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Perceived changes in food intake in response to stress: the role of conscientiousness

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Summary
The role of conscientiousness in understanding the effects of stress on eating behavior remains unknown. In this study, the interactive effects of conscientiousness and established individual differences variables (e.g. restraint, perfectionism) on perceived changes in food intake during a 2-week stressful and non-stressful period were examined. One hundred and fifty-five female participants completed measures of conscientiousness, self-oriented perfectionism, socially prescribed perfectionism and eating style (i.e. external eating, emotional eating and dietary restraint) at the beginning of the study. Perceived changes in food intake (i.e. between-meal snacking), stress and emotional distress were also assessed. The results found that low conscientious individuals who were currently trying to lose weight or were high on self-oriented perfectionism reported eating more between-meal snacks than usual during the stressful period compared to the non-stressful period. This study demonstrates, for the first time, that conscientiousness in conjunction with established individual differences variables is associated with perceived increases in food intake. These results suggest that when faced with a stressful encounter, low conscientious individuals (who are dieters or self-oriented perfectionists) may be less well equipped to cope and as a result shift their preference to more palatable and high energy dense snacks foods. Copyright © 2004 John Wiley & Sons, Ltd.

Key Words
stress; snacking; perfectionism; dieting; restraint; external eating; emotional eating; palatability; Dutch Eating Behavior Questionnaire (DEBQ)

Introduction

There is growing evidence to suggest that stressors affect health directly, through biological mechanisms (i.e. autonomic and neuroendocrine responses) but also indirectly, through changes to health behaviours (Jones & Bright, 2001; O'Connor, O'Connor, White, & Bundred, 2000a, 2000b). The link between diet and life-threatening diseases such as cardiovascular disease (CVD; Van Horn, & Kavey, 1997) and cancer (Wong & Lam, 1999) is also becoming very clear. For example, the evidence relating dietary fat to health is well established and has been incorporated into consensus recommendations in the U.K. and U.S.A. (e.g. American Cancer Society, 1996; DOH, 1991; U.S. Department of Agriculture/U.S. Department of Health

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and Human Services (USDA/USDHHS), 1995). In addition, stressors and daily hassles have also been identified as possible precipitants of binge eating episodes and eating disorders symptomatology (Crowther, Sanftner, Bonifazi, & Shepard, 2001; Hansel & Wittrock, 1997). Therefore, stress induced modifications of habitual health behaviours such as food choice and eating behaviour may be particularly important in understanding physical disease risk as well as the development of some eating disorders (Crowther et al., 2001; Steptoe, Lipsey, & Wardle, 1998).

Previous research has examined either the 'general effects hypothesis', that stress changes consumption of food generally or the 'individual differences hypothesis' that stress leads to changes in eating in particular groups (e.g. restrained eaters, women; Greeno & Wing, 1994). The latter hypothesis suggests that the relationship between stress and eating may be moderated by individual differences variables. For example, several studies have found stress to cause an increase in eating in restrained eaters (i.e. individuals currently restricting their dietary intake) compared to unrestrained eaters (e.g. Cools, Schotte, & McNally, 1992; Greeno & Wing, 1994; Heatherton, Herman, & Polivy, 1991; Wardle, Steptoe, Oliver, & Lipsey, 2000; although see Pollard, Steptoe, Canaan, Davies, & Wardle, 1995 for null effects). In the laboratory, Heatherton et al. (1991) showed that exposure to ego-threatening stress (i.e. failure at an easy task) significantly increased restrained participants' eating, but had no effect on unrestrained participants. Recently, Wardle et al. (2000) also demonstrated a significant stress-induced hyperphagic (overeat) response in a sample of restrained workers, indicating that individuals who normally try to regulate their weight by controlling their food intake are more likely to disinhibit—or lose control whilst experiencing stress.

Similarly, 'emotional' and 'external' eating styles have also been identified as potentially important moderating variables within the stress-eating literature. The former describes individuals who have a tendency to eat in response to affective states (van Strien, Frijters, Bergers, & Defares, 1986a). It has been suggested that high emotional eaters may be less able to discriminate between anxiety and hunger cues and consequently interpret stress as hunger and subsequently overeat (Bruch, 1961; Kaplan & Kaplan, 1957). The latter are individuals who eat in response to food-related cues (i.e. external cues) rather than internal, physiological hunger cues (Schachter, Goldman, & Gordon, 1968). Research has found that stress reduces the salience of internal cues, but increases the salience of external cues (e.g. taste of food), thus leading to overeating when stressed (Greeno & Wing, 1994). However, other studies have failed to find support for the externality hypothesis (e.g. Polivy, Herman, & McFarlane, 1994).

