

## Addictive-Like Eating Mediates the Association Between Eating Motivations and Elevated Body Mass Index

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Obesity continues to be a major public health crisis (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008) and the potential role of an addictive-like process in excess food consumption is a topic of growing interest. Motivations for use have been identified as an important contributor to problematic use of addictive substances like alcohol (Cooper, 1994), and recent research has highlighted the importance of motivations to eat in obesity risk (Burgess, Turan, Lokken, Morse, & Boggiano, 2014). The purpose of this study is to examine if addictive-like eating behavior serves as a mediator between motivations to eat and elevated BMI. Participants ( $N = 257$ ) completed the Yale Food Addiction Scale (YFAS; Gearhardt, Corbin, & Brownell, 2009b) and the Palatable Eating Motives Scale (PEMS; Burgess et al., 2014), as well as provided personal information and self-report measures of height and weight. Regression analysis and bootstrapping revealed addictive-like eating symptoms as measured by the YFAS to be a significant complete mediator between Coping, Enhancement, and Social motivations for eating and BMI. Additionally, addictive-like eating behavior partially mediated the relationship between Conformity motivations for eating and BMI. Thus, elevated addictive-like eating symptoms appear to play a significant role in the association between eating motivations and elevated BMI. This suggests the importance of identifying individuals who exhibit addictive-like eating behavior in the treatment of obesity, especially in the application of interventions that focus on addressing motivations to eat for reasons other than homeostatic need.

*Keywords:* food addiction, eating motives, obesity

Obesity rates continue to rise, with 51% of adults projected to be obese by 2030 (Wang et al., 2008). The consequences of obesity are evident in negative health outcomes, such as diabetes and heart disease, and the significant economic impact of health care expenditures (Allison, Fontaine, Manson, Stevens, & VanItallie, 1999; Mokdad et al., 2000). Despite knowledge of contributing factors to obesity, prevention and treatment programs have had little long-term success (Wadden, Butryn, & Byrne, 2004). Recently, it has been proposed that some individuals may experience an addictive-like response to certain foods, which may

have unique explanatory power for some types of obesity (Avena, Rada, & Hoebel, 2008; Davis & Carter, 2009; Gearhardt et al., 2009b; Gold, Frost-Pineda, & Jacobs, 2003; Volkow, Wang, Fowler, & Telang, 2008). Addictive-like eating and substance use disorders are both associated with dysfunction in neural reward systems (Avena et al., 2008; Volkow et al., 2008), increased impulsivity (Belin, Mar, Dalley, Robbins, & Everitt, 2008; Davis & Carter, 2009; Gearhardt et al., 2012) and emotionally triggered patterns of consumption (Burgess et al., 2014; Cooper, Frone, Russell, & Mudar, 1995; Gearhardt et al., 2009b). Unlike addictive substances such as alcohol, food is necessary for survival and is also consumed in response to homeostatic need (Saper, Chou, & Elmquist, 2002). However, certain foods (particularly highly processed foods) are also consumed for reasons other than survival, such as to feel pleasure or to reduce negative emotions (Burgess et al., 2014; Waters, Hill, & Waller, 2001). Dif-

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ferent motivations for use, especially in the case of alcohol, have been identified as important contributors to problematic patterns of use and the risk of developing dependence (Merrill, Wardell, & Read, 2014). If an addictive-like process is contributing to negative eating outcomes, motivations for eating may provide similar insight into patterns of problematic food consumption. The current study is, to our knowledge, the first to examine whether addictive-like eating symptoms mediate the association between motivations for eating and elevated body mass index (BMI).

