

Stressor-induced eating: Psychological and neuroendocrine factors

By

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Abstract

Stress has been associated with divergent eating responses; eating is either suppressed or increased, and food choices gravitate towards sweet, and carbohydrate-rich foods. In this regard, food might serve as a coping mechanism to deal with negative affect; however, it is uncertain whether eating is used across all stressors situations, and whether factors such as gender and the use of other coping strategies, such as social support, influence its endorsement. Moreover, in addition to psychological factors, the overlap between stress and eating-regulatory systems, particularly those involving cortisol and ghrelin, suggest a role for neuroendocrine processes in stressor-induced eating. This program of research examined factors that might influence stress-related eating from a coping perspective, and examined relations between emotional eating and stressor-elicited changes of circulating cortisol and ghrelin levels in response to acute psychosocial stressors.

As expected, women, more than men, endorsed eating as a coping method, reported emotional eating behaviors, and demonstrated more frequent associations between stressor appraisals and eating as coping. Although support manipulations did not appreciably influence appraisal and coping responses, self-reported unsupportive interactions were related to emotional eating, and this relation was mediated by emotion-focused, but not avoidant, coping styles. When exposed to a psychosocial stressor, women that were emotional eaters appeared to be particularly stressor sensitive, and demonstrated altered ghrelin patterns during the food presentation period. Compared to non-emotional eaters, their baseline ghrelin levels were significantly lower, and they did

not exhibit the decline typically observed following food consumption. Cortisol levels also increased in response to the stressor, but did not appear to be related to eating. In anticipation of the same psychosocial stressor, emotional eaters ate more than non-emotional eaters and altered ghrelin levels persisted.

These studies suggest that emotional eating is engaged primarily for affect regulation, not avoidance or escape, raising the possibility that such behaviors are linked to self-medication or reward processes. Furthermore, among emotional eaters, the ghrelin feedback regulation system might be altered in a manner reminiscent of those observed among obese individuals and binge eaters. Together, the psychological and neuroendocrine results suggest potential vulnerability for obesity and pathological eating disturbances among emotional eaters.

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Table of Contents

Abstract	ii
Acknowledgements.....	iv
Table of Contents.....	v
List of Tables	viii
List of Figures.....	x
List of Appendices	xii
Introduction.....	1
The Regulation of Eating.....	4
Physiological Regulation of Eating	4
Satiety mechanisms: Leptin, insulin, and CRH.....	5
Eating initiation: Glucocorticoids and ghrelin.....	8
Stress-Related Eating	11
Physiological Factors and Stressor-Provoked Eating	11
HPA Axis Activity Following Acute Stressors	12
Acute Stress and Impacts on Food Choice and Intake.	13
Chronic Stress and Impacts on Food Choice and Intake	14
A Role for Ghrelin in Stress-induced Eating	15
Individual difference factors and eating	16
Depressive subtypes and associations with eating behaviour.....	17
Emotional influences on eating behaviours.....	17
Stress and coping	19

The Importance of Social Support in Stress-Related Pathology.....	21
Positive support and impacts on health.....	21
Negative support and impacts on health	22
The role of social support in the development of emotional eating.....	23
Behavioural consequences associated with eating disturbances.....	23
Objectives and Overview.....	24
Chapter 1	26
Abstract	27
Introduction.....	28
Methods.....	33
Results.....	39
Study 1	39
Study 2	54
Discussion	61
Statement Regarding Chapter 2	69
Chapter 2.....	70
Abstract	71
Introduction.....	72
Methods.....	78
Results.....	81
Study 3	81
Study 4	85
Discussion	92

Statement Regarding Chapter 3	97
Chapter 3	98
Abstract	99
Introduction	100
Methods.....	102
Results.....	110
Discussion	120
Statement Regarding Chapter 4	127
Chapter 4	128
Abstract	129
Introduction	130
Methods.....	132
Results.....	141
Discussion	153
General Discussion	158
References.....	174

List of Tables

Table 1. <i>Peptides Associated with the Inhibition and Stimulation of Food Intake</i>	6
Table 2. <i>Mean (SD) of Stress-coping Characteristics of Men and Women</i>	41
<i>for Study 1 (0-4 scales).</i>	
Table 3. <i>Mean (SD) of Stressor Appraisals as a Function of Gender and</i>	44
<i>Stressor Type (1-5 scale).</i>	
Table 4. <i>Mean (SD) of Coping Endorsement as a Function of Gender and</i>	47
<i>Stressor Type for Study 1 (0-4 scale).</i>	
Table 5. <i>Zero-Order Bivariate Pearson Correlations between Stressor</i>	48
<i>Appraisals and Coping Endorsements Displayed as a Function of</i>	
<i>Participant Gender, and Type of Stressor Situation.</i>	
Table 6. <i>Correlations Between Dispositional Coping Styles Displayed as a</i>	52
<i>Function of Participant Gender</i>	
Table 7. <i>Correlations Between Situational Coping Dimensions Displayed</i>	53
<i>as a Function of Stressor Type and Participant Gender</i>	
Table 8. <i>Mean (SD) of Stress-coping Characteristics of Men and Women</i>	55
<i>for Study 2 (0-4 scales).</i>	
Table 9. <i>Mean(SD) of Coping Endorsement as a Function of Gender and Stressor</i>	58
<i>Type for Study 2 (0-4 scale).</i>	
Table 10. <i>Means, Standard Deviations, and Zero-order Pearson Correlations</i>	83
<i>Between Perceived Unsupport, Coping Styles, and Emotional Eating</i>	
<i>Behaviors (N = 221).</i>	

Table 11. <i>Multiple Mediated Direct and Indirect Effects of Unsupport (IV) on Emotional Eating (EmoEat) Through Emotion-focused (EF) and Avoidant (AV) Coping</i>	84
Table 12. <i>Means, Standard Deviations, and Zero-order Pearson correlations between perceived social support, perceived stress, coping styles, and emotional eating behaviors (N = 169).</i>	87
Table 13. <i>Multiple Mediated Direct and Indirect Effects of Unsupport on Emotional Eating (EmoEat) Through Emotion-focused (EF) and Avoidant (AV) Coping, while Controlling for Positive Support</i>	88
Table 14. <i>Model 2: Moderated Mediated Direct and Indirect Effects of Unsupport on Emotional Eating (EmoEat) Through Emotion-focused Coping (EF) with Perceived Stress (PerStr) as a moderator, while Controlling for Positive Support (PosSup)</i>	91
Table 15. <i>Bivariate zero-order Pearson correlations between evoked emotions, and hormone reactivity</i>	118
Table 16. <i>Mean (\pmSD) of Participant Emotional Eating Behaviors, Physical Characteristics, and Hunger (N = 103)</i>	142
Table 17. <i>Bivariate Pearson correlations examining associations between emotional eating, body composition measures, hunger, mood, hormone levels, and food eaten as a function of stressor condition</i>	145
Table 18. <i>Mean (SD) of Food Cravings Immediately Following an Acute Psychosocial Stressor as a function of Stressor Condition and Emotional Eating Status</i>	263

List of Figures

- Figure 1.* Mean (\pm SEM) of the endorsement of eating as a coping strategy 45
as a function of stressor type.
- Figure 2.* Mean (\pm SEM) of appraisals of A) uncontrollability displayed as 60
a function of situation type, participant gender, and support condition;
and appraisals of B) threat, C) challenge, and D) stressfulness
displayed as a function of situation type, and support condition.
- Figure 3.* Sequence of procedures for the laboratory session procedure (Study 5). 106
- Figure 4.* Mean (\pm SEM) of mood ratings following a stressor vs. control 112
task among emotional and non-emotional eaters.
- Figure 5.* Mean (\pm SEM) of women's cortisol levels over a laboratory session 114
as a function of stressor condition and emotional eating status. Food
was introduced immediately after the 20 min blood sample was collected.
- Figure 6.* Mean (\pm SEM) of women's transformed ghrelin levels over time as 116
a function of emotional eating status. Food was introduced immediately
after the 20 min blood sample was collected.
- Figure 7.* The mediating effects of anger and shame on the relationship 119
between the stressor condition and change of cortisol level. Coefficients
are the unstandardized path coefficients, with standard errors indicated
in brackets. C.I. represents the 95% confidence interval around the mediated
path coefficient.

Figure 8. Sequence of procedures for the laboratory session procedure (Study 6)..... 138

Figure 9. Mean (\pm SEM) change of cortisol levels A) 15-min of anticipation 147
 minus baseline to assess anticipatory stress effects, and B) food intake
 period (30-min of stressor anticipation minus 15-min of anticipation) to
 assess cortisol levels as a function of food intake on a background of an
 ongoing anticipatory stressor. Data are displayed as a function of stressor
 condition and emotional eating status.

Figure 10. Mean (\pm SEM) change of ghrelin levels A) 15-min of anticipation 150
 minus baseline as a function of stress anticipation vs no treatment, and B)
 food intake period (30-min of stressor anticipation minus 15-min of
 anticipation) to assess ghrelin levels as a function of emotion eating status
 and food intake that occurred on the background of stressor anticipation.

Figure 11. Mediating effects of percent body fat on the relation between 152
 emotional eating and basal ghrelin levels. Coefficients are the unstandardized
 path coefficients, with standard errors in brackets. C.I. represents the 95%
 bias corrected and accelerated confidence interval around the mediated path
 coefficient.

Figure 12. Hypothetical model depicting the relations between psychological 159
 and neuroendocrine factors being investigated with respect to stressor-
 induced eating.

List of Appendices

Appendix A. Study 1 Information.....	214
Appendix B. Study 2 Information.....	218
Appendix C. Study 3 and 5 Information.....	222
Appendix D. Study 4 and 6 Information.....	228
Appendix E. General Measures	234
Appendix F. Hypothetical Stressor Scenarios.....	248
Appendix G. Final Session Questionnaires.....	255
Appendix H. Food Cravings Following and Acute Psychosocial Stressor.....	262
Appendix I. Statement of Permission	265

Introduction

Canadian women, like women in other Western countries, are facing an obesity epidemic, wherein over 30% of the female population was classified as overweight, and an additional 23% was classified as obese in 2004 (Tjepkema, 2008). In view of the potential adverse effects of obesity (e.g., contributing to heart disease, Type II diabetes), it is important to examine factors contributing to weight gain and excess eating, and the contexts in which they are most influential. This said, eating behaviours are complex, and involve both physiological and psychological mechanisms. The hormones and peptides studied in eating regulation have generally included those involved with satiety mechanisms (e.g., leptin, insulin, corticotropin releasing hormone); however, recent attention has turned to hormones involved with the initiation of eating (e.g., ghrelin), and the pathways through which they act (Berthoud and Morrison, 2008; Cummings, 2006; Higgins et al., 2007; Nestler et al., 2002). Furthermore, these hormone responses may be altered by mood factors, such as depression, as well as eating disturbances (Anisman et al., 1999; Germain et al., 2009; Gluck et al., 2004; Lo Sauro et al., 2008; Nestler et al., 2002).

Situational factors can influence eating behaviours, and stressful events, for example, have been related to changes in food preferences, as well as caloric intake (Epel et al., 2001; Greeno and Wing, 1994; Oliver and Wardle, 1999; Oliver et al., 2000). Among stress-eaters, for instance, food selection tends to shift to foods high in carbohydrates and fats, and to sweet foods (Oliver and Wardle, 1999; Rutters et al., 2009; Zellner et al., 2006), and more calories seem to be eaten, in times of distress (Epel et al., 2001; Rutters et al., 2009; Zellner et al., 2006). However, this is not universally the case,

as some individuals display no change, or reduce eating when distressed (Greeno and Wing, 1994; Mitchell and Epstein, 1996; Wardle et al., 2000). It is possible that this differential outcome may be associated with reactivity differences in response to stressors, the characteristics of the stressors experienced, and in activation of eating-related hormones (e.g., cortisol, ghrelin) (Epel et al., 2001; Lattimore and Caswell, 2004; Mitchell and Epstein, 1996; Pecoraro et al., 2004; Rouach et al., 2007; Wardle et al., 2000).

It is likely that in infrahuman animals physiological mechanisms predominantly control eating in stressful situations, whereas in humans the relationship is likely more complex. When confronted with stressful events, individuals first appraise the situation and the resources they have to contend with the threat (Lazarus and Folkman, 1984). Various coping strategies are then engaged, and among women in particular, this may entail seeking the support of others during times of distress ('tend-and-befriend' stress response) (Taylor et al., 2000). In this regard, social support is a fundamental coping resource that often serves as an effective buffer against the adverse physical and psychological effects of stressors (Heinrichs et al., 2003; Lee et al., 2004; Lepore, 1992). However, if initial coping responses fail to attenuate the adverse effects of stressors, secondary, less effective, strategies may be adopted. Emotional eating (eating in order to alleviate negative mood or distress) might be one of these strategies, and may have long-term implications for health, and future responses to stressful situations (Macht et al., 2005; Spoor et al., 2007). Less clear, however, are the contributions of other coping methods to the development of this eating disturbance.

Independent of the influence of social support, negative social interactions, or ‘unsupport’, has been associated with decreased physical and psychological well-being (Ingram et al., 2001a; Song and Ingram, 2002). With respect to eating behaviours, unsupport has indeed been associated with the development of binge-eating behaviours (a clinical form of emotional eating), and the onset of specific binge-eating episodes (Steiger et al., 1999). Thus, it may be of interest to examine these negative interactions as a potential risk factor for emotional eating.

Although considerable research has focused on the physiological and psychological antecedents and consequences of eating disorders, similar research involving non-clinical samples is less common. Given the rising obesity rates, despite the low rates of eating disorders in the general population (Gauvin et al., 2009; Makino et al., 2004), it might be important to focus attention on factors contributing to sub-clinical eating disturbances within the general population. Thus, the goals of the proposed research are to a) assess the types of stressors (e.g., academic vs. financial) that might be associated with the endorsement of eating as a coping mechanism, b) examine the relations between coping and emotional eating, c) examine the contribution of social support and unsupport to emotional eating behaviours, and the role of coping in this relation d) determine whether emotional eaters display altered behavioural stressor responses to stressor experiences (e.g., mood), e) determine whether hormone levels (cortisol and ghrelin), as well as the behavioural responses to stressors, are related to changes in food choices and intake, and f) assess whether changes of eating and hormone levels differ between emotional and non-emotional eaters.

The Regulation of Eating

In order for survival, organisms must avoid negative energy balance over long periods of time. Ordinarily, hormone signals act to initiate feeding and, when satiated, opposing signals serve to terminate eating. Although a balance between positive and negative energy states is generally the ideal, there are times in which positive energy balance may be adaptive for some species (e.g., in preparation for winter when food is scarce, or in preparation for hibernation). This said, in Western Nations, humans are likely less dependent on energy balances stemming from seasonal factors, and the current challenge might actually be one of avoiding ongoing positive energy balances, particularly during sedentary periods (winter). Although hormones and peptides involved with energy balance generally regulate food intake, as alluded to earlier, several psychological and individual differences factors may contribute to eating, including emotional states, presence of depressive symptoms, and dieting behaviours (Hays and Roberts, 2008; Kubiak et al., 2008; Nestler et al., 2002; Wardle et al., 2000).