Despite this work, the relationship between stress and eating remains unclear—recent findings have suggested that high levels of stress can be associated with both increased (e.g. saturated fat consumption) and decreased (e.g. overall calories) food intake (e.g. Wardle et al., 2000; Weinstein, Shide, & Rolls, 1997). Many previous studies have been overly reliant on laboratory-based methods and have tended to concentrate on the impact of a single moderating variable at a time (e.g. dietary restraint). A more detailed, integrated examination of these key variables is required in order to elucidate the effects of stress on eating.

Conner, Fitter, and Fletcher (1999) conducted one of the few integrated studies to date, in which a range of potential moderating variables (i.e. restraint, emotional eating, external eating and gender) were examined simultaneously. They found only external eating to moderate the relationship between stress (daily hassles) and snacking, such that external eaters reported consuming significantly more between-meal snacks during periods of high stress. Contrary to existing research, dietary restraint and emotional eating failed to moderate the stress-eating relationship within their study. Therefore, one of the central aims of this study was to investigate further these important moderator variables within a naturalistic setting (as opposed to an artificial, laboratory-based environment).

Perfectionism

Perfectionism is another individual differences variable that has been linked to (disturbed) eating behaviour (e.g. Cockell et al., 2002; Hewitt, Flett, & Ediger, 1995). Work conducted by Hewitt et al. (1995) found that eating disorder symptoms were driven by the motivation to meet unrealistic standards set by self (i.e. self-oriented perfectionism) and that self-esteem and concerns about appearance were driven by the motivation to meet standards perceived to be set by others (i.e.

socially prescribed perfectionism). Similarly, Cockell et al. (2002) showed that levels of perfectionism were significantly elevated in women with anorexia nervosa compared to normal women and a psychiatric control group.

However, the present conceptualization of perfectionism as a risk factor for eating disorders and psychological morbidity, more generally, draws from the diathesis-stress literature (cf. Joiner, Heatherton, Rudd, & Schmidt, 1997; O'Connor & O'Connor, 2003; O'Connor, O'Connor, O'Connor, Smallwood, & Miles, in press). This suggests that perfectionistic people will not experience distress (or exhibit eating disorder symptoms) unless they perceive things as imperfect (i.e. if high standards go unmet or they encounter stressful life events). For example, in two studies by Joiner et al. (1997), perfectionism served as a risk factor for bulimic symptoms only in women who perceived themselves as overweight (i.e. perceived imperfection) but not in those who did not. Interestingly, actual weight did not activate perfectionism as a predictor of bulimic symptoms. These findings suggest that individuals high in perfectionism may be at greater risk of overeating during stressful periods, because each new stressful encounter may represent an opportunity for high standards to go unmet.

Consistent with the diathesis-stress framework, Ruggiero, Levi, Ciuna, and Sassaroli (2003) found that stress seemed to stimulate behaviours related to eating disorders in individuals with a perfectionistic personality. In a sample of students, 'concern over mistakes'—a dimension of perfectionism—was found to be significantly associated with a 'drive for thinness' (i.e. a subscale of the Eating Disorders Inventory, EDI; Garner, Olmsted, & Polivy, 1983) only on a high stress day. The authors suggested the relationship between perfectionism and drive for thinness may be explained via the hypothesis of control. That is, individuals with a perfectionistic personality may interpret highly stressful situations as being very threatening and lacking in control. As a result, the relationship between perfectionism and drive for thinness under stress may be an attempt to recover control in other areas of one's life (i.e. eating behaviour).

Despite this research and the importance of perfectionism in understanding eating behaviour, few studies have examined the role of perfectionism as a moderator of the stress–eating relationship. In particular, whether normal individuals with perfectionistic personalities (diatheses) report greater food intake during periods of high stress compared to periods of low stress in the real world.

Conscientiousness

Conscientiousness is the final variable we are concerned with in this study. It is one of the five major dimensions of personality and, according to Costa, McCrae, and Dye (1991), it is defined by six facets: competence, order, dutifulness, achievement striving, self-discipline and deliberation. Surprisingly, to date, this dimension has received little academic or clinical attention in the area of stress and eating. Work conducted by Podar, Hannus, and Jueri (1999) has found evidence linking dimensions of personality, including conscientiousness, with the EDI in clinical and non-clinical samples. More recently, Heaven, Mulligan, Merrilees, Woods, and Fairooz (2001) have suggested that conscientiousness may play an important role in understanding eating behaviours. They found low levels of cautiousness, self-discipline and self-efficacy—all components of conscientiousness to be significantly associated with emotional and external eating styles. The evidence relating to restraint was less straightforward, with low levels of self-efficacy and high levels of cautiousness being associated with restrained eating.

Additional evidence pointing to the potential importance of conscientiousness in understanding stress–eating relations comes from the wider stress literature. Firstly, high conscientious individuals perceive themselves as being able to meet situational demands and secondly, they are more likely to employ active or problem-focused coping when experiencing stress (Penley & Tomaka, 2002; Watson & Hubbard, 1996). Therefore, from a diathesis-stress perspective, conscientiousness may buffer the effects of stress, and prevent the activation of other vulnerability variables (e.g. restraint, perfectionism) associated with stress–eating relations. Taken together, this evidence indicates that low conscientious individuals who are already vulnerable to developing problems with eating may be significantly more likely to report overeating under stressful conditions. However, to the best of our knowledge, little or no studies have examined this avenue of research.

