain or gain weight in outpatient settings, which is influenced by eating-related anxiety (Kaplan et al., 2009; Steinglass et al., 2010), given that difficulty adhering to a meal plan is associated with poor treatment outcomes (McFarlane, Olmsted, & Trottier, 2008). This research highlights the importance of understanding the mealtime experiences of individuals with EDs, with the ultimate goals of reducing anxiety, increasing caloric intake to stabilize a healthy weight and eating patterns, and preventing relapse. To address such anxiety, we need data that focuses on how cognitions and emotions around meal and snack-time impact ED behaviors across transdiagnostic categories, which may ultimately inform our understanding of what contributes to relapse and may help individuals with EDs maintain a healthy weight.

Cognitions that may contribute to difficulty eating meals across all eating disorders include (1) fears of weight gain and feelings of fatness (Cooper, Deepak, Grocutt, & Bailey, 2007; Koskina, Campbell, & Schmidt, 2013; Murray et al., 2016) and (2) perfectionism surrounding eating (e.g., Egan et al., 2013). Fear of weight gain and feelings of

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fatness are core, but distinct, fears in the EDs (Cooper, Deepak, Grocutt, & Bailey, 2007; Fairburn, Cooper, & Shafran, 2003; Levinson, Zerwas et al., 2017) and are hypothesized to maintain ED psychopathology (Fairburn et al., 2003). These fears may be particularly salient during mealtime (Murray, Loeb, & Le Grange, 2016). Additionally, perfectionism, and specifically concern over mistakes (COM; or the excessive worry over making mistakes; Bulik et al., 2003), is a core maintaining factor for EDs, and is elevated in individuals with EDs as compared to healthy controls (Bardone-Cone et al., 2007).

One major challenge of this kind of research is that these cognitions and ED behaviors are context-dependent and transient. Indeed, there has been very little research measuring momentary cognitions and even less research assessing real-time cognitions in the EDs or around mealtime (Marhe, Waters, van de Wetering, & Franken, 2013; Waters et al., 2014). We used ecological momentary assessment (EMA), which is a particularly good technique for detecting transient and context-dependent phenomenon (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004) and has been used to assess ED behaviors and emotions (e.g., Engel et al., 2016; Haedt-Matt & Keel, 2011; Smyth et al., 2009). Measurement of cognitions is inherently difficult, given their brief, but frequent nature (Obsessive Compulsive Cognitions Working Group, 1997). EMA allows for 'real world' measurement of cognitions during or shortly after mealtimes. Additionally, EMA analyses allow us to test whether within-person deviations (e.g., temporal deviations from an individual average) in predictors (e.g., cognitions) predict subsequent outcomes (e.g., behaviors). In other words, we are able to approximate relationships with naturalistic data by disaggregating variables and taking temporal precedence into account.

In the current study, we used EMA to test if cognitions which occur during, or briefly after, mealtime predict subsequent ED behaviors. We specifically assessed these cognitions and behaviors in a trans-diagnostic sample of eating disorders ($N = 66$; primarily AN $n = 40$). We assessed two categories of cognitions: fears of weight gain/feelings of fatness and perfectionistic thoughts about a meal. We also assessed ED behaviors: restriction, weighing oneself, compensatory behaviors/vomiting, body checking, and excessive exercise. If we are able to identify specific cognitions leading to subsequent behaviors (and vice versa), we can target interventions to disrupt the association between these specific behaviors and cognitions.

Accordingly, we had two primary hypotheses. First, there would be specific cognitions and behaviors that predict each other across ensuing mealtimes, representing a self-reinforcing cycle. Second, these cognitions would predict subsequent higher anxiety (or lower anxiety if they serve an avoidance function) and higher ED symptoms at one-month follow-up.