Physiological Regulation of Eating

Several physiological processes have been related to satiety or reduced eating, and there have also been several peptides and hormones that have been associated with increased eating. Table 1 (adapted from Appleyard et al., 2003 and (Ueta et al., 2003) provides a summary of these physiological factors. The present review provides only a brief overview of those factors that have most commonly been implicated in the initiation of food intake, namely cortisol and ghrelin, as well as those peptidergic processes associated with satiety (Leptin, insulin and corticotropin releasing hormone), and that have also been implicated in the stress response (Tannenbaum et al., 2011).

Satiety mechanisms: Leptin, insulin, and CRH.

Many of the peptides examined in relation to eating have been those involved with satiety, including leptin, insulin, and corticotropin releasing hormone (CRH) (Merali et al., 2003; Piroli, 2003). These hormones share overlapping biological regulatory mechanisms that may favor an equilibrium of energy balance being maintained. It is interesting in this regard that the pro-eating peptides are also fundamentally involved in the stress response. In fact, it was suggested that the circuitry responsible for stress responses overlaps considerably with those involved in eating processes (Dallman, 2003; Tannenbaum et al., 2011; Ueta et al., 2003). In effect, it seems that activation of stress neural circuits also have the effect of diminishing eating, possibly reflecting an adaptive response to ensure appropriate focus on defensive strategies.

Leptin. Leptin is a satiety hormone associated with reductions of food intake, adiposity, and increasing energy output (Campfield et al., 1995; Halaas et al., 1995; Zhang et al., 1994). It is secreted predominantly from adipose tissue and may involve multiple brain regions, including the hippocampus, brain stem, paraventricular nucleus (PVN) and arcuate nucleus (ARC) of the hypothalamus (Margetic et al., 2002). In the ARC, leptin acts to suppress appetite by inhibiting neuropeptide Y (NPY) and agouti-related peptide (AgRP) neurons (feeding promoters), and by activating proopiomelanocortin (POMC) neurons (feeding inhibitors) (Cowley et al., 2001; Schwartz et al., 1996; Schwartz et al., 1997; Spanswick et al., 1997). In order to exert these effects, leptin makes use of multiple signaling pathways, affecting NPY and POMC neurons via the Janus Kinase-signal transducer and activator of transcription (Jak-Stat) pathway (Elias et al., 1999; Hakansson and Meister, 1998)(via Stat3), as well as the ERK,

Table 1. *Peptides Associated with the Inhibition and Stimulation of Food Intake**

Orexigenic peptides (Stimulatory)	Anorexic peptides (Inhibitory)
Neuropeptide Y (NPY) Agouti Related Protein (AgRP) Galanin GHRH Growth Hormone (GH) Ghrelin MCH Opioids (β -endorphin) Orexin-A -B/hypocretin-1 -2 Prolactin Peptide YY ₁₋₃₆ Dynorphin 26RFA, a member of the RFamide peptide family VGF	Adrenomedullin Bombesin Cholecystokinin (CCK) Calcitonin CART Corticotropin Releasing Hormone (CRH) Glucagon Glucagon-like peptide-1 (GLP-1) GRP Insulin Leptin Melanocortin α MSH (product of POMC) Neuromedin B and Neuromedin U Neurotensin Oxytocin PACAP POMC Somatostatin TRH Urocortin Urocortin II Urocortin III VIP NT GALP Peptide YY ₃₋₃₆ Ciliary neurotrophic factor (CNTF) Brain derived neurotrophic factor (BDNF) IGF-I and IGF-II Neuropeptide K (NPK) NPB and NPW Motilin Enterostatin Anorectin Amylin IL-1

*Adapted from Appleyard et al., 2003 and Ueta, Ozaki, Saito, & Onaka, 2003

PI3K, and cAMP/PDE3B intracellular pathways (Niswender et al., 2001; Zhao et al., 2002).

Although leptin is a reliable regulator of feeding, it is possible for leptin resistance to develop during times when greater energy is required, such as during pregnancy (Augustine et al., 2008; Denis et al., 2003; Mounzih et al., 1998). However, this also seems to occur among some obese individuals, who exhibit high levels of circulating leptin with a limited behavioural response to the peptide (Heymsfield et al., 1999; Hukshorn et al., 2000). Furthermore, decreased production of leptin has been observed in both anorexic and bulimic patients (Ferron et al., 1997; Germain et al., 2007; Herpertz et al., 1998; Kopp et al., 1998; Mantzoros et al., 1997; Mathiak et al., 1999). In this regard, it was observed that although the expected relation with leptin and BMI was found within each eating disorder sample, the bulimic patients were of normal weight, suggesting that the secretion of leptin may respond to energy, as well as general nutritional needs among eating disordered patients (Monteleone et al., 2000).

Insulin. Insulin is a satiety hormone secreted by the pancreas (Burcelin, 2005). Like leptin, insulin acts to suppress NPY activity, and promotes POMC in the ARC via the PI3K pathway (Niswender et al., 2003; Niswender et al., 2001) thus decreasing food ingestion (Woods et al., 1996). In addition, insulin interacts with other feeding regulatory hormones, such as leptin, ghrelin, cytokines and glucocorticoids, which may contribute to its effects on obesity during challenging times (Landsberg, 2001). As with leptin, insulin resistance may also develop, as is seen in Type 2 diabetes (Jin and Patti, 2009).

Corticotropin releasing hormone. The initiator of the HPA stress-hormone cascade, CRH, also has a role in eating regulation. When secreted by the PVN, CRH targets the NPY neurons in the ARC to inhibit them, thereby suppressing food intake (Heinrichs et al., 1992; Heinrichs et al., 1993). The activity of PVN CRH stimulates pituitary ACTH release and hence glucocorticoid secretion, which then feeds back to inhibit further CRH release (Di et al., 2003).

Eating initiation: Glucocorticoids and ghrelin.

Glucocorticoids. The glucocorticoid, cortisol (or corticosterone in rodents), is secreted from the adrenal glands, and is the end product of HPA activation. In addition to being a reflection of stress-reactivity, differences in cortisol levels have been associated with changes in energy intake and body fat distribution (Laugero et al., 2002; Nieuwenhuizen and Rutters, 2008). Rat studies have provided the opportunity to manipulate glucocorticoid levels, wherein adrenalectomized rats display decreased food intake, with this effect being reversed upon corticosterone replacement (la Fleur, 2006; la Fleur et al., 2004). Importantly, during corticosterone replacement, carbohydrates and palatable food seem to be most preferred (la Fleur et al., 2004). Results in humans paralleled those in rats, as synthetic glucocorticoid administration provoked greater food intake than a placebo treatment (Tataranni et al., 1996).

There seem to be multiple processes by which cortisol may exert its effects on eating. Cortisol may make the pleasurable effects of eating more salient through interactions with the dopamine reward system, thus reinforcing the pleasurable effects of food (Berthoud and Morrison, 2008; Epstein et al., 2007). It has also been suggested that glucocorticoids may increase food intake by the stimulation of endocannabinoid

receptors, and other target neurons of the hypothalamus (Dallman, 2007; Di et al., 2003). Alternatively, one of the more common theories is that glucocorticoids (cortisol in humans) may exert their effects on eating through inhibition of CRH in the PVN that otherwise provokes anorectic effects (Laugero et al., 2002; Nieuwenhuizen and Rutters, 2008).

Excessive cortisol secretion has also been associated with altered body fat distribution, particularly a tendency to gain fat tissue in the central, or abdominal, area (Bjorntorp, 2001; Kuo et al., 2007; Nieuwenhuizen and Rutters, 2008). Indications of this are also seen in disorders involving the dysregulation of cortisol secretion. For instance, Cushing's disease (hypercortisolism) is associated with weight gain (Hankin et al., 1977), whereas Addison's disease (hypocortisolism) has been associated with weight loss (Lovas and Husebye, 2007). However, among rats, the opposite has also been observed, in that chronically stressed rats when subsequently confronted with an acute stressor, glucocorticoids act both directly, and indirectly via effects on CRH neurons in the amygdala, to suppress fat storage, resulting in weight loss (Laugero et al., 2002).

Ghrelin. Unlike many hormones and peptides that regulate satiety, ghrelin is a hormone that acts both centrally and peripherally to promote eating initiation (Kojima and Kangawa, 2005). Ghrelin, the endogenous ligand of the growth hormone secretagogue receptor, is a 28-amino acid peptide that is synthesized primarily from cells of the stomach (Cummings, 2006; Kojima et al., 1999). There are two main forms of ghrelin, acylated ghrelin and des-acyl ghrelin, but the latter is believed to be biologically inactive in humans (Kojima and Kangawa, 2005). Following its release, ghrelin reaches the ventromedial hypothalamus (VMH) and ARC, targeting NPY/AgRP neurons via

growth-hormone secretagogue receptors (GHS-R) (Kohno et al., 2003). Through the activation of these neurons, ghrelin promotes orexigenic activity (Chen et al., 2004; Nakazato et al., 2001). In addition, projections to the lateral hypothalamus (LH) and other nuclei within the hypothalamus (PVN, dorsomedial hypothalamus (DMH), and suprachiasmatic nucleus (SCN)) were also found to be involved in the actions of ghrelin, although these pathways have been less well studied (Hori et al., 2008; Toshinai et al., 2003; Zigman et al., 2006).

The levels of circulating ghrelin vary throughout the day in response to the energy needs of the organism. Among rodents and humans, ghrelin levels peak before waking and before mealtimes, and during periods of fasting (Aydin, 2006; Cummings et al., 2001; Yildiz et al., 2004). Moreover, the administration of ghrelin has been associated with increased hunger, eating initiation, increased caloric intake at meals, and increased daily caloric intake, thus highlighting its importance in eating initiation (Cummings et al., 2005; Cummings et al., 2004b; Cummings et al., 2001; Schmid et al., 2005b; Tang-Christensen et al., 2004). Following the ingestion of food, ghrelin levels rapidly decline, although the rate of decline may vary as a function of factors such as weight and eating disturbances (English et al., 2002; Geliebter et al., 2004).

Ghrelin concentrations, as expected, vary as an inverse relationship with body mass index (BMI), with overweight and obese individuals exhibiting lower daytime levels of ghrelin and blunted nocturnal levels compared to normal weight individuals (Beasley et al., 2009; Yildiz et al., 2004). Conversely, underweight or anorexic individuals display consistently elevated daytime ghrelin levels (Germain et al., 2009; Monteleone et al., 2008). Furthermore, normalization of ghrelin levels from peak

concentrations following eating was shown to take significantly longer among obese than non-obese individuals (English et al., 2002).

Stress-Related Eating

Stressful experiences appear to have opposing effects on eating propensities, wherein some individuals respond by increasing their food intake, whereas others eat less when distressed (Greeno and Wing, 1994; Newman et al., 2007; Oliver and Wardle, 1999; Stone and Brownell, 1994). Furthermore, among those who increase food intake in response to stressors, the foods craved are often high in fat and carbohydrates, and may be sweet in taste (Epel et al., 2001; Oliver and Wardle, 1999). The effects observed may vary with the type or severity of the stressor involved (Stone and Brownell, 1994; Stroud et al., 2002), gender (Stone and Brownell, 1994; Stroud et al., 2002; Weinstein et al., 1997), and pathological symptomatology (e.g., depression) (Christensen and Brooks, 2006). Proposed explanations for these divergent responses include differential activation of physiological systems associated with eating initiation and food preference (e.g., HPA axis) (Epel et al., 2001; Newman et al., 2007), individual differences related to eating restraint and dieting (Oliver and Wardle, 1999; Wardle et al., 2000).

Physiological Factors and Stressor-Provoked Eating

There are several proposed biological hypotheses concerning stress and eating, including those involving dopaminergic regulation of addiction and reward (Berthoud and Morrison, 2008; Epstein et al., 2007; Zheng and Berthoud, 2008), and the serotonergic self-medication hypothesis (Fernstrom and Wurtman, 1971; Leibenluft et al., 1993; Wurtman and Wurtman, 1995). Importantly, these views focus on the craving and consumption of carbohydrates and fats (the foods most commonly involved in stress-

eating (Epel et al., 2001; Oliver et al., 2000; Wurtman and Wurtman, 1995) as a method of alleviating distress. The actions of these neurotransmitters occur centrally, and may be tied to various peripheral and central hormonal factors. In addition to these monoamines, there is ample reason to believe that both ghrelin (Cummings, 2006; Cummings et al., 2001) and glucocorticoid feedforward and feedback mechanisms (Dallman, 2003; Dallman et al., 2003a; Dallman et al., 2005) also contribute to eating initiation, and their peripheral and central actions may be particularly relevant to eating initiation associated with stressful events. Thus, the present review will focus mainly on the role of ghrelin and glucocorticoids in the stress-eating relationship.

HPA axis activity following acute stressors.

When confronted with challenging events, hormonally-related adaptive responses are elicited, resulting in increased arousal, vigilance, and mobilization of energy sources, and the concurrent suppression of those activities unnecessary for promoting immediate survival (e.g., sexual activity, feeding behaviours) (Nieuwenhuizen and Rutters, 2008). In addition to being present in the PVN, CRH is found in the amygdala (the area of the brain associated with fear responses), which in a stress-eating situation may be particularly relevant (Laugero et al., 2002) in modulating HPA functioning, and may serve in an essential adaptive behavioral response. In response to stressors the PVN of the hypothalamus is activated, causing the release CRH and arginine vasopressin (AVP) from the median eminence (the terminal region for neurons of the PVN) (Lamberts et al., 1984). CRH then targets the anterior pituitary gland from which adrenocorticotrophic hormone (ACTH) is released (Antoni, 1986). The circulating ACTH then signals the release of cortisol from the adrenal cortex (Antoni, 1986; Sapolsky et al., 2000). A

negative feedback mechanism exists, so that cortisol inhibits release of CRH from the PVN (either directly or through hippocampal activation), thus turning off the stress-response (Sapolsky et al., 2000). It should be noted that specific stressor appraisals (e.g., type and severity of the stressor) may dictate the extent of initial HPA activation (Stroud et al., 2002).

Acute stress and impacts on food choice and intake.

It has been found that among high cortisol reactors, but not low reactors, daily hassles predicted snack intake (Newman et al., 2007). Furthermore, following an acute laboratory stressor, high cortisol reactors consumed more daily calories than low cortisol reactors, or on a day when the high reactors performed a control task (Epel et al., 2001). As well, in an acute stress-inducing situation, cortisol reactivity seems to influence the types and amount of food eaten, wherein those individuals who were considered high cortisol reactors were found to eat more sweet foods than low reactors (Epel et al., 2001).

The type of stressor encountered may be important in eliciting stress eating responses in humans. Nieuwenhuizen and Rutters (2008) indicated that stressors, such as workplace stressors, academic examinations and surgery-related stressors promoted differing, and sometimes inconsistent, associations with food intake. One possible explanation for this discrepancy is that stressor appraisals result in differences in cortisol activation. Indeed, stressors in which individuals perceive themselves as not having control over events, as well as those presenting a social evaluative threat, elicit greater cortisol responses relative to other types of challenges (Dickerson et al., 2004; Dickerson and Kemeny, 2004). Additionally, when confronted with an academic or social stressor, men and women displayed different cortisol reactivity to these events; men displayed

increased cortisol levels in response to the academic performance challenge, whereas elevated cortisol in women occurred in response to the social stressor (Stroud et al., 2002). Perhaps these more self-relevant, or self-important, types of stressors are most closely aligned with increased food intake.