In light of the work reviewed and that the most consistent results are found in female samples, the

present study set out to investigate the extent to which self-reported changes in food-intake during periods of high and low stress were moderated by established individual differences in eating styles, conscientiousness and perfectionism in a sample of undergraduate women. Specifically, we hypothesized that:

(1) Low conscientious participants who are also restrained eaters (or high on emotional or external eating) will report consuming significantly more between-meal snacks than usual during a period of high stress compared to during low stress.
(2) Low conscientious participants who are also high on perfectionism will report consuming significantly more between-meal snacks than usual during a period of high stress compared to during low stress.

Method

Sample

One hundred and fifty-five female psychology undergraduate students from two British universities participated in the study. One hundred and thirty-one participants completed measures in both the stressful and non-stressful period. Participants did not receive payment or course credits for taking part in the study. The mean age of the sample was 21.12 years (range 19–48 years). The majority of the participants were single and not cohabiting (95 per cent). We did not collect details of the racial-ethnic composition of our sample; however, the students at both universities are predominately White, representing 90 per cent and 95per cent, respectively, of the student populations. The 24 participants who failed to complete both conditions did not differ significantly from completers on age, body mass index, perfectionism, conscientiousness, eating style or perceived stress. In addition, no significant differences across the universities were found on any of the key study variables, the exam conditions were similar and in both universities contributed to their final degree classification.

Design and procedure

Participants were recruited to take part in a study investigating student well-being using a mixed design. Participants were asked to complete questionnaire measures assessing perceived stress, emotional distress and perceived changes in types of food intake at the end of a 2-week examination period (stressful period) and again, 4–5 weeks later, at the end of a non-stressful 2-week period, free from course deadlines[1]. Background and trait measures of eating behaviour styles, conscientiousness and perfectionism were assessed at the beginning of the study.

Measures

Background measures. *Eating style*. Dietary restraint, emotional and external eating were assessed using the Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al., 1986a; Wardle, 1987). The dietary restraint sub-scale consists of 10 items (e.g. If you have put on weight, do you eat less than you usually do?), the emotional eating sub-scale consists of 13 items (e.g. Do you get the desire to eat when you are anxious, worried or tense?) and the external eating sub-scale consists of 10 items (e.g. If food smells and looks good, do you eat more than you usually do?). All items are rated on five-point scales, with higher scores indicating higher dietary restraint, emotional and external eating. The DEBQ has been found to have construct (and factorial) validity and good internal reliability (van Strien et al., 1986a, 1986b; Wardle, 1987). Internal reliabilities in the present sample for dietary restraint, emotional and external eating were good (Cronbach's α = 0.93, 0.92, 0.86, respectively; Cortina, 1993).

Dieting status. Information about dieting status was also collected by asking respondents whether they were currently trying to lose weight (response: yes or no). This single-item measure

[1] This study design was considered optimal for the research questions posed and chosen for the following reasons: (1) we were trying to hold season constant as Pollard et al. (1995) have argued it is important to control for seasonal fluctuations in food intake, therefore two 2-week periods over a two and half month study window (within one season) was regarded to be appropriate; (2) bearing the previous point in mind and to minimize learning, response bias and acquiescence effects two study time points separated by 4–5 weeks was therefore also deemed optimal.

has been found to adequately discriminate dieters from non-dieters in previous research. For example, in keeping with theoretical predictions, Oliver and Wardle (1999) found that when using this single-item measure, twice as many dieters reported a hyperphagic response to stress (as predicted) compared to non-dieters. Thus 'confirming in the subjective experience of everyday eating, the phenomenon observed in the laboratory' (p. 514).

Perfectionism. Perfectionism was measured using two scales from the Multidimensional Perfectionism Scale (MPS; Hewitt & Flett, 1991, 1996): socially prescribed and self-oriented perfectionism. Self-oriented perfectionism (MPS-Self) is defined as a strong motivation to be perfect, all-or-nothing thinking and self-reported high achievement expectations (e.g. One of my goals is to be perfect in everything I do). Socially prescribed perfectionism (MPS-Social) measures the degree of belief that others hold unrealistically high expectations of one's behaviour and that they would only be satisfied with these standards (e.g. The people around me expect me to succeed at everything I do). Respondents are asked to rate each statement on a seven-point Likert-type scale ranging from 1 (disagree) to 7 (agree). The MPS has been shown to exhibit acceptable test–retest reliability and construct validity (Hewitt & Flett, 1991). The MPS has been shown to have very good temporal stability for as long as 3 months later (Hewitt & Flett, 1991). Internal reliability for the MPS-Self and MPS-Social scales in the present sample was good (Cronbach's $\alpha = 0.91$, 0.85, respectively).