Certain motivations for drinking have been related to problematic drinking behavior. In the context of an addiction model, motivations refer to the desire to achieve a certain outcome by performing a particular behavior (Cooper, 1994). Because the motivation to consume alcohol is the most immediate precursor to drinking behavior, it is important to consider motivations in the context of alcohol-related problems (Kuntsche, Knibbe, Gmel, & Engels, 2006). A four-factor motivational model for alcohol consumption suggests that Coping, Enhancement, Social, and Conformity motivations are related to alcohol use and dependence (Cooper, 1994). Cooper (1994) found that Coping (consuming alcohol to handle negative affect) and Conformity (drinking to avoid peer rejection) were strongly associated with drinking problems. Enhancement (drinking for personal pleasure or mood enhancement), Social (drinking for celebrations or social occasions), and Coping motivations predicted higher quantity and frequency of drinking. A later study found that Enhancement and Coping motives were positively related to alcohol use problems and heavy drinking, whereas Conformity motives were negatively related to these outcomes (Kuntsche et al., 2006). These findings suggest that certain motivations to drink may be more strongly associated with problem drinking or heavy alcohol use. Throughout the literature, Coping motives to deal with negative affect were particularly identified as indicators of alcohol addiction and were directly related to problematic drinking behavior, such as drinking at home alone, and peak drinking levels (Cooper, 1994; Foster, Neighbors, & Prokhorov, 2014; Merrill et al., 2014).

Research suggests that Cooper's four-factor motivational model may also be applicable to

problematic food consumption. A study on drinking and eating behavior cited similar motivations to engage in both behaviors, such as to relieve pressure and self-soothe in times of stress to create an immediate, but temporary, relief (Brisman & Siegel, 1984). A recently developed measure was designed to examine individual differences in motivations to consume palatable foods. The Palatable Eating Motives Scale (PEMS), adapted from the Drinking Motives Questionnaire-Revised (DMQ-R; Cooper, 1994), identifies motives for eating hedonically pleasing food (Burgess et al., 2014). Parallel to motivations to drink alcohol, Coping, Enhancement, Social, and Conformity motives were identified as unique factors in eating behavior (Burgess et al., 2014). Coping motives refer to eating to deal with negative emotions; Enhancement motives refer to eating to enhance positive emotions or enjoy rewarding properties of food; Social motives refer to eating for social occasions; and Conformity motives refer to eating because of external pressure, or to "fit in." Each of these motivations was related to elevated binge eating behavior, but only scores on the Coping subscale were associated with elevated weight status (Burgess et al., 2014). Coping motives were particularly associated with the presence of severe obesity (BMI > 40; Burgess et al., 2014). Therefore, as with alcohol, certain motivations to consume palatable foods may be associated with addictive-like eating behavior.

It has been hypothesized that some individuals may experience an addictive-like response to certain foods (Gearhardt, Corbin, & Brownell, 2009a). The Yale Food Addiction Scale (YFAS) was developed to quantify symptoms of addictive-like eating, by assessing *Diagnostic and Statistical Manual for Mental Disorders-Fourth Edition (DSM-IV)* criteria for substance dependence in the consumption of highly processed foods, such as a loss of control over consumption and continued use despite negative consequences (Gearhardt et al., 2009b). Elevated symptoms of "food addiction" are also associated with increased BMI and a greater severity of disordered eating (Gearhardt, Boswell, & White, 2014; Gearhardt, White, Masheb, & Grilo, 2013; Pedram et al., 2013). Though the idea of food addiction remains controversial (Avena, Gearhardt, Gold, Wang, & Potenza, 2012; Ziauddeen, Farooqi, & Fletcher,

2012; Ziauddeen & Fletcher, 2013), evidence exists for behavioral similarities and shared neural underpinnings in both problematic eating behavior and substance-use disorders (Gearhardt, Davis, Kuschner, & Brownell, 2011).