1. Methods

1.1. Procedures

All procedures were approved by the Washington University IRB. Participants were recruited from an ED clinic after discharge from either a residential or partial hospitalization treatment program. Participants were invited to participate in a study of daily habits in general and specifically around meals. All procedures were completed either online or through a mobile application; participants living in any area of the country could participate. Participants provided informed consent (adolescent parents provided consent and adolescents provided assent) and then completed an online survey through RedCap asking about ED symptoms (see measures below), behaviors, treatment history, and demographics. After completion of the online survey, participants were given instructions on how to download and access a mobile application measuring daily habits (please see <http://www.christophermetts.com/status-post>). This application notified participants four times a day for one week and asked questions about mealtime cognitions, as well as ED behaviors and anxiety. Participants were

asked to provide a window of time that was at least 12 h during the day. They were also asked to indicate what times they generally eat. Assessments were then random around these time points, within a 4-h block, to attempt to hit as many meal and snack times as possible, while considering there would be variation in when meals and snacks were actually eaten. At the beginning of each survey, participants were asked if they had eaten since their last check in. In the analyses that we report we only include individuals who endorse having eaten since the last check in, which was 75.3% of total responses. We also assessed time since their last meal on the following scale: (1 = 0 min; 2 = 1–10 min; 3 = 11–20 min; 4 = 21–30 min; 5 = 31–60 min; 6 = 1–2 h; 7 = 2–3 h; 8 = 3–4 h; 9 = more than 4 h). After assessing if the participant had eaten and when, participants were asked a series of questions focused on the last meal or snack they completed using the Daily Life Daily Habits Questionnaire (see measure description below) and were then asked about ED behaviors. One month after completion of the mobile application questions, participants completed a short follow-up questionnaire asking about ED symptoms (EDI-2; see below). We used aggregation of all responses to create means for ED symptoms at one month follow-up. Participants were compensated based on the number of times they responded to the mobile application questionnaires and could receive up to 25 dollars for participation.

1.2. Participants

Participants were 66 individuals diagnosed with an ED. Participants were primarily female ($n = 64$; 97.0%); European American ($n = 56$; 86.2%); average age of 24.98 ($SD = 7.31$; Range = 14–41). Other ethnicities reported were Asian ($n = 3$; 4.5%); Hispanic ($n = 3$; 4.5%); Black ($n = 1$; 1.5%) multiracial ($n = 2$; 3%) and 1 reported her ethnicity was not listed.

1.2.1. Diagnoses and clinical characteristics

Based on the Eating Disorder Diagnostic Scale (EDDS; Stice, Telch, & Rizvi; see measures below) the following diagnoses based on the DSM-5 were made the day prior to beginning the EMA protocol: AN ($n = 40$; 60.6%), atypical AN ($n = 14$; 21.2%), BN ($n = 6$; 9.1%), low frequency BN ($n = 1$; 1.5%), and feeding and eating disorders not otherwise specified ($n = 5$; 7.6%). The majority of participants reported that they were currently in treatment for an ED ($n = 49$; 74.2%) with an average of 2.5 h ($SD = 4.53$; Range = 0–30 h) of treatment per week. Of those in treatment participants report the following levels of care: 4.5% in residential ($n = 3$); 1.5% in partial hospital ($n = 1$); 3.0% in intensive outpatient ($n = 2$); and 68.2% in outpatient ($n = 45$). Median body mass index (BMI) was 20.66 ($SD = 3.46$; Range 13.89–32.28). Other self-reported current diagnoses (using a one item question *Which other diagnoses have you been given, if any* to assess any other diagnoses) were Anxiety Disorder ($n = 41$; 62.1%); Depressive Disorder ($n = 38$; 57.6%); OCD ($n = 13$; 19.7%); and PTSD ($n = 7$; 10.6%).

1.3. Self-report measures

Eating Disorder Diagnostic Scale (EDDS; Stice, Telch, & Rizvi, 2000). The EDDS is a brief self-report measure used to diagnose EDs, such as anorexia nervosa, bulimia nervosa, and binge eating disorder. We used criteria for DSM-5 diagnoses. The EDDS has demonstrated adequate internal consistency, as well as criterion and convergent validity (Stice, Fisher, & Martinez, 2004).

Eating Disorder Inventory-2 (EDI-2; Garner, Olmstead, & Polivy, 1983). The EDI-2 is a 91-item self-report questionnaire designed to measure psychological features commonly associated with AN and BN. It has good internal consistency and good convergent and discriminant validity (Garner & Garfinkel, 1982) and is frequently used by clinicians for the assessment of ED symptoms (Brookings & Wilson, 1994). Three of the eleven subscales were used for this study: The Drive for Thinness (DT), Body Dissatisfaction (BD), and Bulimia symptoms (BN) subscales.

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