

DOES SOCIAL SUPPORT INFLUENCE BULIMIC BEHAVIORS THROUGH ITS IMPACT
ON COGNITIVE APPRAISAL?

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Does Social Support Influence Bulimic Behaviors through Its Impact on
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ABSTRACT

Social support is one of many interpersonal functions that is impaired among individuals with bulimia nervosa. The buffering hypothesis of social support posits that social support shields the deleterious impact of stress on bulimic behaviors. However, the specific mechanism by which social support protects against the negative impact of stress on bulimic symptoms remains to be clarified. To investigate this mechanism, two studies examined the potential role of cognitive appraisal as a mediator in the relationship between social support and bulimic behaviors among undergraduate students.

Study 1 was a longitudinal, naturalistic study in which participants completed online surveys at two assessment points that were four weeks apart. Bootstrap analyses revealed that cognitive appraisal did not mediate the relationship between perceived social support and bulimic behaviors. Exploratory analyses demonstrated that perceived stress, a construct parallel to cognitive appraisal with the emotional experiences taken into consideration, acted as a mediator in this relationship. Perceived social support appeared to be associated with decrease future bulimic behaviors through lowered stress perception.

Study 2 was an experimental study that examined the role of cognitive appraisal in the relationship between social support and food consumption, which was used as a laboratory analogue of binge eating. Female participants were randomly assigned into one of two groups: with or without social support available. Stress was induced with a speech task, followed by a bogus taste task. Results demonstrated that perceived stress, instead of cognitive appraisal mediated the relationship between subjective ratings of the experimenter's supportiveness and calories consumed. Unexpectedly, perceived supportiveness was associated with more caloric consumption through lower stress perception among individuals with high restraint.

These studies extended the existing literature by examining perceived social support, perceived stress, and bulimic behaviors in a mediation model. Findings have theoretical and clinical implications for the role of social support in bulimic behaviors and the stress-disordered eating relationship. For example, stress does not always predict binge eating. Moreover, findings suggest the importance of social support in stress management and eating disorder treatments as well as the potential for emotional interventions for eating disorders.

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INTRODUCTION

Bulimia nervosa (BN) is an eating disorder characterized by binge eating (i.e., eating an unusually large amount of food while experiencing a sense of lack of control) and inappropriate compensatory behaviors (e.g., self-induced vomiting, misuse of laxatives) that occur, on average, a minimum of once a week for three months (American Psychiatric Association, 2013). These behaviors are also accompanied by a disturbance in the self-evaluation that is excessively influenced by body shape and weight. The lifetime prevalence of BN has been reported to range from 1% to 3% among women (Garfinkel et al., 1995; Hudson, Hiripi, Pope Jr., & Kessler, 2007). However, subclinical eating disorders are much more common and have been reported in as many as 31.4% of undergraduate men (Lavender, De Young, & Anderson, 2010), 32.1% of undergraduate women (Luce, Crowther, & Pole, 2008), and 11.2% of adolescents (Eichen, Conner, Daly, & Fauber, 2012).

BN has been linked to a multitude of negative physical health outcomes (e.g., irritable bowel syndrome, functional incontinence; Abraham & Kellow, 2011), psychological impairments (e.g., anxiety, depression; O'Brien & Vincent, 2003; Lehoux & Howe, 2007; Leon, Keel, Klump, & Fulkerson, 1997), lower quality of life (e.g., Doll, Petersen, & Stewart-Brown, 2005), and premature mortality rates (e.g., Arcelus, Mitchell, Wales, & Nielsen, 2011; Button, Chadalavada, & Palmer, 2010; Crow et al., 2009). Given these severe negative outcomes, it is important to identify factors associated with the development and maintenance of BN for prevention and intervention efforts. Social support is a meaningful, but understudied, factor that has been found to be associated with the onset and maintenance of BN (e.g., Arcelus, Haslam, Farrow, & Meyer, 2013; Bodell, Smith, Holm-Denoma, Gordon, & Joiner, 2011; Grissett & Norvell, 1992; Rorty, Yager, Buckwalter, & Rossotto, 1999). The goal of the proposed studies

was to advance the understanding of how social support may buffer the impact of stress on bulimic behaviors.

Social Support and Disordered Eating

Social support is defined as the resources provided by one's social network with the intention to increase one's coping ability (Cohen, 2004). According to the buffering hypothesis (stress-reducing model) of social support, social support serves to shield the deleterious impact of stress on psychological well-being (Cohen & Wills, 1985). During times of stress, social support enables an individual to cope with stress more effectively, thus weakening the relationship between stress and low psychological well-being. The vast importance of social support for health has been demonstrated in a meta-analytic review (Holt-Lunstad, Smith, & Layton, 2010), which shows that lack of social support is as strong of a predictor of premature mortality as cigarette smoking.

Research has shown that individuals with BN, as established by self-report measures and clinical interviews, show deficits in various aspects of social support. When compared to individuals without BN, individuals with BN perceive that they have less social support (Ghaderi & Scott, 1999; Grissett & Norvell, 1992; Rorty et al., 1999). They also report more negative interactions and conflicts (variables related to social support) in their social relationships (Grissett & Norvell, 1992). Moreover, individuals with BN report fewer support figures and smaller support network than their non-disordered eating counterparts (Rorty et al., 1999; Tiller et al., 1997; Troop, Holbrey, & Treasure, 1998), which may explain the low social support satisfaction among the BN population (Limbert, 2010; Tiller et al., 1997; Rorty et al., 1999).

When comparing the different sources of social support, family social support seems to be a main deficit among individuals with BN. In the majority of studies, individuals with BN

report significantly fewer family support figures as well as less satisfaction with family support than healthy control group and individuals with anorexia nervosa (AN; Rorty et al., 1999; Tiller et al., 1997; Troop et al., 1998; but also see Troop & Treasure, 1997). Poor family relational quality between a patient and his or her family has been found to be related to more severe BN symptomatology (Hedlund, Fichter, Quadflieg, & Brandl, 2003; van Furth et al., 1996).

Interestingly, although individuals with BN report a smaller friendship network than control groups, there are not any group differences in satisfaction with social support received from friends (Rorty et al., 1999; Tiller et al., 1997).

The majority of extant research findings point to the important role of social support in bulimic symptomatology. However, many studies utilized retrospective designs that might have compromised the findings due to impaired recollection. For example, Troop et al. (1998) and Troop and Treasure (1997) asked for information that occurred in the past 12 months from the time of assessment, which was a fairly long period of time that might have decreased the accuracy of recollection. The few longitudinal studies that exist have found that lower social support is predictive of greater future bulimic symptoms (Bodell, Smith, Holm-Denoma, Gordon, & Joiner, 2011; Ghaderi, 2003). Specifically, Bodell et al. (2011) found that undergraduate students with lower social support experienced greater bulimic symptoms when encountered with negative life events. Moreover, the predictive role of social support and negative life events was specific to bulimic symptoms but not restrictive eating, depression, or anxiety. This is consistent with another study, in which low social support in combination with some other risk factors (e.g., low self-esteem, high body concern) were causally linked to the development of disordered eating, including bingeing and purging behaviors in a community sample (Ghaderi, 2003).

In summary, a body of research demonstrates that lack of social support is connected with higher levels of bulimic symptomatology and that it differentiates individuals with bulimic symptoms from those without bulimic symptoms. Furthermore, social support prospectively predicts bulimic symptomatology in longitudinal studies. The lack of social support is more apparent among individuals with BN or related symptoms than other disordered eating (e.g., Tiller et al., 1007; Troop et al., 1998) and its predictive role is specific to bulimic symptomatology (Bodell et al., 2011). However, a limitation of existing studies is that they did not investigate the specific mechanism by which social support may buffer or protect against the negative impact of stress on the development or maintenance of bulimic symptoms. Moreover, the diverse aspects of social support (e.g., perceived social support, satisfaction with social support, size of network) investigated in the literature of disordered eating have presented some challenges in the interpretation of these findings.