Much of the evidence for food addiction comes from animal models of palatable food consumption. When rats are given access to palatable foods, they exhibit reward-related neural changes observed in other addictive disorders, as well as behavioral signs of opiate-like withdrawal (e.g., teeth chattering) and continued use despite negative consequences (e.g., electric footshock; Avena et al., 2008; Avena, Rada, & Hoebel, 2009; Johnson & Kenny, 2010). In humans, individual characteristics, such as impulsivity and reward responsiveness, appear to be similarly implicated in excessive consumption of food and drugs of abuse (Davis et al., 2011; Davis et al., 2008). Additionally, like substance-use disorders, individuals endorsing elevated symptoms of food addiction exhibit increased neural activation in reward-related regions in response to food cues (Gearhardt, Yokum, et al., 2011). Further, food addiction and other addictive disorders have both been associated with a dopaminergic multilocus genetic profile (Davis et al., 2013). Thus, it appears that food addiction shares behavioral and biological features with traditional addictive disorders.

Only one study to date has examined addictive-like eating symptoms alongside motivations for eating as measured by the PEMS (Burgess et al., 2014). All PEMS subscales (Coping, Enhancement, Social, and Conformity) were significantly associated with more severe addictive-like eating (Burgess et al., 2014). However, in a multiple regression analysis, YFAS scores did not predict BMI when the PEMS coping subscale and binge eating scores were also included in the model. There are limitations to examining the association between addictive-like eating, motivations to eat, and BMI with this approach. For example, in the case of alcohol, coping motivations are associated with increased levels of alcohol addiction (Cooper, 1994) and both of these constructs are related to increased alcohol consumption (Cooper, 1994; Foster et al., 2014). It may be that drinking to cope leads to the increased consumption of alcohol over time through the development of addiction symptoms. Regarding eating behav-

ior, motivations to eat palatable food may be associated with obesity in part because of the presence of addictive-like eating behaviors (e.g., loss of control over consumption, withdrawal, or inability to cut down on consumption). No prior study has examined whether addictive-like eating mediates the association between motives to consume palatable foods and obesity.

In the current study, we aim to address this gap in the literature by investigating whether addictive-like eating (as measured by the YFAS) mediates the relationship between each of the PEMS motivation subscales (Coping, Enhancement, Social, and Conformity) and BMI. These proposed mediational models will determine whether relationships between eating motives and elevated BMI are fully or partially explained by the presence of addictive-like eating symptoms. Additionally, we will examine for the first time the association between addictive-like eating, motivations to consume palatable food, and BMI in a community sample. The only other study to our knowledge to examine these constructs was conducted in a sample of mostly female, undergraduate college students (Burgess et al., 2014). The use of a community sample with a wider age range and more balanced gender distribution allows us to examine the associations between these constructs in a more representative sample. Although these analyses are correlational and causation cannot be determined, investigating whether eating motivations are related to increased BMI through the presence of addictive-like eating may be beneficial in understanding the factors contributing to excess body weight and aid in the development of more effective interventions.

## Method

### Participants

Two hundred seventy-two participants were recruited using Amazon's Mechanical Turk (MTurk) worker pool to complete a study about eating behaviors. MTurk's worker pool is large and diverse, though not nationally representative, and may replace or supplement traditional convenience samples (Paolacci & Chandler, 2014). Participants were excluded from analysis if they lived outside the United States ( $n = 7$ ),

had missing data ( $n = 4$ ), had outlier height data ( $n = 2$ ), or for incorrectly answering “catch questions” ( $n = 2$ ), which attempt to identify individuals responding without reading the question items. Participants ( $n = 257$ ) were on average 37.10 years old (range 18–71). The sample was 48.2% male ( $n = 124$ ) and 51.4% female ( $n = 132$ ) and one participant did not report gender. The racial/ethnic distribution for the study sample was: 79.0% White, 5.8% Asian, 5.4% Black, 5.1% Hispanic, .4% American Indian, and 4.3% “other.” The participants’ body weight ranged from underweight to severely obese (BMI range 16.30 to 54.03) with the average BMI in the overweight category ( $M = 26.13$ ,  $SD = 6.04$ ).

### Procedure

Participants were required to provide informed consent before completing the survey. No personal identifying information was collected. The University of Michigan Institutional Review Board approved the study. Participants provided basic demographic information and completed a battery of self-report measures. Self-reported height and weight were used to compute Participant BMI ( $\text{kg}/\text{m}^2$ ).