Conscientiousness. Conscientiousness was assessed using the 10-item sub-scale from the International Personality Item Pool (IPIP; Goldberg, 1999)—a public domain measure of the Big 5 personality dimensions. Similar to the NEO inventory (Costa & McCrae, 1985), the IPIP consists of facet scales for each of the five major personality domains. The IPIP facets have been found to correlate highly with its NEO inventory counterparts ($rs > 0.90$ after correction for attenuation) and to have good construct validity and reliability (Goldberg, 1999, in press). Respondents are asked to rate each item on a five-point Likert-type scale ranging from 1 (very inaccurate) to 5 (very accurate). Items included 'Pay attention to details', 'Am exacting in my work'. Higher scores indicate higher conscientiousness. Internal reliability of this scale in the present study was good (Cronbach's $\alpha = 0.87$).

State measures. *Stress.* Perceived stress was assessed using the 14-item Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). The PSS was chosen as it provides a brief and easy to administer global assessment of recent stressful experiences. The scale has been found to have good test–retest reliability and construct and predictive validity (Cohen et al., 1983). It has also been used successfully in college students (e.g., O'Connor & Shimizu, 2002). Each item is scored on a five-point Likert scale. Items included how often one had been 'upset because of something that happened unexpectedly', 'dealt successfully with irritating life hassles', 'felt nervous and stressed', etc. in the last 2 weeks. Internal reliability for this scale with this sample was $\alpha = 0.87$.

Emotional distress. Emotional distress was assessed using the 30-item General Health Questionnaire (GHQ; Goldberg & Williams, 1988). This measure was chosen as it has been successfully used to assess recent psychological distress in college students (e.g. O'Connor, Cobb, & O'Connor, 2003; Pollard et al., 1995; Wardle et al., 2000). In addition, it has been shown to possess good construct and predictive validity and test–retest reliability (Goldberg & Williams, 1988). Items included 'been getting any pains in your head', and 'lost sleep over worry', 'been getting edgy and bad-tempered'. Each item is scored on a four-point scale from 'not at all' extending to 'much more than usual'. Higher scores indicate greater emotional distress. Internal reliability for this scale with this sample was $\alpha = 0.92$.

Changes in food intake. Perceptions of changes in food intake were measured by asking respondents to indicate how much they have eaten of the following types of between-meal snack in the last 2 weeks (i.e. biscuits/cakes, savoury snacks, sweets and chocolate) on a scale ranging from: much less than usual (1), less than usual (2), the same as usual (3), more than usual (4) and much more than usual (5). The snacks were combined into a single scale (between-meal snacks) and utilized as the dependent variable. The internal reliability for this scale with this sample was $\alpha = 0.75$. Construct validity for this measure was demonstrated in a pilot study ($N = 40$). Over a period of 2 weeks, participants completed a 2-week diary that included assessment of daily snack food intake. At the end of the study participants were asked to report their perceptions of food intake over the previous 2 weeks on the same scale described earlier. The results showed

a statistically significant difference in the number of snacks consumed in individuals who perceived themselves as eating 'more' and 'much more than usual' compared to those who perceived themselves as eating 'less than' and 'much less than usuals ($t = 8.14$, $p < 0.01$)[2].

Data analysis

Descriptive statistics were calculated for each of the study variables. Paired samples *t*-tests with Bonferroni corrections were employed to detect significant differences between the stress period and the non-stressful period on the key dependent variables. A series of $2 \times 2 \times 2$ analysis of variances (ANOVA) for a mixed design (i.e. including within and between participants factors) were used to investigate whether low conscientious participants who were also restrained eaters (or emotional or external eating, or perfectionists or dieters) reported consuming significantly more between-meal snacks than usual during a period of high stress compared to during low stress. In order to obtain equal numbers within each group, the individual differences variables were coded as high or low according to a median split (e.g. high versus low emotional eating). Each variable was entered separately into the ANOVA as a between participants factor in addition to conscientiousness (high versus low) and the repeated measures variable, condition (stressful period versus non-stressful period).

Results

Descriptive statistics and zero-order correlations for the background variables are summarized in Table I. Inspection of the correlation matrix shows some evidence of discriminant validity: all coefficients are substantially lower than 0.60. The data indicate that conscientiousness, self-oriented and socially prescribed perfectionism, diet status, and the eating style variables are all distinct constructs.

Stress levels, emotional distress and perceived changes in food intake during the stressful and non-stressful periods

Paired samples *t*-tests revealed statistically significant differences between the stressful and non-stressful periods for all the study variables. Higher levels of perceived stress ($t(130) = 11.26$, $p < 0.01$) and emotional distress ($t(130) = 12.92$, $p < 0.01$) were reported during the exam stress period compared to the non-stressful period, thus confirming that the quasi-naturalistic manipulation of stress was effective. In addition, significantly higher scores were found for perceived changes in between-meal snacking ($t(130) = 3.26$, $p < 0.01$) and each of its constituent food groups during the stressful period compared to the non-stressful period. Inspection of the means indicates that participants perceived themselves as consuming more between-meal snacks than usual during the stressful period (see Table II).