Chronic stress and impacts on food choice and intake.

Periods of chronic stress may be accompanied by increased food cravings, and more specifically, cravings for 'comfort foods' high in carbohydrates and fat (Dallman et al., 2005). As described earlier, CRH can target NPY/AgRP cells in the PVN to suppress food intake, whereas glucocorticoids (i.e., cortisol) act to suppress CRH release, and may thus act as feeding stimulators (Laugero et al., 2002; Nieuwenhuizen and Rutters, 2008). During times of chronic stress, circulating cortisol levels are high, and the activity of CRH in eating suppression will be inhibited. Dallman and her colleagues have advocated a role for cortisol in stress-induced eating initiation, as well as the specific type of food eaten (Dallman et al., 2005). In this regard, it was demonstrated that adrenalectomized rats (and hence depleted of corticosterone) ingested smaller amounts of palatable food than normal, and this effect is reversed with the administration of corticosterone (the rodent equivalent of cortisol) (Bell et al., 2000; Bhatnagar et al., 2000; la Fleur et al., 2004). It was hypothesized these effects may involve dopaminergic pathways associated with reward, thus influencing motivation to eat (Dallman et al., 2005). However, it seems that the presence of insulin may be a requisite of dose-dependent sucrose intake that is independent of reward-motivated intake. Indeed, in order for the dose-dependent relationship between sucrose intake and cortisol levels to be apparent the production of insulin was necessary (Dallman et al., 2005).

As with acute stressors, the type of threat presented as a chronic stressor may also be important to the eating stress response. Dallman (2007) suggested that rodents may habituate to chronic stressors presenting a threat, resulting in a cortisol response that decreases over time. However, when survival is threatened by the chronic stressor (e.g., water deprivation), the reverse pattern occurs wherein the cortisol response becomes exaggerated over time, but is cleared from the system at a much quicker rate.

A Role for Ghrelin in Stress-induced Eating

Ghrelin may interact with HPA functioning, increasing ACTH and cortisol release (Asakawa et al., 2001; Schmid et al., 2005b). The interplay between a system fundamental to the stress response, and a peptide whose action is associated with eating initiation raises the question of whether ghrelin might contribute to stressor-induced eating. Studies in animals have, indeed, shown that ghrelin increases in response to both physical and psychological stressors (Asakawa et al., 2001; Kristensson et al., 2006). However, there are few studies that have analyzed the ghrelin stress response in humans, and the data available have been inconsistent; Zimmermann and colleagues found no increase in ghrelin levels in response to a stressor (Zimmermann et al., 2007), whereas Rouach et al. (2007) observed a rise in plasma ghrelin that coincided with cortisol variations (i.e., ghrelin levels increased among those participants who also displayed increased cortisol following the stressor). The results observed in animal studies appeared to be more consistent than those reported in humans, possibly because the stressors used in animal studies were often prolonged, whereas the laboratory stressors used in humans were applied over a much shorter period of time. As indicated by Dallman (2007), the chronicity and the duration of the stressor experience might be

fundamental in determining the effects on corticoid levels, and it is possible that this might also be the case with respect to ghrelin.

There is also evidence suggesting that ghrelin may be associated with depressive and anxiety-related behaviors. Indeed, increased ghrelin levels in response to stressors among mice were related to a greater number of anxiety behaviors (Asakawa et al., 2001), and attenuation of ghrelin action by the administration of ghrelin antisense DNA (vs. control or scrambled DNA) was associated with lower anxiety and depressive behaviours (Kanehisa et al., 2006). Human studies have likewise suggested that increased ghrelin levels were associated with feelings of anxiety or distress (Rouach et al., 2007).

Individual Difference Factors and Eating

It had initially been proposed that stressful events might lead to physiological changes that would be directly related to changes of eating, the general effect model of stress and eating. Although animal studies revealed some significant findings, investigations of acute stressors on food intake generally yielded mixed results; however, chronic stressors seemed to be associated with increased food intake under certain conditions (Dallman et al., 2005; Greeno and Wing, 1994; Newman et al., 2007; Pecoraro et al., 2004). It quickly became clear that there was little support for such a simplistic model to account for eating disturbances in humans, and this view was supplanted by the suggestion that individual difference factors were fundamental in accounting for the varied stress-eating behavior profiles that had been reported (Greeno and Wing, 1994).

Depressive subtypes and associations with eating behaviour.

Depression has been associated with changes in eating behaviours. Among those with typical depression, appetite is generally decreased, whereas atypical depression is defined by, among other things, increased eating (Posternak and Zimmerman, 2001). It is suspected that alterations in HPA axis regulation may be involved with these divergent presentations of pathology (Anisman et al., 1999; Gold and Chrousos, 2002; Gold et al., 2002), and carbohydrates (both eaten and craved) are associated with these changes (Gold and Chrousos, 2002). In this regard, carbohydrates influence the production of serotonin, a neurotransmitter involved in the regulation of mood and food intake, which has been associated with both typical and atypical depression (Antonijevic, 2006). Thus, it was suggested that eating carbohydrates during depressive mood states may be a form of self-medication to alleviate these negative states (Leibenluft et al., 1993; Wurtman and Wurtman, 1995).

Emotional influences on eating behaviours.

When experiencing stressful events, negative affect is often evoked (Lazarus, 1993; Rutters et al., 2009; Stroud et al., 2002). Importantly, negative mood states (e.g., anxiety, boredom, sadness) have been associated with increased food cravings, choices, and intake among some individuals (Canetti et al., 2002; Hill et al., 1991; Macht and Simons, 2000; Rutters et al., 2009; Schlundt et al., 1993; Stanton and Snider, 1993). Emotional eaters are those individuals who overeat, or increase their eating, in response to such negative emotional arousal. The reason for this reaction is uncertain, although several explanations have been offered in this regard. First, it has been suggested that during times of stress, emotional eaters may have an inability to properly recognize their bodily sensations, and the anxiety and physiological arousal during times of distress are

misinterpreted as hunger (Ouwens et al., 2009; Van Strien et al., 2005; van Strien and Ouwens, 2007). A second perspective of negative affect inducing eating, the “escape model”, is that individuals become disinhibited and as such, eat more, when distressed (Heatherton and Baumeister, 1991). Finally, emotional eating has been proposed as a maladaptive coping strategy, wherein eating serves to alleviate stressor-induced negative emotions (Kubiak et al., 2008; Spoor et al., 2007).

In addition to a role for emotional eating in determining the consummatory response to stressors, it has been reported that restrained and nonrestrained eaters display differential responses to stressors. In this regard, one of the foremost perspectives of stress-eating, namely that of restraint theory (Herman and Mack, 1975; Herman and Polivy, 1980), proposes that individuals can be categorized according to the degree to which food intake, particularly foods high in calories or fat, is monitored, and that these categorizations predict who will increase, and who will decrease, the amount of food eaten during stressful situations. Specifically, restrained eaters are those individuals who exert a large amount of control over the foods they eat with the goal of losing weight, whereas unrestrained eaters exert little or no, control over the food intake. Although both males and females may exhibit restrained eating, it has been consistently found that women are more likely to be restrained eaters than are men (Appleton and McGowan, 2006). Restrained eating has been found to moderate the stress-eating relationship, wherein restrained eaters eat more following stressors than do unrestrained eaters (Wardle et al., 2000; Zellner et al., 2006). Some investigators have attributed this to the depletion of cognitive resources available during stressful events (Boon et al., 2002; Ward and Mann, 2000). Specifically, it is thought that controlling one’s eating requires

constant effort, and during stressful events, assessing, and coping with, the stressor increases the cognitive load, hence decreasing the attention that can be spent on monitoring food intake, and controlling eating. However, this explanation of the effects of eating restraint on stress-eating may, in itself, not fully explain the stress-eating relationship, as there are individuals who do not change, or even decrease, their food intake in response to stressors.

Stress and Coping

When confronted with potentially stressful events, individuals may adopt a variety of coping strategies to contend with the affront. However, all people do not cope with a given situation in the same way, nor do all situations elicit identical patterns of coping (Carver and Scheier, 1994; Carver et al., 1989; Lee-Bagglely et al., 2005). In order to explain these differences, Lazarus and Folkman (1984) proposed the transactional model of stress and coping. This model proposes that when confronted with a potential stressor, individuals first go through a primary appraisal process, wherein the event is deemed either a threat or a challenge to the self. Subsequently, secondary appraisals are made as to whether the individual possesses the necessary coping resources to contend with such an event. When the required coping resources are perceived as being unavailable, emotion-focused coping strategies may be predominant (e.g., emotional expression, rumination), with the purpose of such strategies being that of alleviating the emotional distress caused by the stressor event. In contrast, when the coping resources needed to contend with the stressor are thought to be available, the individual will adopt problem-focused coping strategies aimed at terminating the stressor itself (e.g., problem solving).

It is important to consider the specific coping mechanisms that are adopted in response to a stressor, as they might have differing influences on physical and mental health. Indeed, greater use of emotion-focused coping strategies, such as rumination, have been associated with increased depressive symptomatology, anxiety, as well as decreased well-being, whereas the engagement of problem-focused coping seems to be associated with opposite effects (Bolger, 1990; Carver et al., 1993; Stanton and Snider, 1993). However, this may not always be the case, as there are situations in which emotion-focused coping strategies (e.g., emotional processing, emotional expression) may contribute to well-being (Austenfeld and Stanton, 2004; Gortner et al., 2006; Graf et al., 2008; Stanton et al., 2000b). During situations in which it is not possible to control the outcome (e.g., cancer diagnosis and treatment), focusing on emotional well-being may be beneficial. Indeed, when participants are asked to write about an important emotional issue or traumatic event that has impacted their life, well-being was enhanced, reflected by reduced anxiety and depressive symptoms (Gortner et al., 2006; Graf et al., 2008; Pennebaker, 1997). Likewise, expressing emotion using this diary procedure may promote physiological benefits, such as improved immune functioning (Pennebaker et al., 1988; Petrie et al., 2004), reduced systolic and diastolic blood pressure, and a decline in health centre visits among undergraduate students (Greenberg and Stone, 1992; Pennebaker et al., 1988). Thus, in some situations, specific types of emotion-focused coping may, in fact, have beneficial health effects.

The Importance of Social Support in Stress-Related Pathology

Positive support and impacts on health.

Social support is a fundamental coping resource that may buffer against the negative effect of stressors. Typically, low levels of support have been associated with poorer health outcomes such as depression and anxiety (Anisman and Matheson, 2005; Flemming et al., 1982; Major et al., 1998). Conversely, increased perceptions of support have been related to increased well-being, including beneficial effects on cardiovascular, immune, and endocrine outcomes (Uchino et al., 1996).

Although high levels of support tend to be associated with beneficial health effects, this may not always be the case. It has been suggested that the nature of the support individuals receive ought to match their current needs or goals, and be relevant to the stressor being experienced (Cutrona, 2000; Cutrona and Russell, 1990; Cutrona et al., 2007). For example, the perceived controllability of the stressor may dictate the effectiveness of the offered support. In this regard, it was found that emotional, or nurturant, support was consistently beneficial to individuals regardless of whether the stressor was controllable or not. However, when the situation was perceived as being uncontrollable, or when individuals perceived themselves as having control over (or the capabilities to deal with) the situation, instrumental support (i.e., informational or tangible support; having someone tell you what to do), was related to diminished well-being among individuals (Cutrona et al., 2000). It ought to be noted that social support may serve multiple functions, which can be applied inappropriately or ineffectively. For example, among individuals going through separation of a relationship, emotional expression in support groups seemed to help them understand the roots of distress,

whereas the same type of support intervention for bereaved individuals seemed to exacerbate their distress (Weiss, 1974; Weiss, 1976). Evidently, the effectiveness of support may depend not only on the quantity received, but also on the quality of the support, the type of stressor situation, and the current needs of the individual (Cutrona, 2000).

Negative support and impacts on health.

It has been suggested that that the presence of negative social interactions may play a role in health outcomes, and these negative events (unsupport) may be particularly deleterious. Ingram and colleagues (2001) have classified such negative interactions in terms of distancing, bumbling, blaming, and minimizing behaviors that individuals perceive from their social network in response to stressful events. Indeed, they found that these forms of negative support were associated with depression, psychological distress, and symptoms of physical well-being, and that overall unsupportive interactions were a significant independent predictor of these health outcomes when controlling for positive social support. Further studies have revealed similar findings when examining the influence of negative or poor social interactions and the mood disturbances of those suffering from HIV (Song and Ingram, 2002), and depression and distress during workplace adjustment among homosexual and bisexual employees (Smith and Ingram, 2004). In light of such findings, there has been increased attention focusing on the contribution of unsupport in other situations (Figueiredo et al., 2004; Mindes et al., 2003).

The role of social support in the development of emotional eating.

Although social support can be an important mitigating factor against several stressor-provoked physical and psychological health outcomes, little research exists concerning the role of social support on stress-eating, particularly in a non-eating disordered population. In a study of the effects of exam stress on eating, a lack of social support moderated the effects of trait anxiety to predict eating, wherein a lack of support and high trait anxiety was associated with increased eating, whereas high social support and low trait anxiety was associated with decreased eating in the period leading up to the exam (Pollard et al., 1995). Additionally, a longitudinal study examining risk factors in the development of binge eating among high school women, a lack of social support from peers, but not parents, was found to predict binge-eating onset (Stice et al., 2002). It was hypothesized that social support may have functioned, in part, to buffer against experiencing negative mood, a risk factor for binge eating. Such findings may be relevant in the study of sub-syndromal stress-eating, as negative mood in response to a stressor seems to be a common trigger for eating (Barker et al., 2006; Greeno and Wing, 1994; Kubiak et al., 2008; Spoor et al., 2007).

Behavioural Consequences Associated With Eating Disturbances

In addition to exhibiting endocrine alterations, eating disordered individuals have also been shown to display behavioural stress responses that differed from those of individuals without such a disorder. For example, binge eaters showed exaggerated ratings of stressfulness to a situation, and they seemed to use a greater variety of coping strategies to deal with this event, both positive and catastrophizing (Hansel and Wittrock, 1997). Additionally, bulimic individuals were found to endorse poorer coping strategies

(Hawkins and Clement, 1984). It seems that emotional eaters, a potentially sub-clinical form of binge-eating, also report stressful events as more aversive than do non-emotional eaters (Gibson et al., 2008). Furthermore, following a laboratory stressor, emotional eating was related to increased perceptions of threat, stressfulness, and decreased perceptions of challenge (Skomorovsky et al., 2006b), suggesting that stressor appraisals might also be altered among emotional eaters.

Objectives and Overview

Eating, and emotional eating in particular, is considered a coping mechanism, however scant evidence exists making a direct comparison between emotional eating and coping. Moreover, little consideration is given to compare stress-eating behaviors across a variety of stressor situations, taking gender into consideration. Thus, the present investigation assessed the relation between general perceived stress, coping, and emotional eating behaviors (Studies 1-4). Additionally, it examined the endorsement of eating as a coping mechanism in response to multiple stressor events, for men and women.