### Assessments and Measures

The YFAS (Gearhardt et al., 2009b) measures signs of “addiction” toward certain types of food (e.g., high in fat and/or sugar) based on criteria for substance dependence as stated in the *DSM-IV* (American Psychiatric Association, 2000). The scale includes items that assess specific criteria, such as diminished control over consumption, a persistent desire or repeated unsuccessful attempts to quit, withdrawal, and clinically significant impairment. The current study utilized the YFAS “symptom count” scoring option. This scoring option yields a symptom count score ranging from 0–7 that reflects the number of addiction-like criteria endorsed. The YFAS has received psychometric support in a binge eating population (Gearhardt et al., 2013, 2012), obese bariatric surgery patients (Clark & Saules, 2013; Meule, Heckel, & Kübler, 2012) a diverse clinical sample (Davis et al., 2011) and in community samples (Gearhardt et al., 2014; Pedram et al., 2013). In the current sample, the YFAS exhibited excellent internal consistency ( $\alpha = .91$ ).

The PEMS (Burgess et al., 2014) evaluates specific motivations in the consumption of palatable foods. The scale was adapted from the DMQ-R (Cooper, 1994), a self-report measure to assess different motives for alcohol consumption. The PEMS identifies four subscales as motives for hedonic eating: Coping, Enhancement, Social, and Conformity. In the current sample, internal consistencies for the PEMS subscales ranged from  $\alpha = .83$  to  $\alpha = .91$ .

### Statistical Analyses

We examined the distributions of all variables included in the analyses. All distributions were normal, except for height, for which we excluded two outliers ( $SD > 3$ ). Self-reported height and weight may underestimate BMI (Gorber, Tremblay, Moher, & Gorber, 2007; Taylor et al., 2006); therefore, we applied a formula to adjust for BMI self-reporting bias. This adjustment, developed by Gorber and colleagues (2008) is based on the level of bias between self-reported and measured height and weight in a nationally representative Canadian sample. We tested our models using both adjusted and unadjusted BMI variables; however, none of the analyses differed in whether they were statistically significant based on the version of the BMI variable used. Although use of the adjusted BMI variable resulted in slightly larger unstandardized regression coefficients, both standardized regression coefficients and  $p$  values remained identical between the models using both nonadjusted and adjusted BMI variables. Thus, we report only the results for the unadjusted BMI variable. Correlation coefficients were calculated to ensure there was not multicollinearity between the variables of interest. We also used correlations,  $t$  tests, and one-way analysis of variances (ANOVAs) to assess the relation between demographics (age, race, gender, and parent education) and variables included in the mediational models. To test the hypothesized mediational models (i.e., PEMS motivations  $\rightarrow$  addictive-like eating symptoms  $\rightarrow$  BMI), we first followed the guidelines described by Baron and Kenny (1986), running regression analyses to test that the independent variable affects the mediator, the independent variable affects the dependent variable, the mediator affects the dependent variable, and that the independent variable’s effect on the depen-

dent variable is lessened when the mediator is added into the model. Full mediation is indicated when the independent variable's influence on the dependent variable becomes insignificant when the mediator is added into the model. Partial mediation is indicated if the independent variable's effect on the dependent variable drops, but remains significant when the mediator is added into the model. To confirm any potential indirect mediational effects, we used the bootstrapping method with 1,000 samples described by Preacher and Hayes (2008). This bootstrapping method yields a confidence interval in which statistical significance at the  $p < .05$  level is indicated when the interval does not include zero. To compare the sizes of statistically significant indirect effects, we computed effect sizes by taking the product of the partial correlations (Preacher & Kelley, 2011). We also conducted an exploratory analysis using the PROCESS macro for SPSS designed by Hayes (2012) to investigate whether the mediational models were moderated by gender.