Conscientiousness, diet status and perceived change in food intake

As predicted, the results of ANOVA revealed a significant conscientiousness × diet status × condition interaction ($F(1, 127) = 5.16$, $p < 0.05$) for perceived changes in between-meal snacks. Inspection of the means indicated that low conscientious participants who were currently trying to lose weight perceived themselves as eating more between-meal snacks than usual during the stressful period compared to the non-stressful period (see Figure 1, Table III). A main effect of condition ($F(1, 127) = 21.78$, $p < 0.001$) was the only other significant effect found indicating that participants reported eating more than usual between-meal snacks overall during the stressful compared to the non-stressful period. In order to explore the significant three-way interaction further, 2 (condition) × 2 (diet status) ANOVAs were performed on low and high conscientious participants separately. These showed that the main effect of condition ($F(1, 65) = 12.86$, $p < 0.01$) and the condition × diet status ($F(1, 65) = 7.01$, $p < 0.01$) interaction were statistically significant in the low conscientious group (see Figure

[2] Perceptions of changes in consumption of other foods (bread, cheese and pasta), fruit and vegetables and takeaways/fastfood were also measured. Internal reliability analysis indicated that these did not scale adequately ($\alpha < 0.70$; cf. Nunnally, 1978) and were excluded from the final analyses. However, please note that preliminary analysis revealed that there were no significant differences in perceptions of consumption of these foods across the stressful and non-stressful periods.

Table I. Descriptive statistics (means ± standard deviations) and zero-order bivariate correlations for key independent variables.

	Mean (n = 131)	1	2	3	4	5	6	7	8	9	10	11
1. Age (years)	21.12 ± 4.04	—										
2. Height (m)	1.66 ± 0.07	–0.08	—									
3. Weight (kg)	62.96 ± 16.77	0.22*	0.16	—								
4. Body mass index	22.80 ± 6.03	0.23**	–0.14	0.95**	—							
5. Dietary restraint	26.71 ± 8.55	0.05	0.07	0.11	0.09	—						
6. Emotional eating	37.03 ± 9.26	–0.01	–0.04	0.20*	0.22*	0.49**	—					
7. External eating	32.29 ± 5.75	–0.15	0.02	0.20*	0.20*	0.12	0.48**	—				
8. MPS-Social	57.01 ± 10.08	0.11	–0.25**	0.07	0.14	0.16	0.17	–0.01	—			
9. MPS-Self	67.89 ± 15.43	–0.12	0.04	0.03	0.03	0.15	0.15	0.05	0.20*	—		
10. Conscientiousness	32.95 ± 7.65	0.02	0.06	–0.12	–0.15	–0.10	–0.05	–0.19*	–0.04	0.31*	—	
11. Dieting status	64[†]	0.02	0.04	0.20*	0.19*	0.48*	0.38**	0.11	0.19*	0.18*	–0.02	—

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; [†] number of respondents trying to lose weight.

Table II. Descriptive statistics (means ± standard deviations) for key study variables by time period.

	Time period		*t*-Value
	Stress	No stress	
Perceived stress	32.66 ± 7.71	25.01 ± 7.46	11.26**
Emotional distress	37.49 ± 14.42	21.80 ± 11.08	12.92**
Between-meal snacks†	3.28 ± 0.88	2.83 ± 0.87	4.64**
Biscuits and cakes	3.16 ± 1.01	2.80 ± 1.09	3.03**
Savoury snacks	3.24 ± 0.92	2.74 ± 1.16	3.95**
Chocolate and sweets	3.43 ± 1.12	2.94 ± 1.09	4.30**