Furthermore, it seems that negative social interactions may be associated with eating disorder symptomatology or behaviours, highlighting the potential importance of (un)supportive interactions in the development of subclinical eating disturbances. In this regard, one might suspect that in the context of stressor-induced eating behaviours, unsupport, a stressor in its own right, may also contribute to the development of maladaptive coping mechanisms, such as emotional eating. Thus, one of the purposes of the present investigation was to assess the importance of social interactions in the

development of emotional eating behaviours, and the role of coping mechanisms in this relationship (Studies 3 and 4).

Although stressors have been related to specific food choices, it seems that the type and perceived intensity of stressor events may influence changes in food intake among some individuals. As it is not possible to examine such effects by way of single-session questionnaires, it was of interest to explore them in controlled laboratory settings presenting women with different psychosocial stressors (Study 5 and 6). Furthermore, the proposed studies assessed whether emotional eating (Study 5 and 6) served as predictors of stressor-induced behaviours (e.g., mood, stressor appraisal, coping) and eating.

Finally, given that stress-related hormones (i.e., cortisol) have been associated with changes in food preferences and intake, and that eating regulatory peptides (i.e., ghrelin) may be influenced by stressor experiences, a primary objective of these investigations was to examine whether hormone and peptide reactivity was related to specific food choices as well as food intake. Finally, since eating disordered individuals may display altered hormone levels and stressor responses, these studies examined whether emotional eating behaviours (a sub-clinical form of binge-eating disorder) were related to eating-related hormone responses, and whether these neuroendocrine responses were related to eating responses (Study 5 and 6).

Chapter 1

Eating as a coping mechanism: The influence of gender, stressor type and social support
on appraisal and coping responses

Abstract

Stressor-evoked appraisal and coping processes can be affected by factors such as stressor type, gender, and social support responses. In addition to emotion-focused, problem-focused and avoidant coping strategies, eating might serve as an independent coping method, possibly with ties to avoidant or emotional strategies. The current investigation examined how stressor type, participant gender, and support responses influenced stressor appraisals and coping endorsements in response to several hypothetical stressor scenarios. In Study 1 (N=238), gender, general perceived stress, and problem-focused coping and eating as coping *styles* were related to emotional eating. In response to the scenarios, women appraised more stress and threat than men, and also reported greater endorsements of eating as a coping *strategy*. Additionally, stressor type affected emotion-focused, problem-focused, and avoidant coping endorsements. Finally, relative to men, women demonstrated more associations between stressor appraisals and coping dimensions, and also between coping dimensions. In Study 2, (N=132) gender and eating as a coping *style* predicted emotional eating. Additionally, stressor type, support responses and gender were related to stressor appraisals; women appraised the scenarios as more stressful than men, and stressor type, support responses and gender interacted to affect appraisals processes. Stressor type and participant gender were independently related to the endorsement of all coping dimensions. Thus, eating as coping is particularly relevant for women, and varies across stressors. It is uncertain whether women's elevated coping efforts and increased number of associations between coping strategies reflect an adaptive form of coping flexibility, or a vulnerability to future psychopathology.

Introduction

Stressful events provoke increased eating among some individuals, such as those classified as restrained eaters or emotional eaters (Epel et al., 2001; Oliver et al., 2000; Wardle et al., 2000). It has been suggested that eating might serve as a coping mechanism (Jenkins et al., 2005; Macht et al., 2005; Timmerman and Acton, 2001), although there has been limited empirical evidence in this regard. In part, this might be a result of some coping instruments not considering eating as one of the strategies, whereas other instruments include only single items assessing eating, often in combination with other strategies to assess the larger dimensions of emotion-focused or avoidant coping (Carver et al., 1989; Cosway et al., 2000; Endler and Parker, 1990; Folkman and Lazarus, 1985).

Several reports indicated that coping dimensions comprising emotion-focused and avoidance/distraction might serve as pathways for the promotion or development of disturbed eating behaviors (Freeman and Gil, 2004; Gagnon-Girouard et al., 2010; Koff and Sangani, 1997; Spoor et al., 2007). There has also been the suggestion that stressor-provoked emotional changes might be accompanied by changes of eating (Macht, 2008; Rutledge and Linden, 1998), but few studies actually examined whether eating was used as a strategy to deal with stressors (e.g., (Jenkins et al., 2005; Macht, 2008; Macht et al., 2005). Given the long-term adverse health implications of using eating as a coping strategy (i.e., leading to excessive weight gain and associated health complications), the present investigation assessed several factors that might contribute to the endorsement of eating as a coping method.

Stressor Appraisals and Coping

When confronted with a stressor, individuals engage primary and secondary

appraisal processes, that include assessment of the threat, harm, or challenge to the self, as well as the controllability of the situation, and the coping resources available to deal with the event (Lazarus and Folkman, 1984). Importantly, appraisals can differ with the type of stressor event encountered and as a function of individual difference factors, such as gender. Indeed, women consistently report a variety of stressor situations as being more stressful (Day and Livingstone, 2003; Eaton and Bradley, 2008; Ptacek et al., 1992; Tamres et al., 2002), more uncontrollable, and less challenging than men (Matud, 2004; Ptacek et al., 1992; Tamres et al., 2002). However, these differences are not found in all investigations of stressor appraisals (Ptacek et al., 1994), and it is possible that gender differences in appraisal processes are dependent on the nature of the stressor.

Based on appraisals of the stressor, coping strategies are adopted in order to contend with potential stressor events. These coping efforts, often categorized as emotion-focused, problem-focused, and avoidant coping dimensions (Cosway et al., 2000; Endler and Parker, 1990) can vary depending on the nature of the stressor (Ben-Zur and Zeidner, 1996; Bjorck and Klewicki, 1997). As in the case of appraisals, gender also seems to play a role in determining the coping responses used. It seems that relative to men, women engage more emotion-focused and avoidant coping strategies (Cheng, 2001; Matud, 2004; Ptacek et al., 1992). Yet, there is evidence that women also engage a broader array of individual coping strategies to deal with a stressor than do men (Ben-Zur and Zeidner, 1996; Cheng, 2001; Ptacek et al., 1992), and it was also reported that they used problem-focused coping to a greater extent (Essex et al., 1999; Nicholls et al., 2007; Ptacek et al., 1992; Tamres et al., 2002).

It has been suggested (Bolger, 1990; Carver et al., 1993; Moos et al., 2006) that certain coping strategies (e.g., problem-focused coping) may be superior to others (e.g., emotion-focused coping), but this view was challenged given that the effectiveness of particular strategies may be situation-specific (Tennen et al., 2000). Indeed, in some situations emotion-focused coping strategies may be especially useful as it allows individuals to vent and to buy time in order to engage other forms of coping (Austenfeld and Stanton, 2004; Stanton et al., 2000a; Stanton et al., 2000b). Another view that has been offered is that the effectiveness of coping strategies should be defined in terms of the individual's coping flexibility, characterized as the ability to switch from one strategy to another as the situation demands, and also being able to use particular coping strategies (e.g., rumination) in conjunction with multiple other problem-focused (rather than emotion-focused) strategies. For instance, when coupled with problem-focused coping, rumination may be effective, whereas it is ineffective and even counterproductive when used concurrently with emotion-focused efforts; (Kelly et al., 2007b). It is likewise possible that the effectiveness of eating as a coping mechanism might be dependent upon whether it is used in conjunction with emotion-focused coping (essentially reflecting a stress outlet), avoidant coping (reflecting eating as a disengagement strategy), or problem-focused coping.

Social Support and Unsupportive Social Interactions

Positive social support has often been considered to act as a buffer against adverse effects of stressor (Newsom et al., 2005; Skomorovsky et al., 2006a). Although the absence of support might not be helpful in contending with stressors, the presence of unsupportive social interactions (which is distinct from the lack of support) may be

exceptionally detrimental to well-being. Unsupportive interactions refer to support not being forthcoming when it was reasonably expected, or occasions when attempts at support are actually counterproductive (e.g., bumbling, blaming, distancing or minimizing). In fact, such unsupportive interactions were associated with negative stressor-related outcomes, such as depressive symptoms (Ingram et al., 2001a; Matheson et al., 2008; Song and Ingram, 2002) and binge eating behaviors (Steiger et al., 1999). Additionally, unsupportive interactions have been associated with increased perceptions of threat (Mindes et al., 2003), as well as emotion-focused and avoidant coping efforts (Mindes et al., 2003; Song and Ingram, 2002).

Although gender differences in the stress-coping relationship are well documented, it is uncertain whether gender differences exist with respect to the effects of positive and negative supportive interactions on appraisals and coping processes. In this regard, the tend-and-befriend perspective of female-specific stress responses suggests that women may be particularly reliant on social networks during times of distress (Taylor et al., 2000). As such, the supportive and unsupportive responses received in the face of a stressor might be particularly critical for women when considering stressor appraisals and the coping mechanisms endorsed. Additionally, it is indeed possible that the availability of supportive and unsupportive responses would influence the use of eating as a coping method. In fact, a lack of social support was related to increased stress-induced eating among women, but not men (Laitinen et al., 2002).

The Present Investigation

The current investigation examined the extent to which eating is used as a coping

style, or as a coping *strategy*¹ in response to specific types of negative life events, as well as the relation between coping styles and emotional eating behaviors. Additionally, the present investigation assessed whether participant gender and the nature of the stressor influenced how individuals appraised and coped with hypothetical stressors, with a particular focus on eating as a coping mechanism (Study 1). Moreover, we also assessed the cross correlations between coping styles as well as coping strategies, including the use of eating as a method of coping, in an effort to determine whether men and women use different coping methods in tandem with one another, possibly reflecting their coping flexibility.

A second study evaluated how supportive (i.e., positive) and unsupportive (i.e., negative) social interactions might influence coping, and especially eating as a coping method in response to different hypothetical stressor situations. It was expected, as previously reported (Elfhag and Morey, 2008; Larsen et al., 2006; Snoek et al., 2007), that women would report greater emotional eating, and might, in fact, use eating as a coping style more than men (Study 1 and 2). Additionally, it was expected that when presented with written scenarios of potentially stressful situations women would appraise these scenarios more negatively than men, and would report increased use of eating as a coping strategy (Study 1 and 2). Finally, in assessing support responses in the written scenarios, it was expected that women would be particularly sensitive to the unsupportive social interactions, compared to the supportive or no support conditions (Study 2).

Inasmuch as men and women might not be equally responsive to the same stressors, we

¹ Coping *style* refers to dispositional coping (i.e., coping efforts typically engaged by an individual), whereas coping *strategy* refers to situational coping (i.e., coping efforts engaged in response to specific stressor events).

examined scenarios that entailed a variety of stressful situations that were commonly encountered by university students.

Methods

Participants

Male (Study 1: $n = 62$, $M_{age} = 19.92$ years, $SD_{age} = 3.02$ years; Study 2: $n = 42$, $M_{age} = 20.05$ years, $SD_{age} = 3.64$ years) and female (Study 1: $n = 176$, $M_{age} = 19.99$ years, $SD_{age} = 3.23$ years; Study 2: $n = 90$; $M_{age} = 19.93$ years, $SD_{age} = 4.47$ years) undergraduate students were recruited to participate in an experiment examining student responses to written scenarios. The majority of participants who reported their ethnicity self-identified as Caucasian (Study 1: 55.0%, $n = 126$; Study 2: 55.5%, $n = 71$), with the remainder of participants self-identifying as East Asian (Study 1: 8.7%, $n = 20$; Study 2: 12.5%, $n = 16$), Black (Study 1: 8.3%, $n = 19$; Study 2: 9.4%, $n = 12$), Asian (Study 1: 8.7%, $n = 19$; Study 2: 8.6%, $n = 11$), Middle Eastern (Study 1: 7.4%, $n = 17$; Study 2: 8.6%, $n = 11$), Hispanic (Study 1: 6.6%, $n = 15$, Study 2: 1.6%, $n = 2$), Aboriginal (Study 1: 1.3%, $n = 3$; Study 2: 2.3%, $n = 3$), and Other (Study 1: 4.4%, $n = 10$; Study 2: 1.6%, $n = 2$).

Measures

Emotional eating. The Emotional Eating subscale of the Dutch Eating Behavior Questionnaire (DEBQ) (van Strien et al., 1986) assessed participant emotional eating behaviours. This scale consists of 13 items asking about the frequency with which individuals have a desire to eat in response to negative emotional states (e.g., anger, disappointment, stress, boredom). Items are rated on a 5-point Likert scale ranging from 0 “Never” to 4 “Very Often”. Reliability for this scale was high (Study 1: Cronbach’s $\alpha = .95$; Study 2: Cronbach’s $\alpha = .96$).

Coping styles. The Survey of Coping Profiles Endorsed (SCOPE) (Matheson and Anisman, 2003), with four additional items asking about eating as a coping mechanism, assessed participant coping styles. The measure asks participants to rate on a scale of 0 “Never” to 4 “Almost Always” the extent to which they have used each of the 54 coping strategies as a way of dealing with stressful events in recent weeks. The measure consists of 15 subscales: problem solving, cognitive restructuring, active distraction, rumination, avoidance, humor, seeking social support, emotional expression, emotional containment, self-blame, other-blame, passive resignation, turning to religion, wishful thinking, and eating. A factor analysis, using a varimax rotation, was performed in order to obtain a more parsimonious grouping of the coping dimensions. As turning to religion did not initially factor with the other dimensions, and because it was of interest to examine eating as a separate coping dimension, they were not included in the analysis. Three factors emerged, which accounted for 59.84% of the variance. These factors represented emotion-focused coping (rumination, emotional expression, self-blame, other-blame, wishful thinking) (Study 1: Cronbach’s $\alpha = .89$; Study 2: Cronbach’s $\alpha = .90$), problem-focused coping (problem solving, cognitive restructuring, active distraction, humor, seeking social support) (Study 1: Cronbach’s $\alpha = .88$; Study 2: Cronbach’s $\alpha = .90$), and avoidant coping (avoidance, passive resignation, emotional containment) (Study 1: Cronbach’s $\alpha = .81$; Study 2: Cronbach’s $\alpha = .82$). Given the small number of items making up the eating coping dimension, reliability was acceptable (Study 1: Cronbach’s $\alpha = .67$; Study 2: $\alpha = .71$).

General perceived stress. The Perceived Stress Scale (Cohen et al., 1983) assessed the general stress participants experienced in the past month. Using a Likert scale

ranging from 0 “Never” to “Very Often”, participants indicated the degree to which they have felt or thought the way described in each of the 14 items making up the scale. Reliability was good (Study 1: Cronbach’s $\alpha = .85$; Study 2: Cronbach’s $\alpha = .83$).

Stressor appraisals. Single items from the Stress Appraisal Measure (Peacock and Wong, 1990) assessed participant appraisals of uncontrollability, threat, challenge, and stress in response to each of the four hypothetical written scenarios. Participants rated their appraisals of each of the stressor situations on a scale of 1 “Not at all” to 5 “Extremely”.

Stressor scenario coping responses. Single items² from each of the SCOPE dimensions were used to assess the extent to which participants would endorse each of the coping strategies in response to the hypothetical stressor scenarios. Participants rated their likelihood to use the coping strategies on a scale of 0 “Not at all” to 4 “Extremely so”. Emotion-focused, problem-focused and avoidant coping dimensions were created to reflect the coping subscale groupings of participants’ general coping styles (see above). A single item, “Find comfort in food” assessed eating as a coping style. Across all coping dimensions and scenario types, Cronbach alphas were in the moderate to high range (>0.68) with the exception of avoidant coping, which was low (>0.48). This is in keeping with previous reports indicating that the reliability of questions regarding avoidant strategies was generally lower than that of other strategies (Carver et al., 1989; Matheson and Anisman, 2003).