## Results

### Demographics

We examined the association between the demographic variables and our variables of interest. Age was found to be positively correlated with BMI ( $p < .05$ ); therefore, we controlled for this variable in all future analyses. No other demographic variables were significantly associated with variables in the mediational models ( $p > .05$ ).

### Mediational Models

Coping motivations for eating were significantly associated with both BMI and addictive-like eating symptoms, and addictive-like eating symptoms were significantly associated with BMI. When both addictive-like eating symptoms and Coping motivations for eating were included in the model, addictive-like eating symptoms continued to be significantly associated with BMI, while Coping motivations for eating were no longer associated, indicating full mediation (see Figure 1). We followed this test by examining the degree of the indirect effect using bootstrapping. This test also showed addictive-like eating symptoms to be a significant

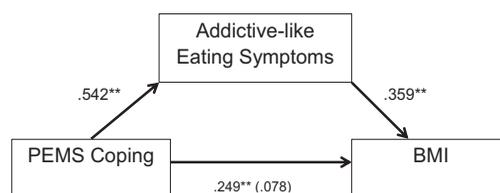


Figure 1. Standardized regression coefficients for the relationship between Coping motivations for eating and BMI mediated by food addiction. The standardized regression coefficient between Coping motivations and BMI controlling for food addiction is in parentheses. \*\*  $p < .01$ .

mediator between the Coping motivations for eating and BMI ( $B = .280$ ,  $SE = .066$ , 95% CI [.164, .433]). This mediation effect was of medium size (effect size = .150).

Enhancement motivations for eating were significantly associated with both BMI and addictive-like eating symptoms, and addictive-like eating symptoms were significantly associated with BMI. When both addictive-like eating symptoms and Enhancement motivations for eating were included in the model, addictive-like eating symptoms continued to be significantly associated with BMI, while Enhancement motivations for eating were no longer associated, indicating full mediation (see Figure 2). We followed this test by examining the degree of the indirect effect using bootstrapping. This test also showed addictive-like eating symptoms to be a significant mediator between Enhancement motivations for eating and BMI ( $B = .198$ ,  $SE = .050$ , 95% CI [.118, .318]). This mediation effect was of medium size (effect size = .132).

Social motivations for eating were significantly associated with both BMI and addictive-like eating symptoms, and addictive-like eating symptoms were significantly associated with BMI. When both addictive-like eating symptoms and Social motivations for eating were included in the model, addictive-like eating symptoms continued to be significantly associated with BMI, whereas Social motivations for eating were no longer associated, indicating full mediation (see Figure 3). We followed this test by examining the degree of the indirect effect using bootstrapping. This test also showed addictive-like eating symptoms to be a significant mediator between Social motivations for eating and BMI ( $B = .117$ ,  $SE = .035$ , 95% CI [.059, .201]). This mediation effect was of medium size (effect size = .092).

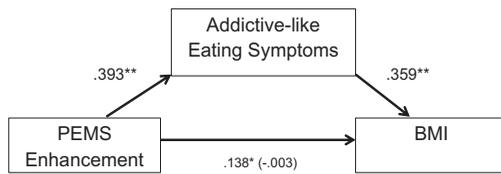


Figure 2. Standardized regression coefficients for the relationship between Enhancement motivations for eating and BMI mediated by food addiction. The standardized regression coefficient between Enhancement motivations and BMI controlling for food addiction is in parentheses. \*  $p < .05$ , \*\*  $p < .01$ .

Conformity motivations for eating were significantly associated with both BMI and addictive-like eating symptoms, and addictive-like eating symptoms were significantly associated with BMI. When both addictive-like eating symptoms and Conformity motivations for eating were included in the model, addictive-like eating symptoms continued to be significantly associated with BMI. Conformity motivations for eating were associated with BMI to a lesser degree than when addictive-like eating symptoms were not included in the model, though this association remained significant, indicating partial mediation (see Figure 4). We followed this test by examining the degree of the indirect effect using bootstrapping. This test also showed addictive-like eating symptoms to be a significant partial mediator between the Conformity motivations for eating and BMI ( $B = .188$ ,  $SE = .054$ , 95% CI [.101, .309]). This mediation effect was of medium size (effect size = .120).