** $p < 0.01$; † combined mean score.

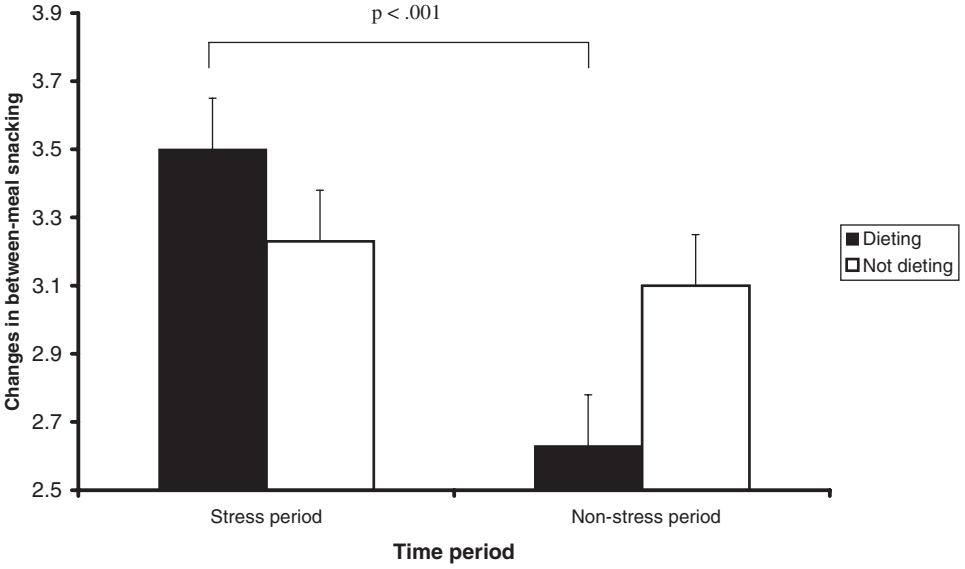

Figure 1. The effects of low conscientiousness and diet status on perceived changes in between-meal snacking.

Table III. Descriptive statistics (means ± strandard deviations) for perceived changes in between-meal snacking in response to stress by level of conscientiousness, condition and individual differences variables.

	Low conscientiousness		High conscientiousness	
	Stress	No stress	Stress	No stress
Currently dieting	3.50 ± 1.03	2.63 ± 0.93	3.08 ± 0.96	2.82 ± 0.80
Not dieting	3.23 ± 0.76	3.10 ± 1.01	3.26 ± 0.71	2.77 ± 0.66
High self-perfectionism	3.80 ± 0.79	2.77 ± 1.06	3.01 ± 0.84	2.70 ± 0.74
Low self-perfectionism	3.11 ± 0.89	2.91 ± 0.96	3.42 ± 0.78	2.93 ± 0.71
High social perfectionism	3.58 ± 0.98	2.91 ± 0.98	3.18 ± 0.82	2.91 ± 0.82
Low social perfectionism	3.13 ± 0.78	2.80 ± 1.02	3.19 ± 0.87	2.67 ± 0.59
High restraint	3.45 ± 0.84	2.73 ± 1.15	3.09 ± 0.93	2.64 ± 0.85
Low restraint	3.28 ± 0.98	2.99 ± 0.81	3.24 ± 0.76	2.91 ± 0.62
High emotional	3.65 ± 0.90	2.92 ± 0.96	3.18 ± 0.87	2.86 ± 0.78
Low emotional	3.08 ± 0.84	2.80 ± 1.04	3.19 ± 0.82	2.74 ± 0.69
High external	3.47 ± 0.80	2.86 ± 0.99	3.18 ± 0.85	2.91 ± 0.68
Low external	3.25 ± 1.02	2.86 ± 1.02	3.18 ± 0.84	2.71 ± 0.76

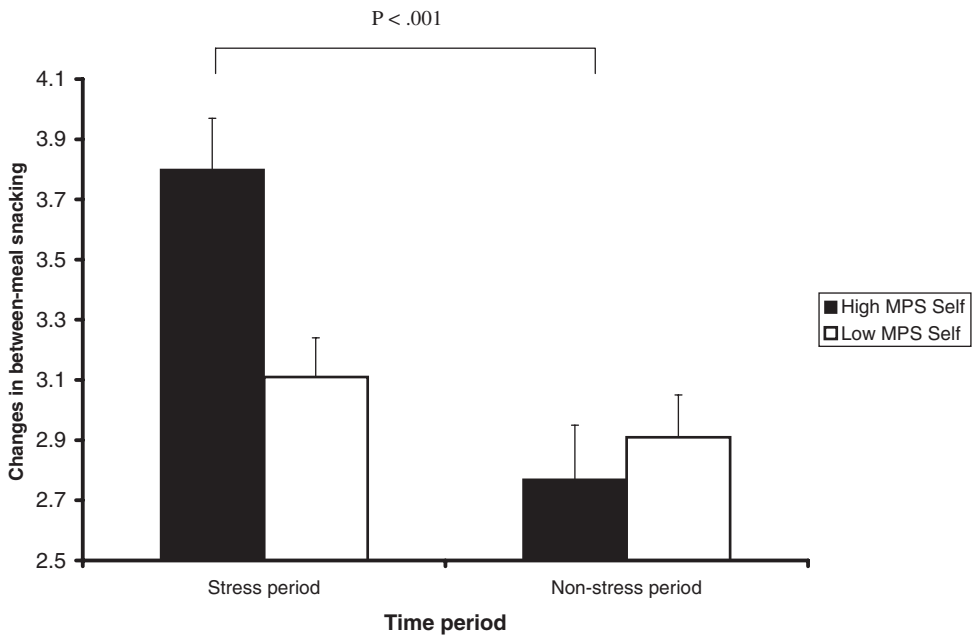

Figure 2. The effects of low conscientiousness and self-oriented perfectionism on perceived changes in between-meal snacking.

