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Does short-term fasting promote pathological eating patterns?

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ABSTRACT

Fasting, or going a significant amount of time without eating, has been identified as a risk factor for the development of pathological eating patterns. Findings from several studies examining the impact of fasting on subsequent eating behaviors have been mixed. The current study recruited college students to record food intake, episodes of binge eating, and use of compensatory behaviors before, throughout, and following a 24-hour fast. Participants attended an initial appointment in which they completed measures of dietary restraint and disinhibition and received instructions on self-monitoring and fasting. Participants (N = 122) self-monitored their eating behaviors for 96 h, including a 24-hour fasting period. Participants did not demonstrate significant increases in disordered eating behaviors following the fast (e.g., objective binge episodes, self-defined excessive eating or compensatory behavior use). Baseline disinhibition predicted excessive eating as well as objective binge episodes both before and after fasting. Altogether, findings have implications for research seeking to further understand how fasting may contribute to the development of pathological eating patterns; specifically, it seems that the ED risk associated with fasting is derived from the behavior's interaction with other individual difference variables.

1. Introduction

Theoretical models of eating disorders (EDs) traditionally posit that some forms of dietary restraint—the cognitive attempt to limit intake in order to lose or maintain weight (Lowe, Whitlow, & Bellwoar, 1991)—play a role in the development of ED psychopathology (Fairburn, 2008; Polivy & Herman, 1985). On the other hand, ample evidence also suggests that caloric restriction, which refers to the practice of limiting energy intake in order to maintain a negative balance of calories, is associated with health benefits, including healthy weight management. A large body of research shows positive health outcomes following caloric restriction in both animal (e.g. Anderson & Weindruch, 2012, Roth & Polotsky, 2012, Weindruch, Naylor, Goldstein, & Walford, 1988) and human subjects (e.g.Heilbronn et al., 2006, Lefevre et al., 2009, Redman et al., 2007). Thus, separate bodies of research have suggested both positive and negative effects of attempting to restrict calories. As obesity rates rise (Ogden, Carroll, Kit, & Flegal, 2012), there is an increasing need to identify effective options for increasing caloric restriction, while also minimizing the risk for the development of EDs. Examining benefits and drawbacks of the various types of caloric restriction, such as fasting, may assist in this endeavor.

1.1. Fasting

Fasting, or going for a specified amount of time without consumption of food or drink, represents one specific form of caloric restriction. One recent study found that almost a quarter of college students endorsed fasting as a weight management strategy (Kelly-Weeder, 2011). Fasting can be distinguished from dietary restraint in that restraint is a primarily *cognitive* construct and may not yield a true negative energy balance (Lowe et al., 1991), while fasting is primarily *behavioral*, and refers to the act of not eating for a period of time. Similar to general caloric restriction and dietary restraint, fasting has been examined within both the eating disorders and overweight/obesity literature, and has been heralded as a potentially useful weight management strategy (e.g., Harvie et al., 2011), as well as a risk factor for disordered eating (e.g., Stice, Davis, Miller, & Marti, 2008).

1.2. The negative impact of fasting

Literature on fasting suggests that prolonged food restriction has physiological and psychological effects that may predispose an individual to overeat or binge eat once food is made available (Polivy, 1996). Physiologically, acute dietary restraint (e.g., fasting) may deplete tryptophan, a precursor to serotonin, subsequently increasing the likelihood of binge eating in an attempt to restore tryptophan levels (Kaye, Gendall, & Strober, 1998). Additionally, research demonstrates that fasting has an impact on food-related attentional biases. For example, undergraduates who fasted during breakfast and lunch were more likely to show bias

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towards high-calorie, as compared to low-calorie foods (Placanica, Faunce, & Soames Job, 2002). Furthermore, two studies explicitly examining the impact of fasting on eating behaviors found that individuals with eating disorders significantly increased food intake following a 6-hour and a 14-hour fast (Agras & Telch, 1998; Telch & Agras, 1996). In a 5-year longitudinal study, Stice et al. (2008) also found self-reported fasting to be a significant predictor of eating pathology and recurrent binge eating.