Psychological Stress Theory of Lazarus

Although research has demonstrated some evidence for the buffering model of social support (Cohen & Wills, 1985), the specific mechanism by which social support buffers the impact of stress on psychological well-being remains to be clarified. Cognitive appraisal has been suggested as a mechanism of change in the buffering model of social support (Cohen & McKay, 1984; Cohen & Wills, 1985). According to the psychological stress theory of Lazarus (1993; 2006), stress is viewed as a relational process between individuals and their environment. The reactions and experiences of stress are shaped by cognitive appraisal processes and individual difference variables (Lazarus, 1993; Lazarus, Deese, & Osler, 1952). Appraisal is a process of evaluating the stressor and one's relationship to the stressor. It mediates the

relationship between demands of the environment (i.e., stressor) and the stress outcome (Lazarus, 1993).

Two cognitive appraisal processes are primary appraisal and secondary appraisal (Folkman & Lazarus, 1988; Lazarus & Folkman, 1987). Primary appraisal generally refers to whether or not an individual has a stake in the stressor. During the primary appraisal, an individual evaluates and decides the importance, relevance, and meaning of the stressor in relation to his/her goals, values, and beliefs. Secondary appraisal relates to the coping options and their availability (Lazarus, 1993). An individual evaluates the options of intervening with the stressor and their potential in positively influencing the encounter of the stressor. These two appraisal processes may influence each other but without a temporal order (Lazarus & Folkman, 1987). These processes then determine the interpretation of the stressor as harm, threat, or challenge (Lazarus, 1993). Harm refers to psychological detriment or loss that had already been done. Threat refers to the anticipation of impending harm while challenge refers to stressors that individuals feel capable of and confident in overcoming or mastering.

Stress and Disordered Eating

To the knowledge of the writer, no previous research has looked into how social support may affect cognitive appraisal of stressful events in relation to disordered eating, although some authors have discussed the social support-cognitive appraisal relationship in other literature, such as trauma (e.g., Guay, Billette, & Marchand, 2006; Spaccarelli, 1994). Social support is suggested to influence one's interpretation of a stressor and coping methods during times of stress. Psychological stress has been researched in the field of disordered eating (e.g., Blodgett Salafia & Lemer, 2012), including bulimic symptoms (e.g., Striegel-Moore, Silberstein, Frensch, & Rodin, 1989). According to a review on psychological stress and disordered eating,

psychological stress is reported to be positively correlated with disordered eating (Ball & Lee, 2000). Higher psychological stress tends to be related to higher levels of disordered eating symptoms. For example, research shows that undergraduate females experiencing stress report more disordered eating symptoms than when they are not experiencing stress (Costarelli & Patsai, 2012). Although Ball and Lee (2000) concluded in their review that the direction of the stress-disordered eating relationship remained inconsistent, recent research has shown evidence suggesting that stress precipitates and maintains disordered eating, instead of vice-versa. These findings show that stress contributes to the development of disordered eating and triggers relapse among individuals with eating disorders, including BN (Bodell et al., 2011; Grilo et al., 2012; Rojo, Conesa, Bermudez, & Livianos, 2006). Moreover, Bodell et al. (2012) found that disordered eating behaviors did not predict stress beyond those attributed to comorbid depression symptoms, providing further support regarding the causal role of stress in eating disorders.

The Current Study

The present study examined the mechanism of how social support affects bulimic behaviors through cognitive appraisal of stressful events. Since the perception of social support has been found to be most relevant to the buffering effect of social support (Cohen, Mermelstein, Kamarck, & Hoberman, 1985; Cohen & Wills, 1985; Wethington & Kessler, 1986), the current study was designed to focus on perceived social support. During primary appraisal, the perception of social support may promote a clearer understanding of a potential stressor by influencing the interpretation of an event (Cohen & Wills, 1985; Shumaker & Brownell, 1984). During secondary appraisal, perceived social support may influence the assessment of coping resources and extend the number of coping options (Cohen & Wills, 1985; Shumaker & Brownell, 1984). Given the role of social support in affecting stress outcome through cognitive

appraisals, it was proposed that cognitive appraisal would mediate the relationship between social support and bulimic behaviors, thus explaining the mechanism of how social support affects bulimic behaviors.

As indicated above, it was proposed that perceived social support buffers the influence of stress on bulimic behaviors through cognitive appraisal of stressful events. However, this mediation model may only be relevant to those with high level of stress because social support exerts its influence on psychological well-being in the face of stress (i.e., the buffering hypothesis). On the other hand, the mediation model may not be applicable when there is an absence of a stressor because there is not a need for social support to exert its influence. Research has shown that binge eating and purging are more likely on days with greater stress among undergraduate women and women with clinical BN (Barker, Williams, & Galambos, 2006; Smyth et al., 2007). Moreover, among binge eaters, the amount of calorie intake is higher on days characterized by higher stress than on days characterized by lower stress (Crowther, Sanftner, Bonifazi, & Shepherd, 2001). These findings suggest that binge eating and purging occur in response to stress. Therefore, it was suggested that the mediating role of cognitive appraisal in the relationship between social support and bulimic behaviors would be contingent upon stress level, such that the mediational relationship would be more apparent among individuals with higher stress levels.

STUDY 1

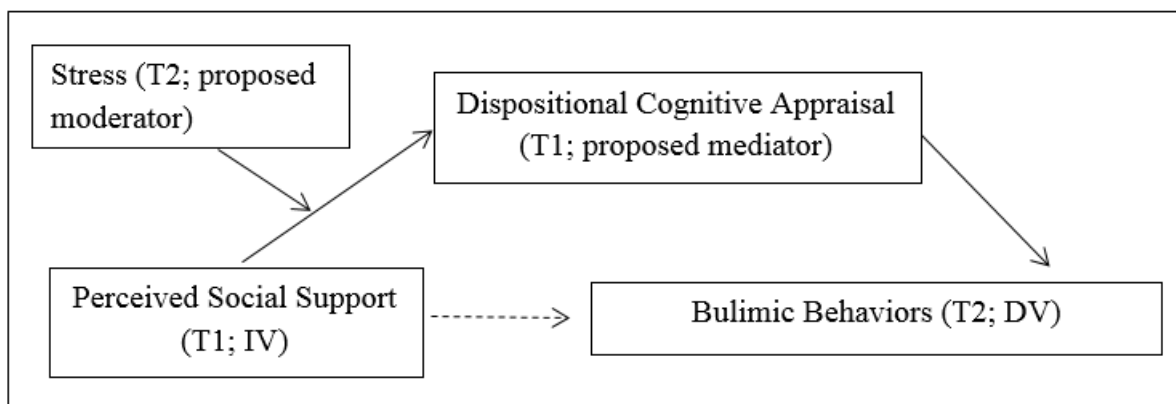


Figure 1. The proposed moderated mediation model. Cognitive appraisal mediates the relationship between perceived social support and bulimic behaviors, contingent upon stress level.

Study 1 was designed to longitudinally examine the effect of perceived social support on bulimic behaviors (i.e., binge eating and inappropriate compensatory behaviors) through dispositional cognitive appraisal in a naturalistic environment (see Figure 1). This study was designed as an online study with approximately four weeks in between two assessment points. The primary independent variable was social support at Time 1 (T1), the hypothesized mediator was cognitive appraisal at T1, and the outcome variable was the frequency of bulimic behaviors that occurred in the past four weeks, as assessed at Time 2 (T2). In this study, binge eating and inappropriate compensatory behaviors were combined into one dependent variable because research has shown similar patterns of change in mood and stress associated with binge eating and self-induced vomiting episodes among females with BN (Smyth et al., 2007). These findings suggest that the proposed model might equally affect both types of bulimic behaviors. Dispositional cognitive appraisal was hypothesized to mediate the relationship between perceived social support and bulimic behaviors, contingent upon stress level. It was hypothesized that the mediation model would be stronger among individuals with high stress than low stress

because perceived social support exerts its influence on cognitive appraisal during times of high stress. A composite bulimic symptomatology that included bulimic thoughts, attitudes, and behaviors was assessed at T1 as a covariate. This was used to control for baseline severity of bulimic symptoms in the analyses as it could be a potential confound.