### Gender Differences

We also conducted exploratory analyses to examine whether gender moderated the media-

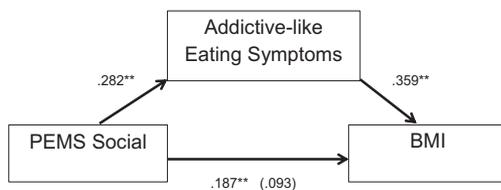


Figure 3. Standardized regression coefficients for the relationship between Social motivations for eating and BMI mediated by food addiction. The standardized regression coefficient between Social motivations and BMI controlling for food addiction is in parentheses. \*\*  $p < .01$ .

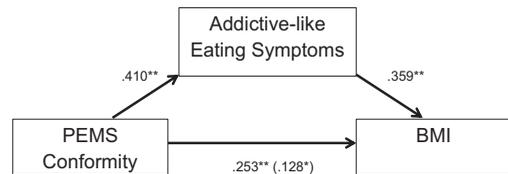


Figure 4. Standardized regression coefficients for the relationship between Conformity motivations for eating and BMI mediated by food addiction. The standardized regression coefficient between Conformity motivations and BMI controlling for food addiction is in parentheses. \*  $p < .05$ , \*\*  $p < .01$ .

tional models. The conditional indirect effects did not differ significantly by gender for Coping (95% CI [−.201, .124]), Enhancement (95% CI [−.062, .202]), Social (95% CI [−.032, .177]), or Conformity (95% CI [−.160, .138]) motivations. Thus, gender does not appear to be a significant moderator of any of these relationships.

### Discussion

In the current study, we examined whether addictive-like eating symptoms mediated the relationships between PEMS motivations for eating and BMI. Addictive-like eating was found to fully mediate the associations between Coping, Enhancement, and Social motivations for eating and BMI. Additionally, addictive-like eating partially mediated the relationship between Conformity motivations for eating and BMI. Further, this pattern of results appears to be similar for men and women. Although not all people who consume highly palatable foods for such motives show elevated BMI, these results suggest that in those that do, addictive-like eating symptoms may be accounting for this elevated BMI. The current findings are consistent with the hypothesis that motives for eating are associated with obesity through addictive-like eating behaviors.

### Coping Motivations, YFAS, and BMI

Endorsement of addictive-like eating behaviors fully mediated the relationship between motivations to eat to cope and BMI. Being motivated to consume highly palatable foods as a coping mechanism may be an ineffective attempt to regulate emotions (Burgess et al.,

2014). Emotion dysregulation, or negative reactivity to one's emotional state, has been implicated in multiple forms of eating pathology, such as bulimia nervosa (Hayaki, 2009; Stice, 2001), binge eating disorder (BED; Arnow, Kenardy, & Agras, 1995; Heatherton & Baumeister, 1991), and obesity (Geliebter & Aversa, 2003; Lowe & Fisher, 1983; Ozier et al., 2008). Similarly, some individuals may use alcohol as a coping mechanism for adverse emotional states (Ostafin & Brooks, 2011). Drinking to cope increases the likelihood that substance dependence will develop, because of the negatively reinforcing effects of consumption, (Cooper, 1994; Cooper, Russell, & George, 1988) and has been linked to increased alcohol consumption (Holahan, Moos, Holahan, Cronkite, & Randall, 2001). In the current study, eating to cope, compared with other motivations, has the strongest relationship with behavioral indicators of food addiction. Similarly, drinking to cope is the motivation most related to alcohol dependence (Carpenter & Hasin, 1998, 1999). The current study suggests that eating to cope may lead to increased consumption through the presence of addictive-like eating symptoms. In other words, although not all people who consume highly palatable foods as a means to cope show elevated BMI, these results suggest that in those who do, addictive-like eating behavior may be accounting for higher BMI.