Procedure

Study 1.

² Two items were included from the seeking social support subscale so that seeking

Male and female Carleton undergraduate students were recruited via an online recruiting system for a study assessing participant responses to written scenarios (Appendix A). Participants were informed that the purpose of the study was to assess factors that influence how students appraise and respond to potentially stressful events. They were then presented an informed consent form (Appendix A) to read and sign, and completed their questionnaire booklet. The measures included general perceived stress, coping styles (i.e., coping methods individuals generally used in recent weeks), and emotional eating behaviors (Appendix E). Participants then read four written scenarios describing (a) a stressful social situation in which a continued disagreement with a friend results after an individual explained a recent argument with a boy/girlfriend, the friend questions their actions in the situation, and the two part awkwardly and have yet to be in touch (b) an academic situation in which an individual has just received a failing grade on a heavily weighted midterm, so they have to do really well on the final to pass the course despite having all of their final exams in a 5-day period, (c) time pressure in which an individual has to complete work assignments, meet scholastic deadlines, fulfill athletic and social commitments, and complete regular household chores in a few days so that they can help a coworker with a big project with high time demands, and (d) and financial situation in which an individual's monthly rent is due and they have no money for groceries. The individual is short of money due to unexpected expenses in combination with regular expenses, a decrease in hours from a part-time job, and inability for parents to help with money at this point in time (see Appendix F). After each scenario was presented, participants provided their appraisals of the situation, as well as the

support for both informational and emotional purposes would be assessed.

coping *strategies* they would use in response to the situation (Appendix F). When the study was completed, participants were debriefed (Appendix A) and granted course credit for participating in the study.

Study 2.

The procedure for Study 2 was similar to that of Study 1, except that only two written stressor scenarios were used in this study, based on the findings of Study 1 (see Appendix B for Study 2 recruitment notice, informed consent forms, and debriefing). Social and academic scenarios were chosen for this study because they have both reported frequently as common stressors among university students (Ptacek et al., 1992; Valentiner et al., 1994), and thus participants would be able to relate to these stressors. Specifically, the scenarios comprised the academic stressor of Study 1, and a social stressor that was developed specifically for this study. Unlike the stressor in Study 1 that used the sharing of problems in a dating relation as the reason for a conflict with a friend, the scenario in Study 4 comprised one in which a friend borrowed money (\$20) from an individual, then wouldn't repay the loan and avoided contact with the individual, despite repeated efforts to get in touch (see Appendix F). The reason a different scenario was used in Study 2 was that in Study 1, not all participants were in a dating relationship (45% reported being single) and thus participants' ability to relate to the situation might have been affected. Indeed, those participants in a relationship reported significantly greater threat in response to the social scenario than did participants who were not in a relationship. As well, a preliminary assessment of the scenario developed for Study 2 revealed that situations such as this were relatively common and thus participants could readily relate to this scenario.

Support manipulation.

One of the primary goals of this investigation was to assess the differing effects of positive and negative support on stressor appraisals and coping responses to potentially stressful events. Participants were presented with two scenarios based on the findings of Study 1; one scenario focused on academic difficulties and the other dealt with a social stressor. For some participants the scenarios involved potentially stressful situations (academic and social) that were met with positive social support ($n = 45$), whereas for others the distress was met with negative unsupportive interactions, ($n = 46$) and in a third condition no support (positive or negative) was offered ($n = 41$) (see hypothetical scenarios in Appendix F). Participants were randomly assigned to one of these three conditions upon entering the laboratory session.

Statistical Analyses

Independent samples t-tests or MANOVA were used to examine differences in general perceived stress, emotional eating, and coping styles between male and female participants. Separate hierarchical linear regression analyses were performed in order to determine potential moderating effects of gender on the relationship between both perceived stress and coping styles on eating. In Study 1, separate 2 (gender: male, female) x 4 (stressor type: social, academic, time, financial) mixed measures ANOVAs, with stressor type as the within subjects factor, assessed the effects of participant gender and stressor type on appraisals (uncontrollability, threat, challenge, stressfulness) and coping endorsements (eating, emotion-focused, problem-focused, avoidant) in response to the written stressor scenarios. In Study 2, separate 2 (gender: male, female) x 3 (support condition: supportive, unsupportive, no support) x 2 (stressor type: social,

to the written stressor scenarios. In Study 2, separate 2 (gender: male, female) x 3 (support condition: supportive, unsupportive, no support) x 2 (stressor type: social, academic) mixed measures ANOVAs, with stressor type as the within subjects factor, assessed the same appraisal and coping outcomes. Follow-up t-tests with Bonferroni corrected alphas, were used for all pairwise comparisons across stressor type (Study 1) and across support conditions (Study 2).

Results

Study 1

Gender differences in general stress and coping styles.

As shown in Table 2, women reported greater general perceived stress, $t(236) = -2.64, p < .01$, and emotional eating, $t(236) = -5.20, p < .001$, compared to men. Additionally, a one-way Multivariate Analysis of Variance (MANOVA) examining the effects of participant gender on emotion-focused, problem-focused, avoidant and eating coping styles indicated a significant effect of sex, $Pillai's = .039, F(4,233) = 2.35, p = .055$, wherein women endorsed greater avoidant, $F(1,236) = 4.67, p < .05, \eta^2 = .019$, and eating coping styles, $F(1,236) = 6.96, p < .01, \eta^2 = .029$ than did men (Table 2). The emotion focused coping among women, as seen in Table 2, was modestly greater than in men, but this difference was not statistically significant. Finally, the sexes did not differ with respect to problem-focused coping.

Effects of gender, perceived stress, and coping styles on emotional eating.

Regression analyses confirmed that compared to men, women were more likely to report emotional eating, $B = .34, t(231) = 3.39, p < .01$, and overall perceived stress was associated with increased emotional eating, $B = .12, t(231) = 1.90, p = .059$. Problem-

focused coping style was associated with decreased emotional eating, $B = -.10$, $t(231) = -2.09$, $p < .05$, whereas emotion-focused and eating coping styles were associated with increased emotional eating, $B = .14$ and $.51$, $t(231) = 2.11$ and 11.09 , $p < .05$ and $.001$, respectively. This model accounted for 50.4% of the variance in emotional eating.

Table 2. Mean (SD) of Stress-coping Characteristics of Men and Women for Study 1 (0-4 scales).

	Men	Women
Perceived Stress	1.68 (.49)	1.93 (.54)**
Emotional Eating	.86 (.73)	1.47 (.93)***
Eating as Coping	1.21 (.78)	1.54 (.89)**
Emotion-Focused Coping	1.66 (.63)	1.80 (.71)
Problem-Focused Coping	2.31 (.68)	2.38 (.64)
Avoidant Coping	1.83 (.67)	2.04 (.63)*

*p < .05, **p < .01, ***p < .001

Stressor appraisals and coping responses: Influence of participant gender and stressor type

Separate mixed measures ANOVAs indicated that the nature of the stressor influenced appraisals of uncontrollability, $F(3,702) = 27.95, p < .001, \eta^2 = .107$, threat, $F(3,702) = 179.32, p < .001, \eta^2 = .434$, challenge, $F(3,702) = 273.33, p < .001, \eta^2 = .539$, and stressfulness, $F(3,705) = 124.60, p < .001, \eta^2 = .347$ (Table 3). Overall, the social situation was appraised as less negative than the other scenarios, in that it was perceived as being less uncontrollable, threatening, and stressful, and was associated with higher appraisals of challenge, $ps < .05$. In contrast, the academic and financial situations were consistently appraised as the most negative scenarios, as they were typically rated as more uncontrollable, threatening, stressful, and received low challenge appraisals, compared to the other scenarios, $ps < .05$ (Table 3). Additionally, compared to men, women reported higher appraisals of threat and stressfulness, $F(1,234) = 5.51, p < .05, \eta^2 = .023$, and $F(1,235) = 22.17, p < .001, \eta^2 = .086$, respectively (Table 3).

As a whole, women ($M = 1.42, SD = 1.12$) were more likely to endorse eating as a coping strategy than were men ($M = .84, SD = .96$), $F(1,235) = 12.57, p < .001, \eta^2 = .051$ (Figure 1). Additionally, the type of stressor moderated the relationship between participant gender and the endorsement of eating as a coping strategy, $F(3,705) = 2.98, p < .05, \eta^2 = .013$. Follow-up analyses indicated that among men, the nature of the stressor was unrelated to the endorsement of eating as a coping strategy, $F(3,705) = 1.92, ns$, however, this effect was significant among women, $F(3,705) = 10.78, p < .001, \eta^2 = .053$. Specifically, women were more likely to endorse the use of eating as a coping

mechanism in response to the social and academic scenarios, relative to the time pressure and financial scenarios, $ps < .05$ (Figure 1).

Table 3. *Mean (SD) of Stressor Appraisals as a Function of Gender and Stressor Type (1-5 scale).*

	Men	Women	Total
Uncontrollable			
Social	1.61(.89)	1.64(.91)	1.64(.91) ^{bcd}
Academic	2.31(1.28)	2.43(1.24)	2.39(1.25) ^a
Time Pressures	2.24 (1.29)	2.18(1.25)	2.19(1.26) ^{ad}
Financial	2.50(1.24)	2.50(1.24)	2.50(1.24) ^{ac}
Total	2.17(.81)	2.17(.81)	
Challenge			
Social	4.08(1.00)	3.99(.88)	4.02(.91) ^{bd}
Academic	4.05(.88)	3.63(.92)	3.74(.93) ^{ad}
Time Pressures	4.05(1.08)	4.00(.83)	4.01(.90) ^d
Financial	1.82(1.29)	1.75(1.33)	1.77(1.32) ^{abc}
Total	3.99(.86)	3.84(.65)	
Threatening			
Social	2.21(.98)	2.48(1.12)	2.41(1.09) ^{bcd}
Academic	3.84(1.15)	4.26(.92)	4.15(1.00) ^{ac}
Time Pressures	3.10(1.13)	3.32(1.13)	3.26(1.13) ^{abd}
Financial	4.16(1.04)	4.24(.86)	4.22(.91) ^{ac}
Total	3.33(.72)	3.56(.71) ^e	
Stressful			
Social	2.82(1.06)	3.29(1.10)	3.26(1.11) ^{bcd}
Academic	4.23(.98)	4.70(.65)	4.58(.78) ^{ac}
Time Pressures	3.47(1.11)	3.98(1.01)	3.84(1.06) ^{abd}
Financial	4.15(1.10)	4.52(.76)	4.42(.87) ^{ac}
Total	3.67(.80)	4.12(.60) ^e	

^asignificantly different than the social situation

^bsignificantly different than the academic situation

^csignificantly different than the time pressures situation

^dsignificantly different than the financial situation

^esignificantly different than men

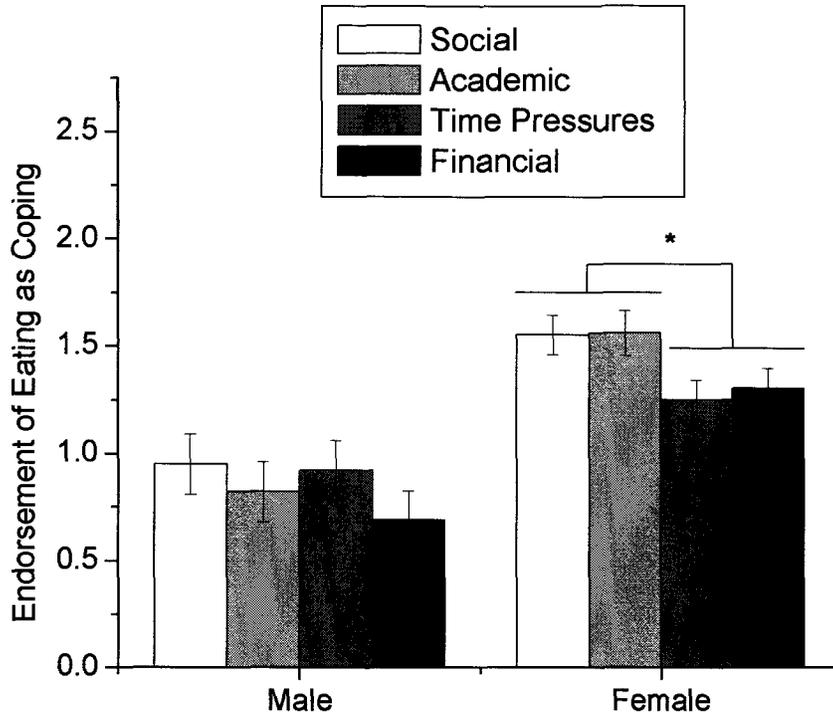


Figure 1. Mean (\pm SEM) of the endorsement of eating as a coping strategy as a function of stressor type.

It also appeared that the endorsement of emotion-focused, $F(3,708) = 26.60, p < .001, \eta^2 = .101$, problem-focused, $F(3,708) = 15.60, p < .001, \eta^2 = .062$, and avoidant, $F(3,708) = 17.43, p < .001, \eta^2 = .609$, coping strategies varied as a function of the nature of the stressor. Overall, it seemed as though participants were less likely to engage emotion-focused and problem-focused coping in response to the time pressure situation, compared to the other stressor situations, $ps < .05$ (Table 4). Additionally, the financial situation evoked greater problem-focused coping efforts than the remaining situations, and the social situation elicited increased avoidant coping responses, $ps < .05$ (Table 4).

Associations between stressor appraisals and coping responses.

Zero-order bivariate Pearson correlations between stressor appraisals and coping responses were performed separately for men and women to examine the association between these factors as a function of participant gender. Significant correlations are displayed in Table 5. In general, it seemed that appraisals were more closely tied to coping responses among women, than men. Additionally, it seemed that appraisals of challenge and stressfulness were typically associated with fewer coping dimensions than appraisals of uncontrollability and threat. Of particular significance in the present investigation was that among men, the use of eating as coping strategy was only associated with stressor appraisals in the social situation. However, among women, eating as a coping strategy was tied to appraisals of uncontrollability, threat, and stressfulness across all situations, except for the financial scenario.

Table 4. Mean (SD) of Coping Endorsement as a Function of Gender and Stressor Type for Study 1 (0-4 scale).