Method

Participants. Participants were undergraduate students recruited through a secure online system that was available to students enrolled in psychology courses at a public Midwestern university. They participated in this longitudinal study in exchange for course credit. A total of 792 undergraduate students participated at T1, and 47.2% ($N= 374$; 43.6% men) returned to complete the T2 assessment. A series of independent t-tests revealed no significant difference between those who returned and those who did not on all variables assessed at T1 (i.e., perceived social support, dispositional cognitive appraisal, and baseline bulimic symptomatology). Eighty-nine of these returners had incomplete responses on the measures (i.e., missing individual items on a measure or missing an entire measure), resulting in a total of 285 participants with complete data. The participants ranged in age from 18-26 years old ($M = 19.24$, $SD = 1.33$), and the majority were Caucasian (93.3%), followed by Asian (2.8%), Hispanic (1.4%), and Other (1.1%). All participants met the inclusion criterion of at least 18 years old at the time of the baseline assessment.

Procedure. Participants provided informed consent and completed this two-part study through a secure online system. Upon agreement to participate in this study, participants completed the following measures at T1 assessment: the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988), the General Appraisal Measure (GAM; Hemenover & Dienstbier, 1996), and the Bulimia Test-Revised (BULIT-R; Thelen,

Farmer, Wonderlich, & Smith, 1991). Participants were provided with a password in an email invitation to take part in T2 assessment 4 weeks after the completion of their T1 assessment. During T2 assessment, participants completed the Inventory of College Students' Recent Life Experiences (ICSRLE; Kohn, Lafreniere, & Gurevish, 1990), the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994), and the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). Although perceived stress was not a variable included in the proposed model, this scale was included to complement the GAM, which measures cognitive appraisal of stress. Perceived stress may be construed as a parallel construct of cognitive appraisal. Although the perception of stress is defined by cognitive appraisal, stress perception includes the experience of emotions. The Perceived Stress Scale (PSS) may be a better measure of stress perception than the GAM given the limited psychometric data on the GAM. Moreover, the PSS items tap into the emotional domain of stress perception in contrast to the mere cognitive domain of stress perception measured in the GAM. The emotional domain in addition to the cognitive domain of stress perception may explain the mechanism of how perceived social support affects bulimic behaviors because bulimic behaviors have been suggested to regulate negative emotions (Berg et al., 2013). This variable was included in the exploratory analysis but not the main analysis. The order of measures were randomly determined for each participant through the online system in an effort to prevent order effects. This study was approved by the institutional review board at North Dakota State University.

Measures. Perceived social support was measured by the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1988). The MSPSS is a 12-item self-report measure assessing respondents' perceived social support from three sources: family, friends, and significant other. Respondents rate their agreement with each statement on a 7-point Likert scale,

ranging from 1 “Very Strongly Disagree” to 7 “Very Strongly Agree”. Sample items from the MSPSS include: “There is a special person who is around when I am in need,” “My family really tries to help me,” and “I can talk about my problems with my friends.” Higher scores indicate higher perceived social support. Adequate reliability and validity of the MSPSS have been demonstrated (Canty-Mitchell & Zimet, 2000; Zimet et al., 1988). Cronbach’s alpha for the MSPSS was .95 in the present study.

The General Appraisal Measure (GAM; Hemenover & Dienstbier, 1996) is a 26-item self-report measure assessing appraisal dispositions. The GAM assesses respondents’ appraisals of diverse hypothetical situations, including situations that may be particularly relevant to college students. It was developed based on the assumption that responses to diverse situations would provide a trait-like measure of appraisal, capturing a general appraisal style across time and situations. Respondents rate on a 7-point Likert scale, with 1 representing “not at all” and 7 representing “extremely”, how stressful and how well they could cope with each item/situation presented to them. Sample items from the GAM are: “Living in a new city,” “Final exam week,” and “Breaking up with boy/girlfriend.” A main index of the GAM was calculated by “taking a ratio of the stress-to-cope items for each event, summed across all 26 events and averaged” (Hemenover & Dienstbier, 1996, p. 304). GAM index increases as stressfulness score increases and coping score decreases. The GAM index defines a continuum of appraisal style ranging from challenge to threat. With the limited studies that had looked into the psychometric properties of the GAM, acceptable internal reliability, test-retest reliability, and discriminant validity have been demonstrated (Hemenover & Dienstbier, 1996; Hemenover & Dienstbier, 1998). Although there is limited psychometric information available on the GAM, it was chosen to be used in this study because it assesses cognitive appraisal of events that are typical among college students.

Moreover, there are limited measures that are designed to measure dispositional cognitive appraisal among college students. Cronbach's alpha for the GAM in this study was .86.

The Bulimia Test-Revised (BULIT-R; Thelen et al., 1991) was used to measure the composite bulimic symptomatology at T1 as a potential confounding variable (e.g., to rule out the possibility that any effects found were due to baseline bulimic symptoms). The BULIT-R is a 36-item self-report measure assessing respondents' bulimic symptoms according to the *Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R*; American Psychiatric Association, 1987) criteria. Although the BULIT-R was developed to accommodate the criteria of bulimia nervosa in the *DSM-III-R*, research suggests that the BULIT-R continues to be a valid measure in identifying individuals with bulimia nervosa according to the *DSM-IV* (American Psychiatric Association, 1994) criteria (Thelen, Mintz, & Vander Wal, 1996). The *DSM-IV* criteria for BN remain the same in *DSM 5* (American Psychiatric Association, 2013), with the exception of the frequency, which changed from twice a week to once a week. Therefore, the criteria for BN in the *DSM 5* continue to reflect a continuous model that is consistent with the previous versions of the manual.

Participants are instructed to choose one of the five answer choices presented in a Likert format for each of the 36 items. Sample items from the BULIT-R are: "I am satisfied with the shape and size of my body," "There are times when I rapidly eat a very large amount of food," and "When I am trying to keep from gaining weight, I feel that I have to resort to vigorous exercise, strict dieting, fasting, self-induced vomiting, laxatives, or diuretics." Only 28 of the 36 items were scored for the composite bulimic symptomatology. Higher scores indicate more severe bulimic symptoms. Adequate reliability and validity of the BULIT-R have been

demonstrated (Thelen et al., 1991; Vincent, McCabe, & Ricciardelli, 1999).). Cronbach's alpha for the sample was .93.

The Inventory of College Students' Recent Life Experiences (ICSRLE; Kohn et al., 1990) is a 49-item self-report measure assessing the extent of hassles (stressors) that occur in the past month among college students. Participants rate the intensity of their experience with each of the 49 hassles in the past month from a 4-point Likert scale, ranging from 1 "not at all part of my life" to 4 "very much part of my life". Sample items from the ICSRLE are: "social rejection," "financial burdens," and "interruptions of your school work." Higher scores indicate more intense exposure to stressor. Adequate reliability and validity of the ICSRLE have been demonstrated (Kohn et al., 1990; Osman, Barrios, Longnecker, & Osman, 1994). Cronbach's alpha for the ICSRLE was .95 in the present study.

The frequency of bulimic behaviors (i.e., binge eating and inappropriate compensatory behaviors) was assessed with the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994). Only four of the 28 items were used in this study. Participants indicated how many times bulimic behaviors had occurred in the past four weeks on these four open-ended questions. Sample items from the EDE-Q include: "Over the past 28 days, how many times have you eaten an unusually large amount of food *and* have had a sense of loss of control at the time?", "Over the past 28 days, how many times have you made yourself sick (vomit) as a means of controlling your shape or weight?", and "Over the past 28 days, how many times have you taken laxatives as a means of controlling your shape or weight?". A frequency score for bulimic behaviors was calculated by summing the four items. Higher number represents more incidents of bulimic behaviors. Adequate reliability and validity have been demonstrated (Fairburn &

Beglin, 1994; Luce & Crowther, 1999; Mond, Hay, Rodgers, & Beumont, 2004; Peterson et al., 2007).

Participants' perceived stress was measured although it was not a variable included in the proposed model. The Perceived Stress Scale (PSS; Cohen et al., 1983) is a 10-item self-report measure that assesses global stress perception. The items measure the three defining components of perceived stress: uncontrollable, overloaded, and unpredictable. Participants rate the extent of their perceived stress in the past month on a 5-point Likert scale, ranging from 0 "never" to 4 "very often". Sample items include "In the last month, how often have you been upset because of something that happened unexpectedly?", "In the last month, how often have you been angered because of things that were outside of your control?", and "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?". Higher number represents higher stress perception. Adequate reliability and validity have been shown (Cohen & Williamson, 1988). Cronbach's alpha for the PSS was .83 in this study.