1.3. The benefits of fasting

Some research suggests a link between fasting and disordered eating; however, another body of work suggests that fasting may not result in disordered eating and may even offer physiological benefits. Several studies using samples of individuals with eating disorders (Hetherington, Stoner, Andersen, & Rolls, 2000) as well as healthy men and/or women (Johnstone et al., 2002; Levitsky & DeRosimo, 2010) found no impact of prescribed fasting on subsequent eating patterns. In addition, a great deal of evidence suggests that intermittent fasting (periods of fasting alternating with non-fasting periods) has a beneficial impact on health outcomes. Evidence suggests that both intermittent fasting and moderate caloric restriction reduce risk for diabetes, cardiovascular disease and neurodegenerative diseases at similar rates (Martin, Mattson, & Maudsley, 2006; Varady & Hellerstein, 2007). Therefore, although clearly different in terms of the type of restriction, intermittent fasting and moderate caloric restriction approaches appear to yield positive health outcomes, suggesting that fasting may confer some physiological benefit.

1.4. Fasting and disordered eating: relevant third variables

Third variables may be the key to understanding the discrepancies in the existing literature on intermittent fasting. That is, one way to view fasting as possessing simultaneous risks and benefits is that fasting may be beneficial for individuals not at risk for developing EDs, but harmful for individuals who may be more vulnerable to developing ED behaviors. For example, because girls may be at higher risk for disordered eating behaviors, they may be more susceptible to the negative effects of fasting. Supporting this hypothesis, Stice et al. (2008) found that the incidence of fasting in middle school girls was a stronger predictor of recurrent binge eating and eating pathology onset than dietary restraint scales over the course of five years. It may be that this effect would function differently depending on the sample's developmental stage and associated ED-risk. Thus, it seems important to investigate potential individual difference variables that could interact with fasting behaviors in order to create increased risk for ED pathology.

Three variables that may make fasting more or less risky include motives for fasting, biological variables, and psychological variables. For instance, individuals with high levels of ED risk may be motivated to fast in order to improve body image (Schaumberg & Anderson, 2014). Alternatively, individuals who report other motivations for fasting, such as for spiritual or religious motivations, may be less likely to develop problematic eating patterns. Furthermore, biological or psychological variables that predispose certain individuals to engage in fasting for weight management purposes may also account for the relationship between fasting and problematic eating patterns. Individuals who report high levels of other ED risk factors may be particularly sensitive to psychological effects of fasting. Two such factors may be dietary restraint and disinhibition. Dietary restraint refers to the degree to which individuals attempt to restrict intake to manage weight, and dietary disinhibition refers to the degree to which individuals are sensitive to episodes of overeating that are inconsistent with weight loss goals. Because dietary restraint and disinhibition both relate to risk for eating pathology, fasting may serve as a trigger for binge episodes for individuals who report high levels of these variables.

1.5. The current study

The five investigations that have examined eating behaviors following a fast to date have provided mixed results; this may be due to variation across study samples and variation in the length of fast, as well as a lack of consideration of third variables. Importantly, only two of the previous studies were conducted using non-overweight, healthy samples. Though the impact of fasting on individuals with eating disorders is of interest, examining effects of fasting on eating behaviors in a healthy sample provides a better assessment of the unique risk associated with fasting for the *development* of eating pathology. The present study sought to examine the effects of a short-term (24-hour) fast on subsequent eating behavior in a population of healthy young adults. Furthermore, we examined the degree to which baseline levels of self-reported dietary restraint and disinhibition moderated participants' responses to fasting. We expected that individuals with higher levels of dietary restraint and disinhibition would report more binge eating and purging episodes following the fast.

2. Materials and methods

2.1. Participants and procedure

Participants (N = 218) in this study were recruited from a large Northeastern University. The majority of participants were female (57%) and Caucasian (59.0%), with a mean age of 18.79 ($SD = 1.24$) and a mean body mass index within the non-obese range ($M = 24.23$; $SD = 4.87$). Recruitment occurred through the University's research pool; participants were asked not to enroll if they had ever had an ED, as fasting may have presented unnecessary risk for individuals with a history of eating pathology. Participants were also advised not to enroll in the study if they had any medical problems that would prevent them from being able to complete the fast successfully.