### Enhancement Motivations, YFAS, and BMI

Symptoms of addictive-like eating also fully mediated the relationship between motivations to eat for enhancement and BMI. Motivation to eat for enhancement relates to the desire to experience the pleasurable effects of highly palatable foods (Burgess et al., 2014). These calorie-dense, nutrient-poor foods appear to activate reward pathways and consumption positively reinforces the food's hedonic effects (Davis et al., 2009; Stoeckel et al., 2008; Volkow et al., 2008). Elevated responses in reward-related regions (e.g., striatum, OFC) to food cues have been observed in several modes of disordered eating, including bulimia nervosa (Brooks et al., 2011), BED (Schienle, Schafer, Hermann, & Vaitl, 2009; Weygandt, Schaefer, Schienle, & Haynes, 2012), obesity (Rothmund et al., 2007; Stoeckel et al., 2008), and food addiction (Gearhardt, Yokum, et al., 2011). Enhancement

motivations are also implicated in alcohol use, where individuals may drink to experience positive, hedonic effects of alcohol (Cooper et al., 1995). Colder and O'Connor (2002) observed that individuals motivated to drink for enhancement demonstrated a unique attentional bias to reward cues, compared with those motivated by coping or social mechanisms. Drinking to experience enhancement has also been associated with higher levels of consumption (Cooper, 1994; Cooper, Russell, Skinner, & Windle, 1992), which may result in the development of alcohol dependence (Cooper, 1994). In the current study, individuals motivated to eat for enhancement may exhibit increased consumption of highly palatable foods coupled with the presence of addictive-like eating behavior. Thus, for individuals who eat to experience pleasure and have a high BMI, addictive-like eating symptoms appear to account for the elevated BMI.

### Social Motivations, YFAS, and BMI

The presence of addictive-like eating symptoms fully mediated the relationship between social motivations and BMI. Thus, social motives to eat appear to be more likely to be associated with elevated BMI when addictive-like eating behavior is also present. Individuals that are motivated to eat hedonically pleasing foods to enjoy occasions like a party or celebration are considered socially motivated eaters (Burgess et al., 2014). Social motives to drink alcohol have been related to increased quantity and frequency of drinking (especially in social settings; Cooper, 1994), although the association of social drinking motives and alcohol-related problems is mixed (Comasco, Berglund, Oreland, & Nilsson, 2010; Cooper, 1994). Social motivations for eating have been found to be positively associated with bingeing behavior, but negatively related to restrictive eating and purging (Jackson, Cooper, Mintz, & Albino, 2003). Like social motivations, elevated addictive-like eating is related to greater frequency of binge eating episodes, but is less strongly associated with dietary restraint (Gearhardt et al., 2012). Thus, when addictive-like eating is present in socially motivated eaters, there appears to be an increased likelihood of elevated BMI. This may suggest that social motives may not increase risk for obesity for individuals who are not eating in an addictive-like way.

### Conformity Motivations, YFAS, and BMI

Addictive-like eating behavior partially mediated the relationship between motivations to conform and BMI. Thus, addictive-like eating accounted for some of the association between conformity motivations and BMI, but the motivation to eat to conform with others was also uniquely related to higher BMI. Motivation to conform refers to a tendency to consume food in response to external pressure (e.g., obtain group acceptance or to avoid peer harassment; Burgess et al., 2014). External norms regarding food can be related to pressure to overeat, but also to restricting or purging type behavior (Jackson et al., 2003). Thus, the effect of conformity motivations may differ depending on the type of external pressure. Conformity motivations to drink alcohol are related to both a greater likelihood of lower alcohol consumption and excessive drinking behavior depending on the type of external pressures present (Cooper, 1994). When external social pressures to overeat are present, individuals with greater conformity motivations may be more prone to addictive-like eating, which may be one pathway to elevated BMI. In contrast, in contexts where restrictive eating behaviors are encouraged, conformity motivations may lead to unhealthy approaches to limit food intake (e.g., rigid dietary rules, fasting). These attempts at dietary restriction have been related to overeating and loss of control over consumption, which may be an alternative pathway to elevated BMI (Polivy, 1996; Stice, Shaw, & Nemeroff, 1998). Thus, individuals with high conformity motivations may exhibit different behaviors regarding eating and alcohol consumption depending on the type of external pressures present.