1), with only the main effect of condition significant (F (1, 62) = 9.09, $p < 0.01$) in the high conscientious group. Consistent with our hypothesis, a *post hoc* paired samples t-test revealed that the low conscientious individuals who were currently on a diet were significantly more likely to report eating more between-meal snacks than usual under stressful periods compared to non-stressful periods ($t = 4.35$, $p < 0.001$).

Conscientiousness, self-oriented perfectionism and perceived changes in food intake[3]

As hypothesized, the conscientiousness × self-oriented perfectionism × condition interaction (F (1, 127) = 6.98, $p < 0.01$) for self-reported changes in between-meal snacking was significant, indicating that low conscientious participants who were also high on self-oriented perfectionism reported themselves as eating more between-meal snacks than usual during the stressful period compared to the non-stressful period (see Figure 2, Table III). The conscientiousness × self-oriented perfectionism interaction (F (1, 127) = 6.16, $p < 0.05$) was also found to be statistically significant. Again, the three-way interaction was decomposed using a 2 (condition) × 2 (self-oriented perfectionism) ANOVA performed separately for high and low conscientious individuals. The results showed that the condition × self-oriented perfectionism (F (1, 65) = 8.34, $p < 0.01$) interaction was only statistically significant in the low conscientious group (see Figure 2). A *post hoc* paired samples t-test demonstrated that low conscientious individuals who were also high on self-oriented perfectionism were significantly more likely to report eating more between-meal snacks than usual during the stressful period compared to the non-stressful period ($t = 4.19$, $p < 0.001$).

Conscientiousness, socially prescribed perfectionism and perceived changes in food intake

For perceived changes in consumption of between-meal snacks, the conscientiousness ×

[3] For the sake of brevity and to avoid repetition, the main effects of condition and the condition × conscientiousness interaction term will not be reported for each individual differences variable as the results are identical.

socially prescribed perfectionism × condition interaction was non-significant. In addition, no other effects of socially prescribed perfectionism were found.

Conscientiousness, dietary restraint and perceived changes in food intake

The conscientiousness × dietary restraint × condition interaction was non-significant. No other effects of dietary restraint were found.

Conscientiousness, emotional eating and perceived changes in food intake

Similarly, the conscientiousness × emotional eating × condition interaction for perceived changes in consumption of between-meal snacks was non-significant. No other effects of emotional eating were found.

Conscientiousness, external eating and perceived changes in food intake

Finally, the conscientiousness × external eating × condition interaction was non-significant. No other effects of external eating were found.

Discussion

We found that low conscientious women who were currently trying to lose weight or were high on self-oriented perfectionism reported consuming significantly more between-meal snacks than usual during a 2-week stressful period compared to a 2-week non-stressful period. These results provide strong support for our hypothesis that conscientiousness would significantly interact with existing individual differences variables to predict changes in stress-related, self-reported eating.

These findings are consistent with the individual differences hypothesis described by Greeno and Wing (1994) that suggests that stress leads to changes in eating in particular groups (e.g. dieters). It is also important to note that in the current study, none of the established individual differences variables exerted their moderating effects independently. Our results suggest, therefore, that the adverse effects of stress on eating (more between-meal snacks) may only occur in women who are currently on a diet or who are high on self-oriented perfectionism in conjunction with low conscientiousness. This notion is congruent with the diathesis-stress model of perfectionism outlined in the Introduction (cf. Joiner et al., 1997; O'Connor & O'Connor, 2003) and the work by Ruggiero et al. (2003), who found a significant association between 'concern over mistakes' and 'drive for thinness' only during their high stress condition. Moreover, these results indicate, for the first time that low conscientiousness may have maladaptive effects on stress and coping relations.

An important question that requires consideration is why (low) conscientiousness might have a moderating effect that is associated with an increased likelihood to eat significantly more between-meal snacks whilst experiencing stress. Several possible mechanisms may underlie this phenomenon. Conscientiousness, as conceptualized by Costa and McCrae (Costa et al., 1991) is defined by six facets, three of which are likely to be particularly pertinent to this question (i.e. order, self-discipline and deliberation). Order refers to 'the tendency to keep one's environment tidy and well organised' (Costa et al., 1991, p. 889), deliberation refers to 'caution, planning and thoughtfulness' (p. 890) and self-discipline refers to 'persistence, the ability to continue with a task despite boredom or other distractions' (p. 889). Moreover, these theorists argue that order and self-discipline are aspects of self-control, and suggest that individuals low in self-discipline are prone to procrastination and are likely to give up (say, a task) when faced with frustration. In addition, high conscientious individuals have been found to perceive themselves as being able to meet situational demands and they are more likely to utilize active or problem-focused coping strategies (Penley & Tomaka, 2002; Watson & Hubbard, 1996). Therefore, it is likely that when faced with a stressful encounter, low conscientious individuals are less well equipped to cope (because they are badly organized and they are more likely to engage in emotion-focussed coping) and consequently may have less time available for food preparation and cooking and have to eat 'on the run'. These effects are likely to be exacerbated in individuals who are high on self-oriented perfectionism because such individuals interpret highly stressful situations as being even more threatening and lacking in control compared to those low on perfectionism. Simi-

larly, it is unsurprising that low conscientious dieters are likely to disinhibit—or lose control—whilst experiencing stress given that high self-control is central to successful adherence to a dietary regimen, but not central to the low conscientious personality.