Data analyses. All data analyses were conducted using SPSS 19.0 version. Baseline bulimic symptoms, perceived social support, stress, dispositional cognitive appraisal, and bulimic behaviors were examined through SPSS programs for accuracy of data entry, missing values, distribution, and assumption of multivariate analysis. Missing value analysis revealed more than five percent of missing data on one baseline bulimic symptoms item (i.e., item 12 of BULIT-R) and all four items on the EDE-Q. Little's MCAR test indicated that the data were not missing completely in random, $\chi^2(7234) = 7787.16, p < .001$. Therefore, expectation-maximization method was used to estimate and impute values of the missing data.

To increase normality of the data, baseline bulimic symptoms, perceived social support, and dispositional cognitive appraisal were square root transformed while bulimic behaviors was

logarithmically transformed. Two cases (i.e., 107 & 324) with a z score of more than 3.29 on square root of dispositional cognitive appraisal was trimmed down to a z score of 3.29. Multiple linear regression using (square root of) baseline bulimic symptoms, (square root of) perceived social support, stress, (square root of) dispositional cognitive appraisal, and (log of) bulimic behaviors as predictors identified case 125, 19, and 107 as multivariate outliers through Mahalanobis distance, $\chi^2(5) = 24.80, p < .001$; $\chi^2(5) = 22.99, p < .001$; and $\chi^2(5) = 22.12, p < .001$, respectively. Baseline bulimic symptoms (square root) and stress were identified as significant predictors for case 125. Using untransformed scores, case 125 had high baseline bulimic symptoms and low stress. Baseline bulimic symptoms (square root) and (log of) bulimic behaviors were identified as significant predictors for case 19. Using untransformed scores, case 19 had high baseline bulimic symptoms and low bulimic behaviors. Stress and (square root of) dispositional cognitive appraisal were identified as significant predictors of case 107. Using untransformed scores, case 107 had high stress and high dispositional cognitive appraisal (i.e., inclination towards appraisal style of threat). These multivariate outliers indicated that a combination of high baseline bulimic symptoms and low stress, a combination of high baseline bulimic symptoms and low bulimic behaviors, and a combination of high stress and high dispositional cognitive appraisal may not be generalized to the population. Case 125, 19, and 107 were deleted. Bivariate scatterplots indicated no evidence of non-linearity and heteroscedasticity. Bivariate correlations, tolerance, and condition index revealed no multicollinearity or singularity among the variables. Analyses were repeated with the original dataset without data imputation and variable transformation, which revealed similar findings as the dataset with imputed values and variable transformation. Consequently, results from analyses using the original dataset ($N = 285$ after listwise deletion) are reported for ease of interpretation.

Moderated-mediation analysis was conducted with PROCESS macro of model 7 developed for SPSS (Hayes, 2013) by using bulimic behaviors as the dependent variable, perceived social support as the independent variable, dispositional cognitive appraisal as the mediator, stress as the moderator, and baseline bulimic symptoms as a covariate. This macro produces regression coefficient of each path in the moderated mediation model and it uses bootstrapping to compute the product of two causal path estimates conditioned on the value of the moderator using 10,000 randomly generated samples. In this study, it computed the estimates of a model in which the indirect effects of perceived social support on bulimic behaviors through dispositional cognitive appraisal was presumed to be moderated by stress. With regression analyses, the conditional indirect effect of perceived social support on bulimic behaviors through cognitive appraisal would be demonstrated by a significant interaction effect between perceived social support and stress on dispositional cognitive appraisal. If the interaction term was significant, the effect of perceived social support would be examined at five levels of stress (10th, 25th, 50th, 75th, and 90th percentile). The moderated mediation model would be further established if the 95% bias-corrected confidence intervals (BCCI) for the conditional indirect parameter estimates did not contain zero. Although mean centering is not mathematically necessary (Hayes, 2013), analyses were repeated with mean-centered variables, which yielded similar findings as analyses without mean centering. Subsequently, results from analyses without mean centering are reported from here onwards.

Results

Means, standard deviation, and bivariate correlations for all variables are shown in Table 1. The hypothesized model posited that stress would moderate the indirect effect of perceived social support on bulimic behaviors through dispositional cognitive appraisal. As shown in Table

2, the interaction between stress and perceived social support on dispositional cognitive appraisal was not significant, $\beta = -.001$, $p = .30$, suggesting that stress did not moderate the indirect effect of perceived social support on bulimic behaviors. Bootstrap BCCIs further showed the absence of conditional indirect effect of perceived social support on T2 bulimic behaviors through dispositional cognitive appraisal at five values of stress (Table 3): 10th percentile (i.e., 61.00; very low stress), 25th percentile (i.e., 70.00; low stress), 50th percentile (i.e., 86.00; moderate stress), 75th percentile (i.e., 101.00; high stress) and 90th percentile (i.e., 117.00; very high stress). Because no conditional indirect effect was found, simple mediation analysis was performed using PROCESS macro of model 4 to examine the indirect effect of perceived social support on bulimic behaviors through dispositional cognitive appraisal with baseline bulimic symptoms as a covariate. Results indicated no indirect effect, point estimate = 0.003, 95% BCCI = -0.04, 0.10, which was consistent with the Sobel test (Sobel, 1982), $z = 0.30$, $p = .76$.

Table 1

Descriptive statistics and correlations for all variables

Variable	Mean	SD	1	2	3	4	5
1. Baseline bulimic symptoms	48.97	18.32	-				
2. Perceived social support	5.53	1.23	-.29**	-			
3. Stress	87.17	21.84	.51**	-.27**	-		
4. Cognitive appraisal	1.64	0.60	.20**	-.08	.32**	-	
5. Bulimic behaviors	4.46	9.27	.52**	-.05	.34**	.09	-

Note. $N = 285$.

** denotes significance at $p = .01$

Table 2

Regression coefficients for the conditional indirect effect of perceived social support on T2 bulimic behaviors through dispositional cognitive appraisal, conditional upon stress

Predictor	Cognitive appraisal			T2 bulimic behaviors		
	<i>t</i>	β	<i>SE</i>	<i>t</i>	β	<i>SE</i>
Constant	0.37	0.24	0.63	-4.30	-13.48**	3.14
Baseline bulimic symptoms	0.65	0.001	0.002	10.18	0.28**	0.03
Perceived social support	1.02	0.11	0.11	2.10	0.84*	0.40
Stress	2.10	0.01*	0.01			
Perceived social support x Stress	-0.99	-0.001	0.001			
Dispositional cognitive appraisal				-0.26	-0.21	0.81

Note. $N = 285$.

* denotes significance at $p = .05$

** denotes significance at $p = .01$

Table 3

Conditional indirect effects of perceived social support on T2 bulimic behaviors through cognitive appraisal at levels of stress

Moderator value	Boot indirect effect	Boot <i>SE</i>	95% BCCIs
Very low stress, 10 th percentile	-0.008	0.06	-0.22, 0.07
Low stress, 25 th percentile	-0.006	0.05	-0.17, 0.05
Moderate stress, 50 th percentile	-0.002	0.03	-0.10, 0.05
High stress, 75 th percentile	0.002	0.04	-0.06, 0.11
Very high stress, 90 th percentile	0.006	0.06	-0.08, 0.19

Exploratory analysis. Although the conditional indirect effect and simple mediation effect were not significant, perceived social support significantly predicted bulimic behaviors, $\beta = 0.84, p = .03$. Exploratory analysis was conducted to examine the presence of another potential mediator in the relationship between perceived social support and bulimic behaviors. Perceived stress was chosen as a potential mediator in this relationship because it is a similar construct as cognitive appraisal. However, perceived stress as measured by the PSS includes both the emotional and cognitive domain of stress perception. Table 4 shows the descriptive statistics of perceived stress and its correlations with perceived social support, bulimic behaviors, and baseline bulimic symptoms. Simple mediation analysis using 297 complete cases was conducted with PROCESS macro of model 4 to examine the indirect effect of perceived social support on bulimic behaviors through perceived stress with baseline bulimic symptoms as a covariate. Table 5 shows the regression coefficient of perceived social support predicting perceived stress, the regression coefficient of perceived stress predicting bulimic behaviors, and the direct, indirect, and total effect of perceived social support on bulimic behaviors. Bootstrap analysis revealed an indirect effect of perceived social support on bulimic behaviors through perceived stress, point estimate = -0.14, 95% BCCI = -0.38, -0.02. This bootstrap-based inference provides results inconsistent with the Sobel test, $z = 1.60, p = .11$. Hayes (2013) recommended the bootstrap analysis over the Sobel test when these two analyses produce inconsistent findings for a few reasons. One, bootstrap analysis does not assume normality of the sampling distribution of the product coefficient ab while the Sobel test assumes such normality. Two, bootstrap analysis has been shown to have higher power than the Sobel test, producing more accurate confidence intervals.