### Limitations and Future Directions

There are limitations to consider for the current study. First, because this study is cross-sectional, we cannot draw conclusions regarding time course or causality in these relationships. Although these findings illustrate that symptoms of addictive-like eating fully or partially mediate the association between motivations for eating and BMI, these results do not indicate that elevated BMI is necessarily preceded by addictive-like eating symptoms. Because information about temporality is necessary to determine cau-

sation, future studies should use a longitudinal design to directly examine potential causal relationships between eating motivations, addictive-like eating, and BMI. Additionally, although samples recruited through MTurk are reasonably diverse, they are still not nationally representative. Individuals recruited through MTurk tend to be younger, more educated, and more liberal than the population at large (Paolacci & Chandler, 2014). MTurk workers are still more heterogeneous than the typical college student sample; however, future studies should attempt to replicate the current findings in a more nationally representative sample. Further, the motivations assessed by the PEMS (Coping, Enhancement, Social, and Conformity) have been found to be particularly important in predicting use of addictive substances. To evaluate whether addictive-like eating is related to similar constructs, we prioritized the assessment of these motivations. However, other motivations to consume may be more salient for food (such as taste, palatability, and appearance) than other addictive substances like alcohol. These motivations to consume high-calorie foods may also contribute to problematic eating behavior and should be assessed in future studies. Additionally, in the alcohol motivation literature, patterns of consumption is a common outcome measure (Cooper, 1994; Foster et al., 2014). In the current study, BMI is the dependent variable, which is a proximal outcome related to excess caloric consumption, but does not directly measure patterns of eating behavior. It will be important for future studies to assess patterns of eating behavior, such as episodes of binge eating. Finally, BMI was calculated using self-reported height and weight, which can be prone to reporting bias. Although some studies have found self-reported height and weight to correlate highly (i.e.,  $r_s > .89$ ) with direct measurements of height and weight, regardless of weight status (Kuczmarski, Kuczmarski, & Najjar, 2001; White, Masheb, & Grilo, 2010), others suggest that self-report BMI to inaccurately reflect obesity rates (Flood, Webb, Lazarus, & Pang, 2000; Taylor et al., 2006). In the current study, we applied an adjustment to counter reporting bias, and use of adjusted BMI did not alter any results from those obtained using self-report. Still, future studies would benefit from direct measurement.

## Conclusions

In summary, addictive-like eating fully mediated the association between Coping, Enhancement, Social motivations, and BMI, and partially mediated this relationship in the case of Conformity motivations. Thus, these eating motivations may be particularly related to elevated BMI when individuals exhibit signs of addictive-like eating. These findings may have several implications for the treatment of overeating. Intervention efforts that address drinking motivations have been effective in reducing excess alcohol consumption and risky drinking behavior (Conrod, Castellanos-Ryan, & Mackie, 2011; LaBrie et al., 2009). The current study suggests that addressing eating motivations may be a worthwhile area of focus in obesity treatments, especially for individuals exhibiting addictive-like eating behavior. If motivations for eating are leading to elevated weight status by way of addictive-like eating, it is also possible that targeting motivations before the development of addictive-like eating symptoms may in turn decrease overconsumption of highly palatable foods and problematic outcomes such as obesity, although more research is needed. Eating motivations may also highlight underlying processes influencing individuals to overeat. For example, in the case of Coping motivations, developing alternative emotion regulation skills may improve not only eating outcomes, but overall mental health as well. The present study adds to the limited literature examining the associations between eating motives, addictive-like eating symptoms, and BMI, but the current findings suggest this avenue merits continued attention in obesity research.

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