Participants attended an appointment 24 h before the fast; during this appointment, they provided informed consent for participation in the study and completed survey measures of body image and eating pathology. Participants self-monitored their food intake for 36 h prior to fasting, and recorded this information online once per day. After recording each eating episode, participants indicated whether or not they felt that what they ate was excessive ("Did you find this episode of eating excessive?"), and whether they engaged in a compensatory behavior (laxative use, diuretic use, vomiting, excessive exercise) after eating. Participants also reported whether their eating episode would be considered a large amount of food given the circumstance, along with the degree to which they felt a loss of control over eating. Participants then fasted for 24 h before which time they received detailed instructions on fasting. Individuals could drink water along with any zero calorie beverages (i.e., coffee and tea). Participants were asked to abstain from all food for 24 h; however, they were not penalized for failure to complete the fast successfully. Individuals attended an additional appointment at the end of their fast and continued to record their intake online for 36 h after the end of the fast, along with any experiences of binge eating or purging. Therefore, participants attended two in-lab sessions: one 24 h before the fast and one immediately following the fast. Additionally, they completed self-monitoring logs for a total of 96 h; they monitored 36 h previous to the fast, the 24-hour fasting period, and 36 h following the fast.

2.2. Measures

2.2.1. Food records

Participants completed food records online during the week. All self-monitoring occurred on weekdays and all participants fasted at the same time during the week to minimize the potential impact of the day of the week on results (e.g., weekend vs. weekday). Undergraduate research assistants instructed participants on the utilization of the self-

monitoring records, and participants received class credit for completion of the study in proportion to the number of days that they self-monitored. Participants received paper-based self-monitoring forms to assist in recording the time of day and place that they ate, the food or drink that they consumed, the serving size of that food or drink, and the number of calories it contained. Participants then entered this information into the online self-monitoring website each night after their last meal. Participants varied in their compliance with self-monitoring. Fifty-six percent (56%) of participants self-monitored their intake every day.

2.2.2. Three factor eating questionnaire (TFEQ)

The TFEQ is a 51-item self-report survey that includes three subscales: restraint, hunger, and disinhibition (Stunkard & Messick, 1985). The restraint subscale (TFEQ-R) includes a series of self-report items assessing the degree to which individuals purposefully restrict their intake. Examples of questions include, "I deliberately take small helpings as a means of controlling my weight," and "Life is too short to worry about dieting." The TFEQ-R has been shown to reliably predict reduced daily caloric intake over a 7-day period (Laessle, Tuschl, Kotthaus, & Pirke, 1989). The disinhibition subscale of the TFEQ (TFEQ-D) measures the degree to which individuals feel a loss of control over eating and the inability to control emotional cues. TFEQ-D scores have been associated with weight gain over time in undergraduate samples (Finlayson, Bordes, Griffioen-Roose, de Graaf, & Blundell, 2012). The hunger subscale (TFEQ-H) measures susceptibility to both internal and external hunger cues (Bond, McDowell, & Wilkinson, 2001; Stunkard & Messick, 1985). Participants completed the TFEQ at the laboratory appointment, prior to fasting.

2.3. Analytic plan

In order to assess differences in compensatory behaviors, excessive eating, and binge eating before (in the 36 h prior) and after (in the 36 h following) the fast, paired t-tests were used whenever the sample size of individuals endorsing the behavior was large enough to conduct the test. Logistic regression analyses were conducted in order to assess the role of disinhibition and restraint on compensatory and binging behaviors prior to and following the fast; two regressions were conducted for each outcome variable, with one assessing the role of disinhibition and restraint prior to the fast, and another evaluating reports following the fast. Participants' fasting periods were scheduled to conclude at mid-day, allowing for further examination of eating behavior for the remaining part of the day (post-fast), along with the entire subsequent day (totaling 36 post-fast hours). Only participants who completed all relevant self-monitoring (N = 122) were included in these analyses. Prior to analyses, those who completed the self-monitoring logs and those who did not were compared on all variables of interest; no significant differences emerged between the two groups of individuals.