	Men	Women	Total
Emotion-Focused			
Social	1.72(.71)	1.89(.78)	1.85(.76) ^c
Academic	1.73(.72)	1.88(.96)	1.84(.90) ^c
Time Pressures	1.35(.75)	1.50(.88)	1.46(.85) ^{abd}
Financial	1.72(.82)	1.85(.95)	1.81(.92) ^c
Total	1.63(.60)	1.78(.79)	
Problem-Focused			
Social	2.31(.75)	2.39(.76)	2.37(.76) ^{cd}
Academic	2.31(.76)	2.34(.79)	2.33(.78) ^{cd}
Time Pressures	2.03(.82)	2.27(.81)	2.21(.81) ^{abd}
Financial	2.42(.79)	2.58(.71)	2.54(.73) ^{abc}
Total	2.27(.65)	2.40(.64)	
Avoidant			
Social	1.95(.84)	1.92(.77)	1.93(.79) ^{bcd}
Academic	1.77(.85)	1.53(.84)	1.60(.85) ^a
Time Pressures	1.57(.94)	1.53(.88)	1.54(.89) ^a
Financial	1.55(.83)	1.55(.86)	1.55(.85) ^a
Total	1.71(.71)	1.63(.66)	

^asignificantly different than the social situation

^bsignificantly different than the academic situation

^csignificantly different than the time pressures situation

^dsignificantly different than the financial situation

Table 5. *Zero-Order Bivariate Pearson Correlations between Stressor Appraisals and Coping Endorsements Displayed as a Function of Participant Gender, and Type of Stressor Situation.*

Situation	Appraisal	Men (n = 62)		Women (n = 176)	
		Appraisal is correlated with	r	Appraisal is correlated with	r
Social	Uncontrollable	Eating as Coping	.14	Eating as Coping	.03
		Emotion-Focused Coping	.21	Emotion-Focused Coping	.25**
		Problem-Focused Coping	.03	Problem-Focused Coping	.04
		Avoidant Coping	.33**	Avoidant Coping	.15*
	Threat	Eating as Coping	.30*	Eating as Coping	.18*
		Emotion-Focused Coping	.24*	Emotion-Focused Coping	.21*
		Problem-Focused Coping	.02	Problem-Focused Coping	.05
		Avoidant Coping	.35**	Avoidant Coping	.12
	Challenge	Eating as Coping	-.29*	Eating as Coping	-.06
		Emotion-Focused Coping	-.37**	Emotion-Focused Coping	-.03
		Problem-Focused Coping	.10	Problem-Focused Coping	.21**
		Avoidant Coping	-.48***	Avoidant Coping	-.04
	Stressful	Eating as Coping	.31*	Eating as Coping	.26**
		Emotion-Focused Coping	.30*	Emotion-Focused Coping	.40***
		Problem-Focused Coping	.09	Problem-Focused Coping	.07
		Avoidant Coping	.26*	Avoidant Coping	.12
Academic	Uncontrollable	Eating as Coping	.12	Eating as Coping	.10
		Emotion-Focused Coping	.23 ⁺	Emotion-Focused Coping	.07
		Problem-Focused Coping	-.25*	Problem-Focused Coping	-.06
		Avoidant Coping	.15	Avoidant Coping	.15*

Table 5. (Cont.)

Situation	Appraisal	Men (n = 62)		Women (n = 176)	
		Appraisal is correlated with	r	Appraisal is correlated with	r
	Threat	Eating as Coping	-.12	Eating as Coping	.23**
		Emotion-Focused Coping	.02	Emotion-Focused Coping	.44***
		Problem-Focused Coping	-.25*	Problem-Focused Coping	-.01
		Avoidant Coping	-.16	Avoidant Coping	.15*
	Challenge	Eating as Coping	.03	Eating as Coping	-.10
		Emotion-Focused Coping	-.25*	Emotion-Focused Coping	-.14*
		Problem-Focused Coping	.07	Problem-Focused Coping	.20**
		Avoidant Coping	.06	Avoidant Coping	-.10
	Stressful	Eating as Coping	.07	Eating as Coping	.06
		Emotion-Focused Coping	.13	Emotion-Focused Coping	.25**
		Problem-Focused Coping	-.09	Problem-Focused Coping	-.18*
		Avoidant Coping	-.10	Avoidant Coping	.04
Time	Uncontrollable	Eating as Coping	.23 ⁺	Eating as Coping	.14⁺
		Emotion-Focused Coping	.19	Emotion-Focused Coping	.21**
		Problem-Focused Coping	-.02	Problem-Focused Coping	.07
		Avoidant Coping	.21	Avoidant Coping	.23**
	Threat	Eating as Coping	.06	Eating as Coping	.30***
		Emotion-Focused Coping	.15	Emotion-Focused Coping	.31***
		Problem-Focused Coping	.30*	Problem-Focused Coping	.07
		Avoidant Coping	.21	Avoidant Coping	.25**
	Challenge	Eating as Coping	-.14	Eating as Coping	-.06
		Emotion-Focused Coping	-.35**	Emotion-Focused Coping	-.20**
		Problem-Focused Coping	.10	Problem-Focused Coping	.18*
		Avoidant Coping	-.21	Avoidant Coping	-.25**

Table 5. (Cont.)

Situation	Appraisal	Men (n = 62)		Women (n = 176)	
		Appraisal is correlated with	r	Appraisal is correlated with	r
	Stressful	Eating as Coping	.03	Eating as Coping	.16*
		Emotion-Focused Coping	.39**	Emotion-Focused Coping	.24**
		Problem-Focused Coping	.22 ⁺	Problem-Focused Coping	.03
		Avoidant Coping	.17	Avoidant Coping	.09
Financial	Uncontrollable	Eating as Coping	-.01	Eating as Coping	-.02
		Emotion-Focused Coping	.29*	Emotion-Focused Coping	.19*
		Problem-Focused Coping	.09	Problem-Focused Coping	.02
		Avoidant Coping	.31*	Avoidant Coping	.23**
	Threat	Eating as Coping	-.05	Eating as Coping	.09
		Emotion-Focused Coping	.18	Emotion-Focused Coping	.28***
		Problem-Focused Coping	.14	Problem-Focused Coping	.08
		Avoidant Coping	-.15	Avoidant Coping	.17*
	Challenge	Eating as Coping	-.18	Eating as Coping	-.10
		Emotion-Focused Coping	-.31*	Emotion-Focused Coping	-.01
		Problem-Focused Coping	-.02	Problem-Focused Coping	.18*
		Avoidant Coping	-.28*	Avoidant Coping	.02
	Stressful	Eating as Coping	.08	Eating as Coping	.04
		Emotion-Focused Coping	.34*	Emotion-Focused Coping	.24**
		Problem-Focused Coping	-.00	Problem-Focused Coping	-.04
		Avoidant Coping	-.10	Avoidant Coping	.12

⁺p < .10, *p < .05, **p < .01, ***p < .001

Associations between coping dimensions.

Bivariate Pearson correlations assessed the relations between the various coping *styles* for men and women. As indicated in Table 6, emotion-focused coping was associated with each of the other coping dimensions among both men and women. Interestingly, whereas these were the only significant associations observed between the coping dimensions in men, among women eating was associated with both emotion and avoidant coping styles.

The cross correlations between the different coping strategies tended to vary with the stressor scenarios as with gender. As depicted in Table 7, among women, eating as a coping strategy was tied to each of the other strategies across the 4 scenarios, with the exception of the social stressor where eating and problem focused coping were not significantly related to one another. Among men, emotional eating strategies were likewise tied to emotional and avoidant coping across the scenario. However, eating was not correlated with problem-focused coping in the social, academic and time pressure situations.

Table 6. *Correlations Between Dispositional Coping Styles Displayed as a Function of Participant Gender*

	EF	PF	AV	Eat
Emotion-Focused		.31*	.56***	.35**
Problem-Focused	.16*		.11	.19
Avoidant	.61***	.15*		.18
Eating	.31***	.14	.28**	

Note: The correlations between coping dimensions among men (n = 62) are displayed above the diagonal, whereas the correlations among women (n = 176) are displayed below the diagonal.

Table 7. Correlations Between Situational Coping Dimensions Displayed as a Function of Stressor Type and Participant Gender

	Social				Academic				Time Pressure				Financial			
	EF	PF	AV	Eat	EF	PF	AV	Eat	EF	PF	AV	Eat	EF	PF	AV	Eat
Emotion		.33**	.43**	.41**		.16	.28*	.24*		.33**	.38**	.29*		.19	.36**	.41**
Problem	.28***		.15	.14	.19*		-.09	.15	.32***		.24 ⁺	.19	.25**		-.05	.28*
Avoidant	.48***	.27***		.43**	.32***	.14 ⁺		.45***	.57***	.22**		.24*	.53***	.25**		.40**
Eating	.45***	.12	.35***		.48***	.15*	.24**		.49***	.24**	.37***		.37***	.19*	.30***	

Note: The correlations between coping dimensions among men (n = 62) are displayed above the diagonal, whereas the correlations among women (n = 176) are displayed below the diagonal.

Study 2

Gender differences in general stress and coping styles.

Analyses of the gender differences indicated that relative to men, women reported greater emotional eating, $t(130) = -3.75, p < .001$, as well as a modest, non-significant tendency for increased perceived stress, $t(130) = -1.81, p = .072$ (Table 8). Additionally, a one-way MANOVA revealed a significant effect of participant gender on emotion-focused, problem-focused, avoidant and eating coping styles, $Pillai's = .111, F(4,127) = 3.95, p < .01$. Follow-up univariate analyses indicated that, compared to men, women endorsed greater emotion-focused, $F(1,130) = 7.57, p < .01, \eta^2 = .055$, problem-focused, $F(1,130) = 8.86, p < .01, \eta^2 = .064$, avoidant, $F(1,130) = 6.12, p < .05, \eta^2 = .045$, and eating coping styles, $F(1,130) = 5.61, p < .05, \eta^2 = .041$ (Table 8).

The effects of participant gender, perceived stress, and coping styles on emotional eating.

A considerable portion of the variance of emotional eating behaviors was explained by the relationship between participant gender and coping styles, $R^2 = .455$. Specifically, relative to men, women reported higher levels of emotional eating, $B = .25, t(168) = 2.06, p < .05$. Additionally, the endorsement of eating as a coping style was associated with increased emotional eating, $B = .524, t(168) = 9.08, p < .001$.

Table 8. Mean (SD) of Stress-coping Characteristics of Men and Women for Study 2 (0-4 scales).

	Men	Women
Perceived Stress	1.79(.46)	1.96(.53) ⁺
Emotional Eating	.87(.79)	1.53(1.00) ^{***}
Eating as Coping	1.16(.75)	1.53(.88) [*]
Emotion-Focused Coping	1.53(.69)	1.90(.73) ^{**}
Problem-Focused Coping	2.02(.73)	2.40(.68) ^{**}
Avoidant Coping	1.79(.77)	2.10(.59) [*]

⁺p < .10, ^{*}p < .05, ^{**}p < .01, ^{***}p < .001 compared to men

Stressor appraisals and coping responses: Effects of participant gender and type of support.

Analyses of appraisals of uncontrollability revealed a significant gender, support condition, and stressor type interaction, $F(2,126) = 5.95, p < .01, \eta^2 = .086$ (see Figure 2a). Follow-up analyses revealed that in response to the social scenario men perceived the unsupportive condition as more uncontrollable than the no support condition, $p < .05$. An opposite, but marginal effect was observed among men in response to the academic scenario, $p = .066$, in that the unsupportive condition was perceived as less uncontrollable than the no support condition. Among women, the support condition did not affect appraisals of uncontrollability in response to the social scenario. However, in response to the academic scenario, social support buffered against appraisals of uncontrollability in comparison to receiving no support, $ps < .05$ (see Figure 2a).

The nature of the stressor affected participant appraisals of threat, $F(1,126) = 169.79, p < .001, \eta^2 = .574$, in that the academic situation was perceived as more threatening than the social scenario, (see Figure 2b). In contrast, as displayed in Figure 2c, the support condition moderated the effect of stressor type on appraisals of challenge, $F(2,126) = 5.33, p < .01, \eta^2 = .078$. Follow-up analyses revealed that support received did not influence challenge appraisals in response to the social scenario. In contrast, in response to the academic situation, increased challenge appraisals were reported in both the supportive and unsupportive conditions, compared to the no support condition, $ps < .05$ (see Figure 2c).

Overall, women ($M = 3.36, SD = .81$) appraised the written scenarios as more stressful than men ($M = 3.04, SD = .86$), $F(1,126) = 4.20, p < .05, \eta^2 = .032$, and support

condition affected participant appraisals of stress, $F(2,126) = 3.79, p < .05, \eta^2 = .057$, wherein the participants who received supportive responses ($M = 2.96, SD = .77$) reported less stress than those who received unsupportive responses ($M = 3.39, SD = .86$) or no support ($M = 3.43, SD = .82$), $p < .05$. Additionally, as shown in Figure 2d, the nature of the stressor moderated the effect of support condition on appraisals of stressfulness, $F(1,126) = 4.92, p < .01, \eta^2 = .072$. Follow-up analyses indicated that appraisals of stress in response to the social scenario did not vary as a function of support condition. In contrast, for the academic scenario, receiving no support was perceived as more stressful than the receipt of supportive or unsupportive responses, $ps < .05$ (see Figure 2d).

Table 9. *Mean(SD) of Coping Endorsement as a Function of Gender and Stressor Type for Study 2 (0-4 scale).*

	Coping Endorsement		
	Men	Women	Total
Eating			
Social	.57(.86)	1.07(1.12)	.91(1.06) ^b
Academic	.79(1.16)	1.39(1.23)	1.20(1.24) ^a
Total	.69(.98)	1.22(1.07) ^c	
Emotion-Focused			
Social	1.28(.72)	1.60(.76)	1.50(.76) ^b
Academic	1.51(.86)	1.88(.79)	1.76(.83) ^a
Total	1.40(.69)	1.75(.68) ^c	
Problem-Focused			
Social	1.77(.81)	2.29(.78)	2.13(.82) ^b
Academic	2.20(.77)	2.61(.61)	2.48(.69) ^a
Total	1.98(.72)	2.45(.61) ^c	
Avoidant			
Social	1.50(.75)	1.84(.87)	1.73(.84) ^a
Academic	1.37(.72)	1.62(.80)	1.54(.78) ^b
Total	1.43(.62)	1.72(.71) ^c	

^asignificantly different than the social situation

^bsignificantly different than the academic situation

^csignificantly different than men

Relative to men, women reported greater endorsements of eating as a coping response, $F(1,125) = 7.78, p < .01, \eta^2 = .059$ (Table 9). Additionally, participant endorsements of eating as a coping strategy, varied according to the nature of the stressor, wherein the academic situation was more likely to elicit endorsements of eating as a coping strategy than the social situation, $F(1,125) = 10.41, p < .01, \eta^2 = .077$ (Table 9).

Overall, it seemed that in response to the stressor scenarios, women endorsed each of the coping dimensions to a greater extent than did men (Table 9). Indeed, they reported greater emotion-focused, $F(1,6.97), p < .01, \eta^2 = .053$, problem-focused, $F(1,126) = 14.57, p < .001, \eta^2 = .104$, and avoidant coping efforts, $F(1,125) = 5.86, p < .05, \eta^2 = .045$ (Table 9). Emotion-focused coping responses also varied as a function of the nature of the stressor, $F(1,125) = 12.74, p < .001, \eta^2 = .099$, as did problem-focused, $F(1,126) = 33.93, p < .001, \eta^2 = .212$, and avoidant coping responses, $F(1,125) = 4.78, p < .05, \eta^2 = .037$. As in the case of eating as a coping strategy, increased endorsements of these coping efforts were reported following the academic situation (Table 9). These outcomes were evident irrespective of whether participants read the supportive, unsupportive or no support scenarios.