Table 4

Descriptive statistics of perceived stress and its correlations with perceived social support, bulimic behaviors, and baseline bulimic symptoms

Variable	Mean	SD	Perceived social support	Bulimic behaviors	Baseline bulimic symptoms
Perceived stress	17.06	6.58	-.29**	.29**	.43**

Note. $N = 297$.

** denotes significance at $p = .01$

Table 5

Simple mediation analysis for perceived social support predicting bulimic behaviors through perceived stress, with baseline bulimic symptoms as a covariate

	Effect	SE	95% BCCIs
Effect of IV on M (Path a)	-0.92**	0.28	-1.47, -0.37
Effect of M on DV (Path b)	0.15	0.08	-0.004, 0.31
Direct effect (Path c')	1.05**	0.39	0.29, 1.82
Indirect effect	-0.14	0.09	-0.38, -0.02
Total effect (Path c)	0.91*	.38	0.16, 1.67

Note. $N = 297$. IV = Independent variable (perceived social support); M = Mediator (perceived stress); DV = Dependent variable (T2 bulimic behaviors).

* denotes significance at $p = .05$

** denotes significance at $p = .01$

Discussion

Study 1 examined the mechanism of how perceived social support influenced bulimic behaviors in a naturalistic, longitudinal study. Results did not support the hypothesis that dispositional cognitive appraisal would mediate the relationship between perceived social

support and bulimic symptoms, contingent upon stress level. However, a mediation effect was found with perceived stress mediating the relationship between perceived social support and bulimic behaviors. Higher perceived social support predicted lower perceived stress, which in turn predicted less bulimic behaviors among undergraduate men and women.

Results from Study 1 are consistent with the existing literature. Research demonstrates that deficits in social support is an important contributing factor in bulimic symptomatology (e.g., Bodell, 2011; Ghaderi, 2003). Findings from this study suggest this relationship is accounted for by perceived stress. There are some limitations in this study. One, although it was a longitudinal study, this study consisted only two instead of three assessment points. Perceived stress and bulimic behaviors were both measured at Time 2 and consequently, the predictive role of perceived stress on bulimic behaviors was not clearly established. However, the literature suggests a close temporal relationship between stress and disordered eating, as demonstrated in laboratory studies and ecological momentary studies (e.g., Laessle & Schulz, 2009; Goldschmidt et al., 2014; Smyth et al., 2007). Eating behaviors are usually measured immediately after (e.g., Tanofsky-Kraff, & Wilfley, 2000) or concurrent with stress or mood induction (e.g., Yeomans & Coughlan, 2009) in most laboratory studies. Goldschmidt et al. (2014) demonstrated that stress predicted bulimic behaviors and these bulimic behaviors occurred within 2-4 hours after the occurrence of stressors in their ecological momentary study. As a result, measuring perceived stress and bulimic behaviors at the same time was a close reflection of the temporal relationship between stress and disordered eating. Two, the follow-up rates of 47.2% in this study was less than desirable although analyses indicated no significant differences on the baseline variables between participants who returned and those who did not return for follow-up assessment. Despite these limitations, this study has several strengths, including the longitudinal design with

two assessment points, inclusion of baseline bulimic symptoms as a stringent covariate, and a considerable sample size.

STUDY 2

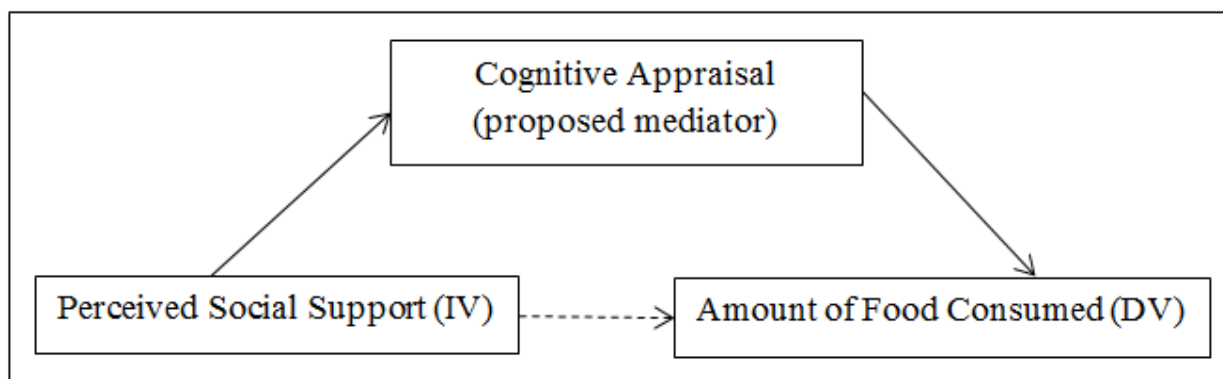


Figure 2. The proposed mediation model. Cognitive appraisal mediates the relationship between perceived social support and amount of food consumed.

Study 2 was designed as an experimental, laboratory examination of the effect of perceived social support on amount of food consumed in laboratory (a laboratory analogue of binge eating) through anticipatory cognitive appraisal of a stressful event. An experimental, laboratory design allows for inferences to be made regarding the causal relationships between variables. The independent variable was perceived social support, the hypothesized mediator was anticipatory cognitive appraisal, and the dependent variable was the amount of food consumed measured in calories. It was hypothesized that anticipatory cognitive appraisal would mediate the relationship between perceived social support and amount of food consumed. Similarly to Study 1, baseline bulimic symptomatology was assessed and included as a covariate. Although perceived stress and dietary restraint were not part of the proposed model, these two variables were measured to be used in exploratory analyses.

Method

Participants. Participants were undergraduate students recruited in the same way at the same public institution as Study 1. A total of 161 undergraduate women participated in this study; however, nine of these participants had incomplete data from missing individual items of

the measures on the online survey, resulting in a total of 152 participants for analyses. The participants ranged in age from 18-36 years old ($M = 19.26$, $SD = 2.1$), and the majority were Caucasian (90.1%), followed by Black (3.3%), Hispanic (3.3%), Asian (1.3%), and Other (1.3%). All participants met the inclusion criterion of at least 18 years old at the time of the baseline assessment. When participants signed up for this study, they were asked to abstain from eating for at least three hours prior to the experiment in order to control for hunger levels, a method that has been used in previous research (Baumeister, Bratslavsky, Muraven, & Tice, 1998).

Procedure. The data on baseline bulimic symptoms and dietary restraint were collected online using the BULIT-R (Thelen et al., 1991) and the Revised Restraint Scale (RRS; Herman & Polivy, 1980), prior to laboratory session to minimize suspicion from participants regarding the true intent of the experimental component of this study. Participants were also screened for any food allergy at this time in order to determine their eligibility to participate in this study. Participants who had consumed any food three hours prior to the laboratory session or had any food allergy were excluded from the study.

Participants were informed the purpose of this study was to understand their opinions regarding controversial topics. Upon agreement to participate in this study, participants were told they had five minutes to prepare a 5-minute descriptive speech on capital punishment. They were informed they would present the speech in front of three evaluators at the end of the preparation period. A speech task is a commonly used stress induction strategy (e.g., Starcke, Ludwig, & Brand, 2012; Plessow, Fischer, Kirschbaum, & Goschke, 2011).

Participants were randomly assigned into one of two groups: with social support (WSS) and without social support (WOSS). To manipulate perceived social support for the WSS group,

the experimenter informed participants of her availability to assist at the beginning of the experiment. Moreover, the experimenter offered her assistance to the participants halfway through the preparation. On the other hand, for the WOSS group, there was no mention of the availability of assistance and the experimenter did not offer any assistance. A similar paradigm of social support manipulation has been used in previous studies (e.g., Uchino & Garvey, 1997). The experimenter informed the participants they would be brought to meet with the evaluators in another room at the end of the 5-minute preparation time.