Our results are also consistent with Heatherton and Baumeister's (1991) theory of binge eating as an escape from self-awareness, particularly for perfectionism. They argue that binge eaters are very sensitive to standards, and when these standards are not met, binge eaters view themselves negatively. These painful self-perceptions and resultant emotional distress, subsequently activate an escape response—disinhibition—and binge eating occurs. In terms of the current investigation, when they encounter stress, low conscientious individuals with a self-oriented perfectionistic personality are more likely to perceive events/encounters as imperfect and that their high standards have not been met. As a result, in order to escape such painful self-perceptions, they consume more high fat, energy dense snacks than usual as a distraction from self.

In the present study, we also found that the eating style variables measured by the DEBQ (dietary restraint, emotional and external eating) did not have a significant influence on eating behaviour under stress. Although, it is worth noting that the means for perceived changes in between-meal snacking (shown in Table III) are all in the predicted direction (i.e. highest scores for low conscientious, high emotional eaters during the stressful period, etc.). Nevertheless, the lack of significant effects is surprising, particularly for dietary restraint, as several other studies have found strong support for its moderating effects (e.g. Heatherton et al., 1991; Wardle et al., 2000). However, as argued elsewhere (Oliver, Wardle, & Gibson, 2000), the dietary restraint sub-scale of the DEBQ measures successful restraint, not vulnerability to disinhibition and, therefore, it may actually be less sensitive to discriminating individuals who are vulnerable to stress-induced hyperphagia in non-eating disordered populations. The Restraint Scale (Polivy, Herman, & Howard, 1988) has been used extensively by other researchers and has been found to discriminate between individuals' eating behaviours in response to stressful manipulations and it may be better at detecting individuals prone to disinhibit (e.g. Heatherton et al., 1991; Heatherton, Herman, Polivy, King, & McGree, 1988). Another implication of this study is the suggestion that future studies include a direct measure of dietary restraint (e.g. Are you currently trying to lose weight?) as this may be an additional, simple and more useful assessment of dietary restraint.

Our findings also corroborate previous research (e.g. Conner et al., 1999; Oliver & Wardle, 1999; Steptoe et al., 1998; Wardle et al., 2000) and suggest that stress may have its impact only on particular types of food intake, such as high-fat, energy dense foods (i.e. between-meal snacks). They reflect the findings of Oliver and Wardle (1999) in a study of the perceived effects of stress on food choice: they found that sweets, chocolate, cakes, biscuits and savoury snacks were all reported to be consumed more under stress by the majority of their sample. Oliver and Wardle suggest that (i) these snack-type foods are characterized by high palatability, high energy density and are easy to prepare and (ii) it is possible that certain groups of individuals may shift their preference to these more palatable foods when stressed. In their words, during stressful periods, palatability may 'serve as a marker for foods that replenish energy stores more quickly, which might be preferred at a time when energy demands could be high, but eating may have to take a lower priority in the behavioral repertoire' (Oliver & Wardle, 1999, p. 514). Although consistent with the current findings, future research should investigate this proposition further using a more detailed assessment of food intake and a more rigorous design.

Finally, it is important to consider some of the shortcomings of the current study. We acknowledge that our measure of stress is a global assessment and that the current study design does not directly tap the potential stress-related behavioural mechanisms that may mediate these changes in food intake. For example, it is likely that exam stress will have its impact via causing disruptions to sleep patterns, meal times and normal access to food. We would suggest that future studies should utilize a diary methodology and to include some measure of access to foods and level of disruption to meal times in order to assess these factors. We also recognize that our measure of eating behaviour assesses perceived changes and not actual changes in food intake and that it is possible that there may have been an interaction between the individual differences variables and responses to stress and the description of prior eating behaviour (e.g. during a time of stress, individuals high on self-oriented perfec-

tionism, may be more critical of themselves and overestimate the amount of snack food previously consumed). This remains a possibility, but is unlikely to explain our results for two reasons. Firstly, our preliminary analyses suggest that the effects of stress are restricted to changes in between-meal snacks and not other non-energy dense foods. Secondly, if this was the case, it is likely that this effect would generalize to those high on socially prescribed perfectionism and emotional eating style. This was not the case.

However, notwithstanding these limitations, the results of this study are consistent with the notion that stress can modify habitual health behaviours (i.e. between-meal snacking) that may impact on physical disease risk and the development of some eating disorders. These effects are likely to be the result of a complex interaction of conscientiousness and eating behaviour related individual differences variables.

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