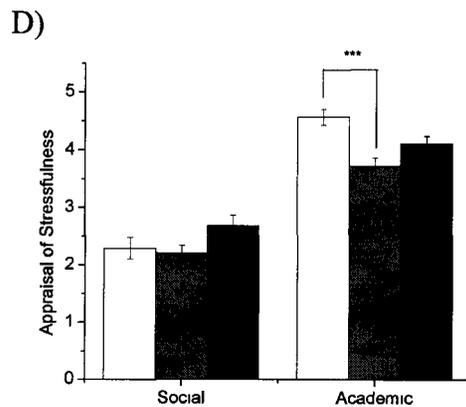
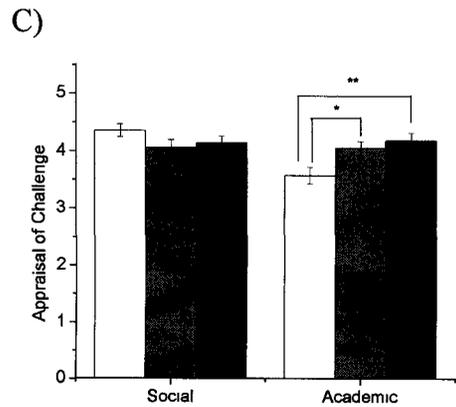
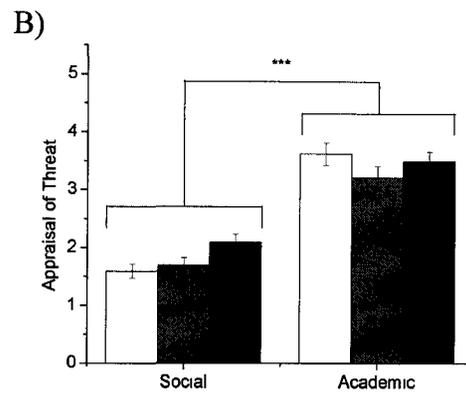
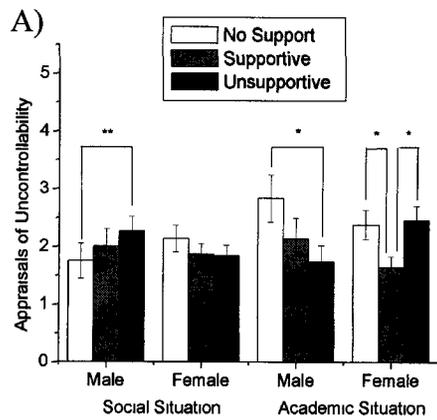


Figure 2. Mean (\pm SEM) of appraisals of A) uncontrollability displayed as a function of situation type, participant gender, and support condition; and appraisals of B) threat, C) challenge, and D) stressfulness displayed as a function of situation type, and support condition.

Discussion

Confirming earlier reports, both the nature of the stressor (Carver and Scheier, 1994; Carver et al., 1989; Lee-Baggley et al., 2005) and gender (Abouserie, 1994; Day and Livingstone, 2003; Eaton and Bradley, 2008; Ptacek et al., 1992; Tamres et al., 2002) were strong predictors of appraisal and coping responses. As well, in the present study conducted with undergraduate students, the scenarios dealing with the financial and academic stressors were viewed as being particularly aversive, whereas the scenario that was concerned with a social stressor was viewed as being least negative. Likewise, as previously reported (DeLongis and Holtzman, 2005; Lee-Baggley et al., 2005; Tennen et al., 2000), the coping strategies individuals endorsed varied across situations, even though they were provided as hypothetical, although realistic, scenarios. To be sure, financial, time pressure and social stressors are all part of the student experience, and received varying ratings of negative appraisals and coping endorsements. The fact that the academic stressor was viewed as particularly stressful is not surprising as the sample comprised students, and this was likely at the forefront of the challenges that they had to deal with.

Consistent with reports concerning gender differences in response to stressors (Essex et al., 1999; Matud, 2004; McDonough and Walters, 2001; Nicholls et al., 2007; Ptacek et al., 1992; Tamres et al., 2002), relative to men, women reported increased general stress and they tended to use each of the coping styles (i.e., as a dispositional characteristic in response to stressors in general) to a greater extent. Moreover, compared to men, women appraised the hypothetical stressor situations as more negative in terms of their threat (Study 1) and stressfulness (Study 1 and 2), and they also indicated that they

would endorse each of the coping strategies to a greater extent than would men (Study 2). Of particular relevance was that this was especially evident with respect to the use of eating as a method of coping (Study 1 and 2).

As previously observed (Elfhag and Morey, 2008; Larsen et al., 2006; Snoek et al., 2007), women reported increased emotional eating behaviors and used eating as a coping *style* to a greater extent relative to that apparent among men. Similarly, women were more likely than men to endorse eating as a coping *strategy* in response to the hypothetical written scenarios³. Eating as a coping method was associated with stressor appraisals in males, but only in response to the social stressor, whereas in females this strategy was associated with appraisals in the social, academic and time pressure scenarios. These findings raise the possibility that women's stressor appraisals, more than those of men, were tied to eating as a method of coping. It will be recalled that women consistently reported increased stress in general, as well as in response to the hypothetical situations. This raises the possibility, as others have suggested, that eating might serve to limit the negative emotions evoked by increasingly stressful experiences (Jenkins et al., 2005; Macht and Simons, 2000; Ozier et al., 2007). In effect, eating might be acting as a form of self-medication to decrease negative affect and/or increase positive affect (Christensen and Pettijohn, 2001; Corsica and Spring, 2008; Dallman et al., 2005).

It will be recalled that the effectiveness of coping strategies might be determined by how these strategies are used in conjunction with one another (Cheng, 2001, 2009; Kelly et al., 2007b; Matheson and Anisman, 2003; Matheson et al., 2005). Individuals

³ The perceived effectiveness of this strategy was also assessed, and was low among both men and women (data not shown), thus indicating that women endorse eating to cope with stressor events despite its admitted ineffectiveness at improving the stressful

with very few coping resources at their disposal, or those who tend to use the same set of strategies in response to a large variety of stressors, would be considered to have low coping flexibility. In this regard, it has been observed that compared to men, women might be more flexible in their coping efforts, in that they used more coping strategies in conjunction with one another (Ben-Zur and Zeidner, 1996; Ptacek et al., 1992). The present investigation supports these findings in that women reported using coping efforts to a greater extent than men with respect to both their dispositional and situational coping efforts, and they displayed a greater number of associations between stressor appraisals and coping outcomes. Moreover, in using eating as a coping strategy women tended to use this in conjunction with each of the other coping strategies, except in the social scenario where the correlation between problem- and eating-focused coping did not reach significance. Men, likewise used emotion and avoidant coping in each of the scenarios, but the conjoint use of eating and problem-focused coping was not used in the social, academic and time pressure situations, and it was only in the financial scenario that these two strategies appeared conjointly. In effect, it seemed that although men used eating as a coping strategy less frequently than did women, for the most part, when they did use eating in this capacity it tended to be associated with emotionally based strategies. In women, in contrast, it was as likely as not that eating would be associated with problem- and emotionally-based coping methods. This points to greater coping flexibility in females, as well as the use of eating in conjunction with a relatively functionally effective strategy.

Although coping flexibility is typically considered adaptive, and has been

situations.

associated with positive health outcomes, such as lower symptoms of depression and anxiety (Fresco et al., 2006; Katz et al., 2005; Mino and Kanemitsu, 2005), it was suggested that although some individuals might use multiple coping strategies in a systematic and organized fashion, others might use them in an unfocused manner, or not properly match their coping efforts to the demands of the situation (Cheng, 2001). Indeed, although women in the present investigation displayed greater coping efforts, and an increased number of associations between situational coping strategies, the combination of these strategies might not always reflect effective coping methods. Inasmuch as women tend to exhibit stress related illness (e.g., depression, general anxiety, PTSD) to a greater extent than men, possibly owing to varied neuroendocrine processes (Gold and Chrousos, 2002; Yehuda et al., 1996), the possibility exists that coping methods used by women are not sufficiently well matched to deal with the array of stressors that they encounter.

The present investigation also highlights the importance of examining the different patterns of associations between dispositional versus situational coping dimensions, as dispositional coping is often a low to moderate predictor of situational coping outcomes (Carver and Scheier, 1994; DeLongis and Holtzman, 2005). Indeed, compared to dispositional coping, a greater number of associations between coping dimensions were present in response to the hypothetical situations. Furthermore, examining the associations between situational coping dimensions as a function of gender revealed a different pattern of associations for men and women, which also seemed to vary with the specific stressor situation.

The results of the present investigation revealed a relation between eating as a

coping method and emotional eating behaviors, supporting the view that among individuals classified as emotional eaters, the eating behavior is being used as a coping method to diminish distress. This said, the emotional eating subscale of the Dutch Eating Behavior Questionnaire, which was used in the present study, includes questions concerning a desire to eat in response to negative emotions such as boredom and loneliness. Thus, in addition to alleviating negative emotional states evoked by stressors, emotional eating might reflect a broader method of negative affect regulation (e.g., eating to alleviate negative emotion or to increase positive emotion). In this regard, although some individuals might use eating to diminish the adverse effects of stressor events, it is also possible that some individuals might eat in response to stressor-induced changes in hormone levels (i.e., cortisol, ghrelin) that are associated with eating regulatory processes (Epel et al., 2001; Newman et al., 2007; Rouach et al., 2007).

It will be recalled that unsupportive social interactions engender behavioral disturbances and exacerbate the psychological distress associated with physical and mental illnesses (Ingram et al., 2001a; Ingram et al., 1999; Matheson et al., 2008; Mindes et al., 2003; Song and Ingram, 2002). It was likewise expected that while social support would attenuate the effects of stressors on negative appraisals, unsupportive interactions would have the opposite effect. Indeed, compared to receiving no support or unsupportive responses, the supportive interactions mitigated overall appraisals of stressfulness. However, the effects of support responses on stressor appraisals also varied as a function of gender and the nature of the hypothetical stressor. As might be expected, following the academic situation, it seemed that supportive responses buffered against appraisals of stressfulness for both genders, and appraisals of uncontrollability among women.

However, compared to receiving no support, unsupportive (or negative) responses also evoked increased appraisals of challenge, similar to those reported following the receipt of supportive responses, and this outcome was apparent among both males and females. Additionally, it was observed that among males, unsupportive responses associated with the academic scenario elicited appraisals of uncontrollability that were significantly lower than those reported when no support was received. Thus, it seems as if unsupportive responses influenced appraisals in what would typically be considered a positive manner. However, it is likely that these counterintuitive findings were a result of the characteristics of the unsupportive response offered having positive attributes associated with it. Specifically, the academic situation involved an individual telling a friend about a negative midterm exam result and the pressure to succeed on the final exam. The friend responded by pointing out that the individual went out a few days before the test, and this time would have been better spent studying. Thus, although this response blames the individual for their poor grade (blame being an unsupportive interaction), it might also have allowed the participant to recognize the fault, and to see that the poor grade was not entirely due to an inability to deal with the course material (i.e., they did poorly because they didn't spend the time studying), and to recognize an approach for improving future grades (i.e., don't go out, spend time studying). In effect, although this remark was intended to be perceived as unsupportive, it might actually have allowed them to reinterpret the response in a positive fashion that encouraged perceptions of control and challenge in response to the academic scenario.

Unexpectedly, the nature of the supportive responses offered to participants in the scenarios did not affect coping endorsements. Based on previous observations of women

with infertility problems and individuals with HIV (Mindes, 2003; Song et al., 2002), it was predicted that individuals who received unsupportive responses would have endorsed emotion-focused and avoidant coping strategies to a greater extent than those receiving positive support responses or no support, and that this effect would be particularly strong among women. It is unclear why this effect was not observed since, as already indicated, the support manipulations were sufficient to influence stressor appraisals. However, as coping responses in this study reflected an intention to endorse specific coping strategies, and not the extent to which these responses would actually be used to deal with an event, it is possible that participants were reporting the strategies they believed would be those they would engage or that would be the most successful, and not those that would necessarily be emitted in an actual stressor situation.

Limitations and Conclusions

The present investigation highlighted the influence of the nature of the stressor, gender, and support responses on the use of eating as a coping method, as well as appraisal and coping processes in general. There are, however, several limitations that should be addressed. First, the use of an undergraduate sample might not be realistic in terms of the variety and severity of stressors typically experienced by the general population. However, the situations of social, academic, time, and financial stressors are relevant for the population used (i.e., undergraduate students), and representative of those typically reported when these individuals are asked about daily stressors (Crandall et al., 1992; Ptacek et al., 1992; Valentiner et al., 1994).

An additional point of consideration concerns the use of hypothetical written scenarios. Given that the scenarios were researcher-generated, it is possible that they

might not have interpreted in the same way as stressors that had actually been encountered by participants, and thus the meaningfulness of participant coping strategies in relation to the scenarios must be viewed cautiously. Likewise, it is possible that the supportive and unsupportive responses provided with the scenarios were not representative of those participants would typically receive from their social network. Moreover, as already indicated, supportive/unsupportive manipulations might not have had the intended impact in each scenario, thereby obscuring responses to such interactions. Indeed, the response to unsupport occurred under conditions where the participant was essentially a distal observer, as opposed to being the victim of unsupport. Their response might well have been very different had they actually encountered this response from a friend.

In summary, it seems that the nature of a stressor and gender are strong determinants of appraisal and coping responses among undergraduate students. The present investigation provides support for the views that women report stressor experiences as more negative than men, and also engage coping methods to a greater extent. Moreover, it seems that eating serves as a coping response, particularly for women, and that coping partially subserves emotional eating behaviors, possibly by attenuating stressor-induced negative emotional states.

Statement Regarding Chapter 2

Studies 1 and 2 established that eating serves as a coping mechanism in its own right, and that using eating as a method of coping was strongly related to emotional eating behaviors. Moreover, these maladaptive eating behaviors were significantly more prevalent among women than men. Overall, stressor appraisals varied as a function of gender and the nature of the stressor, as did coping responses. Importantly, endorsing eating as a coping strategy seemed to be more closely associated with stressor appraisals among women than men, although these associations also differed with the nature of the stressor. Although stressor appraisals were affected by support responses, coping responses were not. However, participants might not have perceived the unsupportive response manipulation as such. Studies 3 and 4 examine the effects of *self-reported* unsupportive social interactions on coping behaviors, and more importantly, on emotional eating behaviors. Since maladaptive eating behaviors seem to be more prominent among women than men, these studies focused on the factors that promote these behaviors among women.

Chapter 2

Unsupportive social interactions influence emotional eating behaviors: The role of coping styles as mediators

Abstract

Social support and certain coping methods (emotion- or avoidant-focused coping) are often associated with disturbed eating patterns. In the context of other psychopathologies, such as depression, it appeared that unsupportive social interactions (distancing, blame, bumbling, minimizing) were related to adverse health outcomes beyond the contribution of the lack of social support resources. Thus, the purpose of the present investigation was to examine the effects of general unsupportive social interactions (unsupport) on emotional eating behaviors, and to assess whether this relationship was mediated by individual coping styles. Based on responses to a series of questionnaires, Study 3 (N =221) indicated that unsupport was associated with emotional eating behaviors, emotion- and avoidant-focused coping. Furthermore, multiple mediation analyses indicated that emotion-focused coping was a significant mediator between unsupport and emotional eating. Study 4 (N = 169) replicated the multiple mediation between unsupport and emotional eating, and perceived stress was a moderator of these links, wherein the mediated relationship was only significant when perceived stress was low. It seems that unsupport has unique effects on disturbed eating patterns, and that this may be related to the influence of unsupport on coping mechanisms that are often ineffective. However, this effect occurred when perceived stress was relatively low, but when perceived stress was high, inefficient coping styles predominated irrespective of unsupport.