After the 5-minute preparation, participants completed a few questions regarding their cognitive appraisal of the anticipatory stressor (i.e., speech) and perceived stress. The experimenter then informed the participants that the evaluators were working with another participant in a simultaneous session and participants were asked to complete a bogus food tasting task, which was described as a pilot study on food determination for a future study. The experimenter presented the participants with two bowls of chocolate-chip cookies and two bowls of potato chips of different brands. Participants were also provided with evaluation forms to record their food appraisal on domains such level of creaminess, sweetness, saltiness, moistness, texture, and deliciousness. Participants were instructed to eat as many of the cookies and potato chips as they would like to in the next ten minutes in order to increase the accuracy of their appraisal. The experimenter left the participants alone in the room during the food tasting task.

At the end of the food tasting task, the experimenter returned to administer a manipulation check. Participants rated the experimenter's supportiveness on a 5-point Likert scale, ranging from 1 "not supportive at all" to 7 "very supportive". Lastly, participants were debriefed and thanked for their participation. This study was approved by the institutional review board at North Dakota State University.

Measures. A method described by Tomaka et al. (1999) was used to measure anticipatory cognitive appraisal. This method contains three questions measuring primary (demands) appraisal and three questions measuring secondary (resources) appraisal of the anticipated task. Participants rated how they viewed the upcoming task (i.e., speech) on a 9-point Likert scale, ranging from 0 “not at all” or “strongly disagree” to 8 “very much” or “strongly agree”, on each of the six items. Sample items include “How demanding is the upcoming task going to be?” “The upcoming task is very demanding,” and “How able are you to cope with the upcoming task?” According to Lazarus and Folkman (1984), stress is perceived when secondary appraisal of coping resources is insufficient to meet the demand of the primary appraisal. Therefore, an appraisal index was calculated by taking a ratio of primary to secondary appraisal (a common practice in previous studies; Feldman, Cohen, Hamrick, & Lepore, 2004; O’Connor, Arnold, & Maurizio, 2010). A higher appraisal index represents a higher threat perception (high threat/low coping) whereas a lower appraisal index represents a lower threat perception (low threat/high coping).

To measure the amount of food consumed (i.e., dependent variable), the weight of chocolate-chip cookies and potato chips was measured using a kitchen scale prior to the food tasting task and at the end of the experiment. Given that there were two types of food, the total calories, instead of the weight of food was used as the measurement unit for the amount of food consumed (using the weight of food as the measurement unit did not change the results). The amount of calories was calculated using information from food labels and the weight of food consumed.

Bulimic symptoms were measured with the BULIT-R (Thelen et al., 1991). Please see Study 1 for the description of this measure. The Revised Restraint Scale (RRS; Herman &

Polivy, 1980) is a 10-item measure assessing dietary restraint (i.e., efforts to restrict eating). Respondents rate their tendency to restrict eating using 4- and 5-point Likert scales, with higher number representing higher level of dietary restraint. Sample items are “How often are you dieting?”, “Do you eat sensibly in front of others and splurge alone?”, and “Do you ever give too much time or thought to food”. Adequate reliability and validity of the RRS have been demonstrated (Heatherton, Herman, Polivy, King, & McGree, 1988; van Strien, Herman, Engels, Larsen, & van Leeuwe, 2007). Cronbach’s alpha for the RRS was .82 in this study.

Perceived stress was measured using a 6-item scale described by Lepore, Allen, and Evans (1993). Participants rate on six 7-point bipolar adjective scales depicting their psychological state. Sample items include: relaxed-stressed, comfortable-uncomfortable, and not anxious-anxious. Cronbach’s alpha was .92 in this study.

Data analyses. All data analyses were conducted using SPSS 19.0 version. Baseline bulimic symptoms, perceived social support (condition), cognitive appraisal, and amount of food consumed were examined through SPSS programs for accuracy of data entry, missing values, distribution, and assumption of multivariate analysis. Missing value analysis revealed less than five percent of missing data. Consequently, subsequent analyses were conducted with listwise deletion of cases with missing value ($N = 152$ cases). To increase normality of the data, baseline bulimic symptoms and cognitive appraisal were logarithmically transformed. Two cases (i.e., 7 & 87) with a z score of more than 3.29 on logarithm of cognitive appraisal was trimmed down to a z score of 3.29. Multiple linear regression using perceived social support, (log of) baseline bulimic symptoms, (log of) cognitive appraisal, and amount of food consumed as predictors identified no multivariate outliers. Bivariate scatterplots indicated no evidence of non-linearity and heteroscedasticity. Bivariate correlations, tolerance, and condition index revealed no

multicollinearity or singularity among the variables. Analyses were repeated with the original dataset without variable transformation, which revealed similar findings as the dataset with variable transformation. Consequently, results from analyses using the original dataset without variable transformation are reported for ease of interpretation.

Simple mediation analysis was conducted with PROCESS macro of model 4 developed for SPSS (Hayes, 2013) by using amount of food consumed as the dependent variable, perceived social support as the independent variable (dummy coded 0 = without social support, 1 = with social support), cognitive appraisal as the mediator, and baseline bulimic symptoms as a covariate. In this study, the macro computed the estimates of a model in which the indirect effect of perceived social support on amount of food consumed was presumed to be mediated by cognitive appraisal using 10,000 randomly generated samples. The indirect effect was tested with bootstrapping although the macro also produces a normal theory test (i.e., the Sobel test). The simple mediation model was established if the 95% bias-corrected confidence intervals (BCCI) for the indirect parameter estimates did not contain zero.

Results

Means, standard deviation, and bivariate correlations for all variables are shown in Table 6. The hypothesized model posited that anticipatory cognitive appraisal would mediate the relationship between perceived social support and amount of food consumed. As shown in Table 7, baseline bulimic symptoms was not a significant predictor of cognitive appraisal ($\beta = .005, p = .09$) and amount of food consumed ($\beta = -0.14, p = .85$). Perceived social support did not predict cognitive appraisal ($\beta = -0.06, p = .55$) and amount of food consumed ($\beta = 22.34, p = .36$). Cognitive appraisal did not predict amount of food consumed ($\beta = -24.43, p = .22$). These findings indicate that cognitive appraisal did not mediate the relationship between perceived

social support and amount of food consumed. Bootstrap 95% BCCI (-3.32; 14.76) and Sobel test ($z = 0.44, p = .66$) confirmed the absence of an indirect effect.

Table 6

Descriptive statistics and correlations for all variables by social support condition

Variable	1	2	3	Mean	SD
1. Baseline bulimic symptoms	-	.19	-.14	49.84	18.03
2. Cognitive appraisal	.09	-	.08	1.10	0.59
3. Amount of food consumed	.07	-.26*	-	256.24	142.54
Mean	51.76	1.04	279.57		
SD	17.43	0.65	156.69		

Note. Correlations for the group without support ($N = 76$) are above the diagonal; correlations for the group with support ($N = 76$) are below the diagonal.

* denotes significance at $p = .05$

Table 7

Regression coefficients for the indirect effect of perceived social support on amount of food consumed through anticipatory cognitive appraisal

Predictor	Cognitive appraisal			Amount of food consumed		
	<i>T</i>	β	<i>SE</i>	<i>t</i>	β	<i>SE</i>
Constant	5.44	0.86**	0.16	6.88	289.74**	42.13
Baseline bulimic symptoms	1.69	0.005	0.003	-0.19	-0.14	0.70
Perceived social support	-0.60	-0.06	0.10	0.92	22.34	24.39
Cognitive appraisal				-1.22	-24.43	20.02

Note. $N = 152$.

** denotes significance at $p = .01$

Manipulation check data was examined with an independent t-test, which revealed that the manipulation was unsuccessful, $t(150) = 0.57, p = .57$. Participants did not differ in their perceived social support of the experimenter by condition. Simple mediation analysis was repeated with participants' subjective rating of the experimenter's supportiveness as the independent variable. Bootstrapped 95% BCCI (-1.32; 7.61) and Sobel test ($z = 0.66, p = .51$) showed the absence of an indirect effect.