3. Results

3.1. Preliminary sample description

Preliminary description of pre-fasting eating behaviors is provided to characterize the sample. A small number of individuals ($n = 4$) reported engaging in self-reported compensatory behaviors in the days prior to fasting, despite reporting a lack of ED. Relatedly, although no participants self-identified as an individual with an ED, the presence of excessive eating ($n = 25$), and binge eating behaviors ($n = 6$) were noted in the pre-fasting period. Such behaviors were expected to occur at low levels, consistent with self-reports of binge eating and compensatory behaviors in similar samples (e.g. Mintz & Betz, 1988; Luce, Crowther, & Pole, 2008). Mean levels of disinhibition ($M = 8.69 \pm 3.78$), restraint ($M = 11.81, \pm 6.02$) and hunger ($M = 6.00, \pm 3.35$), were similar to reported norms in a combined sample of dieters and free eaters (Stunkard & Messick, 1985). Levels of these variables were also similar to those found in a comparable sample of undergraduate females (Fayet, Petocz, & Samman, 2012). Therefore, the current sample seemed representative of a non-clinical undergraduate population demonstrating a range of healthy and unhealthy eating behaviors.

3.2. Excessive eating

First, we evaluated the degree to which individuals engaged in episodes of self-defined "excessive eating" during the 36 h prior to and after the fast; excessive eating episodes were distinguished from binge eating in that they do not require a loss of control. Overall, 25 participants reported eating excessively at least once in the 36-hour period prior to fasting. After fasting, 28 participants reported excessive eating, 12 of whom also reported excessively eating before the fast.

3.3. Objective binge eating episodes

Binge eating was assessed through participants' responses to food records each day during the study. Consistent with the criteria for a binge within DSM-5, objective episodes of binge eating were defined as using the DSM-5 criteria for a binge episode—(1) eating, in a discrete period of time, an amount of food that is definitely larger than what most people would eat in a similar period of time under similar circumstances and (2) a sense of lack of control over eating during the episode (American Psychiatric Association, 2013). Rates of binge eating 36 h prior to the fast were compared to rates of binge eating 36 h after fasting. Altogether, six individuals (4.9%) reported an episode of binge eating prior to the fast, while 12 individuals (9.8%) reported binge eating after the fast, a difference that approached statistical significance, $t(121) = 1.98$, $p = .05$. Of the twelve individuals who reported binge eating after the fast, four had experienced a binge episode prior to the fast.

3.4. Compensatory behaviors

In addition to evaluating changes in the frequency of binge eating, we also assessed compensatory behavior use before and after fasting. Despite reporting no eating pathology during the screening process, four individuals nonetheless endorsed episodes of compensatory behavior use when completing measurement prior to the fast, while three participants reported compensatory behaviors after the fast. As we asked participants to not enroll in the study if they currently had an eating disorder, it can be inferred that these individuals did not consider themselves to have an ED. Generally, self-reported compensatory behaviors are relatively high in college samples and do not necessarily mean that an individual simultaneously endorses high ED psychopathology (Schaumberg, Anderson, Reilly, & Anderson, 2014). Therefore, it seems possible that these reports of compensatory behaviors were reflective of normative levels of exercise among this sample and participants did not consider themselves to have an ED. These seven reports of compensatory behaviors (i.e., over-exercising, using diuretics and laxatives, and purging) came from different individuals.

3.5. Restraint, disinhibition, and hunger

Restraint predicted excessive eating before, $B = .11 \pm .05$, Wald = 4.00, $p < .05$, but not after the fast. Restraint did not predict objective binge episodes during the week; however, disinhibition predicted episodes of excessive eating before, $B = .21 \pm .07$, Wald = 10.28, $p < .05$, and after the fast, $B = .22 \pm .07$, Wald = 10.85, $p < .05$. Disinhibition also predicted objective binge eating episodes before, $B = .55 \pm .23$, Wald = 5.71, $p < .05$, and after fasting, $B = .22 \pm .07$, Wald = 8.83, $p < .05$. Hunger did not account for any variance in excessive eating or binge eating in the periods immediately before or after fasting. Due to the relatively low number of episodes of purging

reported in this sample, we did not evaluate the degree to which restraint, disinhibition, and hunger related to purging.