Exploratory analysis. Exploratory analysis was conducted to examine the role of perceived stress as a potential mediator in the relationship between perceived social support and amount of food consumed. Because the manipulation of social support was unsuccessful, the exploratory analysis utilized participants' subjective rating of the experimenter's supportiveness as the independent variable. Given the absence of significant correlations between baseline bulimic symptoms and food consumption, baseline bulimic symptoms was not included as a covariate in subsequent analyses. Table 8 shows the descriptive statistics of participants' subjective rating of the experimenter's supportiveness, perceived stress, and amount of food consumed and their intercorrelations. Simple mediation analysis using 161 complete cases was conducted with PROCESS macro of model 4 to examine the indirect effect of perceived social support on amount of food consumed through perceived stress. Table 9 shows the regression coefficient of perceived social support predicting perceived stress, the regression coefficient of perceived stress predicting amount of food consumed, and the direct, indirect, and total effect of perceived social support on amount of food consumed. Bootstrap analysis revealed an indirect effect of perceived social support on amount of food consumed through perceived stress, point estimate = 4.43, 95% BCCI = 0.14, 12.94. This bootstrap-based inference provides results inconsistent with the Sobel test, $z = 1.57, p = .12$. Findings from bootstrap analysis were

presumed to be more accurate than findings from the Sobel test due to reasons discussed in Study 1.

Table 8

Descriptive statistics and correlations for participants' subjective rating of supportiveness, perceived stress, and amount of food consumed

Variable	Mean	SD	1	2	3
1. Subjective rating of supportiveness	5.64	1.13	-		
2. Perceived stress	30.43	6.56	-.18*	-	
3. Calories	272.97	149.57	.07	-.19*	-

Note. $N = 161$.

* denotes significance at $p = .05$

Table 9

Simple mediation analysis for subjective rating of supportiveness predicting amount of food consumed through perceived stress

	Effect	SE	95% BCCIs
Effect of IV on M (Path a)	-1.04*	0.45	-1.94, -0.15
Effect of M on DV (Path b)	-4.25*	1.81	-7.82, -0.67
Direct effect (Path c')	4.72	10.53	-16.07, 25.52
Indirect effect	4.43	2.82	0.14, 12.94
Total effect (Path c)	9.16	10.50	-11.59, 29.90

Note. $N = 161$. IV = Independent variable (subjective rating of supportiveness); M = Mediator (perceived stress); DV = Dependent variable (amount of food consumed).

* denotes significance at $p = .05$

Although an indirect effect was observed, the direction of the stress-food consumption relationship was in contrary to the expected direction. To further understand this indirect effect, a moderated mediation model was examined. In this model, dietary restraint was examined as a moderator of the relationship between perceived stress and amount of food consumption. Table 10 shows the descriptive statistics of participants' subjective rating of the experimenter's supportiveness, perceived stress, dietary restraint, and amount of food consumed and their intercorrelations. Moderated mediation analysis using 156 complete cases was conducted with PROCESS macro of model 14 to examine the indirect effect of perceived social support on amount of food consumed through perceived stress, contingent upon dietary restraint level. As shown in Table 11, the interaction between perceived stress and dietary restraint on food consumption was significant, $\beta = -3.0401$, $p < .01$, suggesting that restraint moderated the relationship between perceived stress and food consumption. Bootstrap BCCI showed the presence of conditional indirect effect of perceived social support on food consumption through perceived stress at two values of dietary restraint (Table 12): 75th percentile (i.e., 17.00; high restraint), point estimate = 7.3, BCCI = 1.13 to 17.67 and 90th percentile (i.e., 21; very high restraint), point estimate = 10.92, BCCI = 1.85, 25.05. There was no indirect effect at lower values (10th percentile, 25th percentile, and 50th percentile) of dietary restraint.

Table 10

Descriptive statistics and correlations for participants' subjective rating of supportiveness, perceived stress, dietary restraint, and amount of food consumed

Variable	Mean	SD	1	2	3	4
1. Subjective rating of supportiveness	5.63	1.14	-			
2. Perceived stress	30.46	6.59	-.17*	-		
3. Dietary restraint	12.94	6.17	.05	.11	-	
4. Calories	270.55	150.80	.07	-.19*	.06	-

Note. $N = 156$.

* denotes significance at $p = .05$

Table 11

Regression coefficients for the conditional indirect effect of perceived social support on food consumption through perceived stress, conditional upon dietary restraint

Predictor	Perceived Stress			Calories		
	t	β	SE	t	β	SE
Constant	13.57	35.91**	2.65	-0.31	-50.36	160.43
Perceived social support	-2.10	-0.97*	0.46	0.84	8.89	10.53
Perceived Stress				1.82	8.37	4.59
Dietary restraint				3.19	30.06**	9.42
Perceived stress x restraint				-3.04	-0.94**	0.31

Note. $N = 156$.

* denotes significance at $p = .05$

** denotes significance at $p = .01$

Table 12

Conditional indirect effects of perceived social support on food consumption through perceived stress at levels of dietary restraint

Moderator value	Boot indirect effect	Boot <i>SE</i>	95% BCCIs
Very low restraint, 10 th percentile	-4.48	4.74	-17.88, 2.20
Low restraint, 25 th percentile	0.05	3.15	-6.14, 7.32
Moderate restraint, 50 th percentile	2.77	2.94	-1.09, 11.32
High restraint, 75 th percentile	7.30	4.11	1.13, 17.67
Very high restraint, 90 th percentile	10.92	5.73	1.85, 25.05

Discussion

Study 2 examined the mechanism of how perceived social support influenced food consumption in a laboratory study. Results revealed anticipatory cognitive appraisal did not mediate the relationship between manipulated social support and amount of food consumed. Although perceived stress was once again found to mediate the relationship between perceived social support (i.e., participants' subjective rating of experimenter's supportiveness) and bulimic behaviors (i.e., amount of food consumed), the direction of this relationship was unexpected. Specifically, although higher perceived social support predicted lower perceived stress as expected, this lower perceived stress predicted higher instead of lower amount of food consumption. There are a few limitations to note in this study. One, the manipulation of social support was not successful, which might explain why the proposed mediation model was not observed. Two, participants' subjective rating of social support was assessed after the assessment of perceived stress and the bogus taste task. Consequently, the temporal precedence of perceived social support as the independent variable was not clearly established. However, it is worth

noting that most of the interaction between experimenter and participant occurred prior to the assessment of perceived stress and the bogus taste task. Therefore, it is possible that participants' ratings of experimenter's supportiveness were mostly based on their early interaction. Further analyses using perceived stress as the independent variable, food consumption as the mediator, and perceived social support as the dependent variable (i.e., the actual event sequence) indicated no indirect effect (point estimate = -0.001; BCCI = -0.01 to 0.003). Moreover, neither perceived stress nor food consumption predicted perceived social support when both predictors were simultaneously included in a regression model. The strengths of this study include a relatively successful stress induction (mean of 30 with a possible maximum score of 42) and inclusion of both sweet and savory food, whereas previous studies often only include one of these types of food.

GENERAL DISCUSSION

A longitudinal, naturalistic study and an experimental laboratory study examined the mediating role of cognitive appraisal on the relationship between perceived social support and bulimic behaviors. The hypotheses in both studies were not supported. However, a mediation effect was found for perceived stress. The direction of the relationship between perceived stress and bulimic behaviors was inconsistent across these two studies, indicating that different methods of examining stress-disordered eating do not always yield complementary findings, as observed in a previous study (Wallis & Hetherington, 2009). The differences between the two studies (e.g., general bulimic symptoms measured in Study 1 versus eating behavior in the moment in Study 2; familial and friend support measured in Study 1 versus perceived support of an experimenter in Study 2; daily stressors measured in Study 1 versus an acute, intense stressor in Study 2) in this project may have been responsible for the discrepant findings.

Social support and stress have been independently investigated in relation to eating disorders. However, to the knowledge of the author, this is the first study to examine the mechanism of how social support exerts its influence on bulimic behaviors through cognitive appraisal of stress. In the current studies, cognitive appraisal did not mediate the relationship between social support and bulimic behaviors. Research suggest that bulimic behaviors occur in response to stress (e.g., Costarelli & Patsai, 2012, Crowther et al., 2001). Although cognitive appraisal processes help to define stress perception, other variables are involved in the experience of stress. In other words, cognitive appraisal does not fully capture the experience of stress and it might not explain the stress-disordered eating relationship established in the literature. According to the psychological stress theory of Lazarus (Folkman & Lazarus, 1988; Lazarus & Folkman, 1987), the experience of stress is defined by a transactional process between

an individual and the environment, which involves the experience of emotions. Emotions are generated from cognitive appraisal of an encounter, which then influence the adoption of coping strategies. For example, negative emotions are generated when an encounter is appraised as unfavorable to goal attainment. These negative emotions influence the choice of coping strategy, which may or may not further alter the emotional experience. This chain of events is important to consider in this study as it indicates that the stress-disordered eating relationship may be better explained by emotions or a combination of emotions and cognitive appraisal processes.

The importance of emotions is evidenced from the mediating effect of perceived stress on the relationship between perceived social support and bulimic behaviors. As mentioned above, the PSS utilized in Study 1 tapped into the emotional domain of stress experience while the perceived stress measure in Study 2 measured only the emotional domain of stress perception. When cognitive appraisal was replaced with perceived stress as a mediator, the mediation effect was observed. These findings demonstrate that perceived social support exerts its influence on bulimic behaviors through stress perception that is not purely accounted for by cognitive appraisal. Furthermore, these findings suggest that the emotional domain of stress experience may be more important than cognitive appraisal in explaining the stress-disordered eating relationship.

Interestingly, although a mediation effect was observed, higher perceived stress predicted lower food consumption in Study 2. Further analysis showed that this mediation effect was driven by high restraint. In other words, perceived social support predicted lower perceived stress, which then predicted higher food consumption; however, this mediation relationship was only applicable to participants with high restraint level. This finding is inconsistent with the existing literature on the stress-disordered eating relationship as well as the literature on restraint.

Empirical evidence demonstrates that stress is predictive of disordered eating (e.g., Bodell et al., 2011; Grilo et al., 2012). However, not everyone who is under stress exhibits disordered eating and one variable that has been suggested to moderate the stress-disordered eating relationship is restraint. According to the restraint theory, individuals with a tendency to restrict their food intake are particularly vulnerable to disordered eating, particularly binge eating, because their cognitive effort to consciously restrict eating is disrupted under disinhibiting circumstances such as stress (Greeno and Wing, 1994; Woods, Racine, & Klump, 2010) and anxiety (Herman, Polivy, Lank, & Heatherthorn, 1987). Therefore, the stress-disordered eating relationship should be more apparent among individuals with high restraint, such that higher stress predicts higher disordered eating among these individuals.

Although unexpected, a few factors may explain the finding from Study 2. One possible explanation is the distinction between successful restrainer and unsuccessful restrainer. Successful restrainers are individuals who actually restrict their caloric intake, often characterized by low disinhibition while unsuccessful restrainers are those who believe they are restrained eaters without actual caloric restriction and are often characterized by high disinhibition. It is possible that the negative association between perceived stress and food consumption was driven by successful restrained eaters in the study. There is empirical evidence showing that the positive association between stress and disordered eating is not always supported, particularly among successful dieters. Haynes, Lee, & Yeomans (2003) demonstrated that successful restrainers did not differ in their food intake based on stress level. This finding demonstrated that the food consumption of successful restrainers was not affected by stress. In fact, although not significant, successful restrainers consumed less food than unsuccessful restrainers when stressed. Similarly, Yeomans and Coughlan (2009) found that the disinhibition

effect of negative mood on eating was only observed among unsuccessful restrainers.

Unsuccessful restrainers consumed more food than successful restrainers when experiencing negative emotions.

Another theory that explains the differential effect of stress on eating is the theory proposed by Schachter, Goldman, and Gordon (1968). According to this theory, normal-weight individuals decrease food consumption during times of stress due to decreases in gastric contraction as a cue for non-hunger. In this study, the majority of the participants (70%) had a body mass index (BMI) of 24.9 and lower, indicating that most of them are within the normal weight range (approximately 6% of these are underweight with a BMI of less than 18.5). Therefore, it is possible that the findings from Study 2 parallel the theory that normal-weight individuals are more perceptive of their physiological cues for states of hunger. Consequently, perceived stress may have lowered food consumption among participants in this study.

Two other possible explanations for the unexpected finding in Study 2 are 1) positive emotions as positive reinforcement of weight-control behaviors and 2) the fluctuation of bingeing behaviors across time of day. Selby and colleagues (2014) demonstrated a positive feedback loop between weight-control behaviors (e.g., exercising, vomiting, laxative use) and positive emotions among individuals with full-blown and subclinical anorexia nervosa. Specifically, weight-control behaviors predicted positive emotions, which reinforced further weight-control behaviors. This suggests that individuals with disordered eating may engage in weight-control behaviors to increase positive emotions. It is possible that participants in Study 2 refrained from eating to enhance their experience of positive emotion during times of stress. Using ecological momentary assessment, Smyth and colleagues (2009) demonstrated bingeing behavior was most probable in the evening (between 7PM-9PM) among individuals with bulimia

nervosa. It is worth noting that all laboratory sessions took place between 9AM and 5PM. Therefore, it is possible the laboratory sessions did not capture participants' having a greater likelihood of overeating during the evening.

Findings from these two studies have multiple theoretical and clinical implications and suggest areas for future research. For instance, these studies extended the existing literature by examining perceived social support, perceived stress, and bulimic behaviors in a mediation model. The findings indicate that perceived stress helps to explain the relationship between perceived social support and bulimic behaviors. Perceived social support decreases the perception of stress; however, stress perception does not always predict bulimic behaviors. Moreover, other factors in addition to restraint should be taken into account when considering the stress-disordered eating relationship.

An important implication from these findings is that the perception of stress that affects bulimic behaviors is not a pure measure of cognitive appraisal. Instead, the emotional experiences of stressful events are important to consider when studying the stress-disordered eating relationship. This is consistent with the current trend of incorporating emotional interventions in eating disorder treatments. Although cognitive-behavioral therapy (CBT) is generally the treatment of choice for bulimia nervosa, a significant number of patients fail to respond to or drop out of treatment (Wilson, Grilo, & Vitousek, 2007). Moreover, about 50% of patients completing the treatment continue to struggle with binge eating and purging (Wilson, Fariburn, & Agras, 1997). Based on the association between negative emotions and bulimic behaviors, empirical support has been demonstrated for treatment modalities involving emotional regulation for bulimia nervosa, including dialectical behavioral therapy (Safer, Telch, & Agras, 2001) and integrative cognitive-affective therapy (ICAT; Wonderlich et al., 2014). For instance,

ICAT helps patients to increase their emotional awareness and addresses the role of emotions in predicting bulimic behaviors. Its effectiveness has been shown to be comparable to CBT.

The inconsistent findings observed in the current studies reflect the complexity of the stress-disordered eating relationship while paralleling the existing literature. Some research has demonstrated the disinhibiting effect of stress on eating among restrained eaters while some did not find such effect. Although these two studies produced inconsistent findings, it is interesting and worth noting that the restrained eating (as indicated by low food consumption) observed in Study 2 is also a part of the bulimic syndrome. It is possible that stress predicts different bulimic behaviors under different circumstances. Future research may consider examining the impact of different types of stressor on bulimic behaviors. Additionally, social influence has been suggested to play a role on eating (Herman & Polivy, 2005). Given that individuals with BN often binge in secrecy and restrain in the presence of others, future studies may benefit by experimentally manipulate the presence of others while examining the stress-disordered eating relationship. Findings from this study also has a clinical implication regarding the importance of perceived social support on perceived stress. Stress management programs may benefit from incorporating social skills and problem solving skills for interpersonal problems.

In conclusion, both studies provide evidence that perceived stress instead of cognitive appraisal of stressor mediates the relationship between social support and bulimic behaviors. The naturalistic study suggests that social support decreases bulimic behaviors through lower stress perception while the experimental study demonstrates that social support is related to more bulimic behaviors through lower stress perception among individuals with high restraint. These findings have theoretical implications for the stress-disordered eating relationship, suggesting that stress does not always predict binge eating, not even among individuals with high restraint.

These findings also have clinical implications for eating disorder treatments and stress management programs. The differential effects of stress on eating and the potential implication of perceived social support on stress management warrant further investigation.

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