4. Discussion

Altogether, the results from the current study did not provide support for our first hypothesis; however, we did find partial support for our second hypothesis. First, we hypothesized that participants would show increased binging and purging following the fast. Although there was a trend for participants to report increased binge eating behaviors following the fast, this effect did not meet traditional thresholds for significance ($p = .05$). Therefore, we cannot conclude that fasting had any impact on binge eating behaviors or excessive eating in the current sample. Such results stand in contrast to etiological models of bulimia nervosa (e.g., Stice, Shaw, & Nemeroff, 1998) and indicate that fasting may not increase the likelihood of disordered eating in samples at low-risk. However, it is important to note that conclusions cannot be made solely on the basis of our results, as a trend-level effect was present. Though the difference in rates of objective binge episodes did not meet threshold for significance in the current sample, the current study was underpowered to detect small effects. It is possible that there is a true, small effect on objective binge episodes that occurs in the population after fasting that was not captured in this study. Results from the current investigation suggest that, even in the event that there is a true effect that was not detected in this sample, this effect would likely impact only a minority of individuals, as less than ten percent of the current sample reported objective binge eating episodes before and after fasting. Nonetheless, it seems pertinent for future work to examine whether the observed findings are upheld when considered within a clinical or more high-risk population.

Furthermore, compensatory behavior use was a relatively rare behavior both before and after fasting. It seems that, within a low-risk college student sample, fasting did not relate to high levels of compensatory behaviors. Notably, participants who reported a history of, or current EDs were asked not to enroll in this study; we did so purposefully in order to test how fasting impacted individuals who reported fairly low levels of irregular eating. Fasting may have a more pronounced effect on bulimic behaviors in individuals who are at higher risk for such problems.

Second, we predicted that restraint and disinhibition would be important predictors that account for the increase in ED behaviors after fasting. Interestingly, the results of this study suggest that level of dietary restraint may *not* influence the tendency for individuals to binge eat after a period of fasting; however, disinhibition did relate to risk for episodes of excessive eating and binge eating both before and after fasting. Disinhibition, then, appears to be a risk factor that is most proximally related to the tendency to engage in excessive eating. Thus, our second hypothesis was partially supported by the data.

There are several limitations to the current findings that are important to note. First, this study included only college students who did not report a history of eating pathology. Thus, the effects of short-term fasting may be different for those who are at greater risk for eating problems, for those who may have different motives for fasting (e.g., religion), have different demographic profiles, such as populations in a different age range. Furthermore, only 56% of the sample completed self-monitoring for the duration of the study. As a result, it is possible that individuals that did not self-monitor showed different responses to fasting. Nonetheless, a comparison of those who did and did not complete self-monitoring indicates that these individuals had similar demographic characteristics and similar average scores of restraint and disinhibition. It is also worth noting that past research has indicated that self-reported intake is often under-reported (Hill & Davies, 2001); thus, participants may have underreported episodes of excessive eating and binge eating in this study. Finally, all individuals in the current study were assigned to the same fasting condition; utilization of a control group, or the presence of another experimental group with a different level of dietary restriction would enhance confidence in the current findings.

4.1. Conclusions

While our findings highlight an effect of fasting on ED behaviors and the role of disinhibition in this relationship, future research must aim to extend our understanding of this phenomenon. For instance, variables commonly cited within the ED literature, such as individual differences in emotion regulation or hunger and appetite awareness, may serve as moderators of the fasting-ED relationship and shed further light on factors that contribute to disordered eating behaviors. Additionally, future studies may investigate motives for fasting, and whether specific motives differentially impact risk for ED behaviors.

Findings from this study add to a growing body of literature on the impact of fasting on the development of eating pathology. From this study, it appears that within a sample at low-risk for disordered eating, fasting does not significantly predict increases in ED behaviors and thus may represent an adaptive method of caloric restriction when other risk factors are not present.

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Contributors

The first author designed the study, ran the statistical analyses, and contributed to the manuscript. The second author contributed to the design of the study and aided in manuscript composition and edits. The third and fourth authors assisted primarily in writing and preparing the manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

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