Introduction

Considerable variability exists concerning the impact of stressors on eating behaviors. Whereas some individuals report reduced eating in response to stressful events, others report that eating is increased, particularly in the form of carbohydrates (Dallman et al., 2005; Oliver and Wardle, 1999; Rutters et al., 2009; Zellner et al., 2006). In this regard, among “emotional eaters”, negative emotions tend to provoke eating (van Strien et al., 1986), possibly owing to particular hormonal changes that are elicited (Newman et al., 2007). Several views have been expressed concerning the relation between stressful experiences and emotional eating. These have included the view that emotional eaters do not accurately recognize bodily sensations when under duress, essentially mistaking arousal for hunger (Ouwens et al., 2009; Van Strien et al., 2005; van Strien and Ouwens, 2007). An alternative view, essentially representing an escape theory, posits that distress results in disinhibition, thus leading to increased eating (Heatherton and Baumeister, 1991). Related to this is the perspective that eating acts as a coping mechanism to alleviate the negative emotions otherwise evoked by stressful events (Kubiak et al., 2008; Spoor et al., 2007).

The development of psychological and behavioural disturbances more generally have been linked to the coping mechanisms individuals adopt in response to stressors (Lazarus and Folkman, 1984). When an event is seen as a threat, and the necessary resources are perceived as being available, efforts aimed at dealing directly with the situation with the goal of putting an end to the stressor (problem-focused coping strategies) may predominate. Conversely, if coping resources are perceived not to be available, then efforts aimed at using emotional or avoidant strategies, and concentrating

on dealing with the negative affect associated with stressors (emotion-focused coping strategies), as well as engaging in activities aimed at distracting one from thinking about the stressor event (avoidant coping strategies) might prevail. Social support seeking, a common coping strategy, may be involved in emotional or problem-focused efforts as individuals may use social resources in order to obtain tangible, informational, or emotional support. Although receiving social support is typically thought to reflect an effective strategy to deal with stressors, when the support provided is inappropriate or negative (i.e., unsupportive relations such as blame, bumbling, distancing or minimizing), then it may act as a profound stressor in its own right, activating less appropriate coping efforts. In light of this, the present investigation was undertaken to evaluate the influence of support-related factors in affecting emotional eating and whether coping processes mediated these relations.

Social Support and Coping

Social support represents a fundamental buffer (coping resource) to limit the effects of stressful experiences, including anxiety and depression (Anisman and Matheson, 2005; Flemming et al., 1982; Major et al., 1998), as well as physical health, cardiovascular, immune, and endocrine functioning (Uchino et al., 1996). It appears that social support can have multiple functions, such as providing emotional, tangible or informational requirements (Bertera, 1997; Weiss, 1974; Weiss, 1976), and generally occurs in conjunction with other coping methods. By example, social support can be used in conjunction with problem solving (can we solve this together?), or it can be used with emotional expression (a shoulder to cry on or the opportunity to vent). Furthermore,

social support may have the effect of supplanting other strategies (e.g., in the presence of social support individuals might be less likely to avoid/deny the presence of stressors).

Despite the beneficial effects of social support, there are some circumstances in which social support might not be beneficial. It was suggested that the effectiveness of social support may depend on it matching the individual's current needs and goals, and may vary with the specific situation at hand (Cutrona, 2000; Cutrona and Russell, 1990; Cutrona et al., 2007). For example among individuals going through a relationship separation, emotional expression in support groups seemed to help them understand the roots of their distress, whereas the same type of support intervention for bereaved individuals seemed to exacerbate distress (Weiss, 1974; Weiss, 1976). Evidently, the effectiveness of support may depend not only on the quantity received, but also on the quality of the support, the type of stressor situation, and the current needs of the individual (Cutrona, 2000).

Lower levels of positive support have been reported by women with clinical levels of an eating disorder compared to non- or sub-clinical women (Aimé et al., 2006), and positive support was negatively associated with eating disorder symptoms in an undergraduate, non-clinical population of women (Wonderlich-Tierney and Vander Wal, 2010). In general, however, most studies that assessed the relation between social support and eating behaviors have focused on women with, or at risk for, eating disorder symptoms as in the case of anorexia nervosa, binge eating, and bulimia nervosa (e.g., Ghaderi, 2003; Limpert, 2010), whereas the relation between positive support and emotional eating as a sub-clinical eating disturbance is less clear. For instance, among individuals attempting to lose weight either through surgery or diet, there was no

association between positive support from the individual closest to the participant and emotional eating (Canetti et al., 2009).

Negative Social Interactions

In addition to inappropriate positive support, it seems that certain negative or unsupportive social interactions may act as an independent influence on physical and mental health. Ingram, Betz, Mindes, Scmitt, & Smith (2001) defined four types of unsupportive social interactions that individuals might encounter: distancing (not listening or paying attention, refusal of help or support), bumbling (displaying feelings of discomfort, offering support that was not welcomed or desired such as cheering up, uninvited physical contact, or taking on tasks that the individual was capable of and wanting to perform themselves), blaming (suggestions of being at fault, displays of disappointment, or “I told you so” comments), and minimizing (suggestions of the unimportance of, or minimizing, the severity of the event, suggestions to forget about the event).

Unsupportive interactions may have adverse consequences given that they might not only undermine the effectiveness of social support that could have been offered, but might also act as a stressor in their own right. Indeed, when considering implications for psychological well being, unsupport was associated with elevated levels of depressive symptoms and other negative mental health outcomes among HIV patients, homosexual and bisexual employees in the workplace, and breast cancer patients, and even among Somali refugees that had escaped civil unrest, and emigrated to Canada (Figueiredo et al., 2004; Matheson et al., 2008; Smith and Ingram, 2004; Song and Ingram, 2002).

Evidently, unsupport may have profound effects on psychological well being, beyond the effects associated with simply the absence of support.

It is possible that encountering unsupport influences depression and self-esteem, through a subsequent reliance on ineffective coping methods (Ingram et al., 2001b; Mindes et al., 2003). Contrary to the association between positive support and problem-focused or cognitive coping methods, it seems that unsupportive interactions may elicit avoidant coping methods. For instance, among individuals with HIV, the receipt of negative support in response to HIV-related events was associated with increased use of disengagement and denial as coping methods (Song and Ingram, 2002), an outcome that was also apparent among women that experienced unsupport in relation to infertility problems (Mindes et al., 2003). Similarly, in a prospective study, among women in the early stages of breast cancer, the perception of unsupport from their partner predicted increased subsequent avoidant coping (Manne et al., 2005). However, such investigations have focused primarily on associations of unsupportive interactions with avoidant coping efforts, and similar relations with emotion-focused coping efforts remain to be determined.

Associations between unsupportive interactions and emotional eating behaviors have yet to be demonstrated, even though it is often thought that emotional factors might contribute to elevated eating that sometimes accompanies stressful experiences. However, given the association of unsupportive interactions with ineffective coping methods, and the relation between emotional eating behaviors and both avoidant and emotion-focused coping methods (Spoor et al., 2007), it is possible that unsupport may be associated with such disturbed eating patterns.

The Present Investigation

When faced with a stressor, individuals often seek social support in an effort to cope with the aversive situation. When this is met with unsupport, which itself acts as a potent stressor, well-being might be jeopardized still further. In this regard, unsupport might promote the use of coping methods (e.g., emotion focused coping; avoidance/denial or withdrawal, disengagement) that favour the development of increased eating, especially if one considers that eating might actually be a way of coping with adverse events (as a disengagement strategy or in an effort to “self-medicate” through increasing glucose availability). It was predicted in Study 3 that perceptions that unsupportive responses were experienced, when support was needed and sought, would be associated with emotional eating. As well, it was predicted that perceptions of unsupport would be related to the propensity to adopt coping styles that do not require reliance on others (especially emotional and avoidant coping), and these coping methods would mediate the relation between unsupportive experiences and emotional eating. Furthermore, given that stressors, in general, have adverse effects on well being, especially when superimposed on other adverse events, it was hypothesized in Study 4 that perceived stress would moderate the mediated relation between unsupport and emotional eating. In particular, it was expected that when perceived stress was low the relation to emotion-focused coping would be increased by an unsupportive social interaction. However, the role of unsupport would be less pronounced when perceived stress was relatively high as emotion-focused coping would be most likely to occur under such conditions irrespective of whether or not unsupport was present.

Methods

Participants

Study 3.

Undergraduate females ($N = 221$, $M_{\text{age}} = 20.44\text{yrs}$, $SD_{\text{age}} = 4.86\text{yrs}$) were recruited from an online experimental study recruitment system (Appendix C). Participants were informed that the study would assess the relations between daily stressful events and how individuals coped with these stressors. Of the women who reported their ethnic background, 56% ($n = 117$) were Caucasian, 6.7% ($n = 14$) were East Asian, 11.9% ($n = 25$) were Black, 6.2% ($n = 13$) were Middle Eastern, 4.3% ($n = 9$) were Hispanic, 4.3% ($n = 9$) were Aboriginal, 9.5% ($n = 20$) were Asian, and 1.4% ($n = 3$) were Other.

Study 4.

Undergraduate women ($N = 169$, $M_{\text{age}} = 20.45\text{yrs}$, $SD_{\text{age}} = 4.36\text{yrs}$) volunteers were obtained as described in Study 3 (see Appendix D for recruitment notice). Women who reported their ethnic background were Caucasian ($n = 88$, 54.0%), Middle Eastern ($n = 21$, 12.9%), Black ($n = 20$, 12.3%), East Asian ($n = 17$, 10.4%), Asian ($n = 5$, 3.1%), Hispanic ($n = 5$, 3.1%), Aboriginal ($n = 2$, 1.2%), and Other ($n = 5$, 3.1%).

Procedure

Upon arriving at the laboratory, the purpose of the study was described as examining student responses to daily stressful events (Study 3), or as examining student responses to an employment task (Study 4). They were told that the purpose of the session was to assess general perceptions of stress, coping styles, factors that may influence coping (e.g., social support), and eating behaviours that they engaged in. They were then presented with an Informed Consent form to read and sign (see Appendix C

and D for the informed consent forms for Study 3 and 4, respectively). After signing the Informed Consent, women began to complete the questionnaires, which included background information, coping styles, unsupportive social interactions, and emotional eating (Study 3 and 4), as well as general perceived stress and social support (Study 4) (see Appendix E for all measures). After completing the questionnaires, all women were debriefed, given a contact information sheet, and were compensated (course credit, money (\$10.00), or a combination of the two as they desired) (see Appendix C and D for the debriefing information for Study 3 and 4, respectively).

Measures

Negative support. The Unsupportive Social Interactions Inventory (Ingram et al., 2001a) was used to assess the general unsupportive interactions perceived by participants during the previous month in both Study 1 and 2. This scale, which consists of 24-items, uses a 5-point Likert scale ranging from 0 “None” to 4 “A lot”, and has four dimensions of unsupport (bumbling, blaming, distancing, and minimizing), demonstrated high reliability (Cronbach’s $\alpha = .89$ and $.91$ for Study 1 and 2, respectively).

Coping styles. The Survey of Coping Profiles Endorsed (SCOPE), which assessed women’s general coping styles (Matheson and Anisman, 2003), was used in both Study 3 and Study 4. This 50-item scale uses a 5-point Likert scale, and asks participants to indicate the degree to which they have used each of the 50 coping strategies in recent weeks, ranging from 0 “Never” to 4 “Almost Always”. The items assesses 14 dimensions of coping: problem solving, cognitive restructuring, active distraction, avoidance, rumination, humor, seeking social support, emotional expression, other blame, self blame, emotional containment, passive resignation, turning to religion,

and wishful thinking. In order to remain consistent with the previous chapter, the factor structures of problem-focused (Cronbach's $\alpha = .87$ for Study 3, Cronbach's $\alpha = .88$ for Study 4), emotion-focused (Cronbach's $\alpha = .90$ for Study 3, Cronbach's $\alpha = .90$ for Study 4), and avoidant (Cronbach's $\alpha = .78$ for Study 3, Cronbach's $\alpha = .84$ for Study 4) coping styles were retained⁴.

Emotional eating. Emotional Eating behaviours were measured using the Emotional Eating subscale in the Dutch Eating Behavior Questionnaire (van Strien et al., 1986). These 13 items use a 5-point Likert scale ranging from 0 "Never" to 4 "Very Often". Items assess specific (e.g., anxious, irritated) and diffuse emotional states (e.g., emotionally upset) that might evoke eating responses. Reliability for this measure was high (Cronbach's $\alpha = .95$ and $.96$ for Study 3 and 4, respectively).

Perceived stress. Cohen, Kamarack & Mermelstein's (1983) Perceived Stress Scale, used only in Study 4, assessed the degree to which statements assessing participant stress-related feelings and thoughts were true of themselves during the previous month. This is a 14-item measure that uses a 5-point Likert rating scale ranging from 0 "Never" to 4 "Very often", which showed good reliability (Cronbach's $\alpha = .87$).

Positive support. The consumption portion of Bertera's Consumption and Generation of Social Support scale (Bertera, 1997) was used in Study 4, to assess the amount of general positive support women perceive in their daily lives. The 12 scale items assess tangible, informational, and emotional types of support on a 5-point Likert scale ranging from 0 "Not at All" to 4 "About Every Day". A total support score was

⁴ A confirmatory factor analysis accounting for 60.89% of the variance corroborated the factor groupings observed in Chapter 1.

created by taking the mean of all items; the scale demonstrated high reliability (Cronbach's $\alpha = .83$ for Study 4).

Results

Study 3

Coping styles as mediators between unsupport and emotional eating behaviors.

To determine whether there were significant relationships between the variables forming the proposed mediated analyses, bivariate zero-order Pearson correlations were performed between emotional eating behaviours, unsupport, and coping styles. As expected, encountering unsupport was related to emotion-focused and avoidant coping, as well as with emotional eating behaviours (Table 10). As these relations were significant, and emotion-focused and avoidant coping were highly correlated, a multiple mediation analysis was performed to assess the unique effects of the two types of coping on emotional eating behaviors. Preacher and Hayes' procedures for multiple mediation using bootstrap analyses were employed (Preacher and Hayes, 2008), with 95% bias corrected accelerated confidence intervals, and using 5000 bootstrap samples.

The model was significant $F(3,192) = 14.19, p < .0001$, and accounted for 18.2% of the variance. As indicated in Table 11, when both emotion-focused and avoidant coping were added as mediators in the same model, only emotion-focused coping was a significant mediator of the relation between unsupport and emotional eating behaviors. However, due to the correlational nature of the relations between general unsupport, coping styles, and emotional eating it is possible that unsupport could mediate the relationship between the use of ineffective coping styles and emotional eating behaviors.

As such, these alternative models were tested (emotion-focused and avoidant coping were examined separately). The alternative models were not viable, as unsupport was not a significant mediator when either emotion-focused (C.I. = -.038, .201) or avoidant coping were the predictor variables (C.I. = -.008, .086).

Together, the data of Study 3 suggest that encountering unsupport predicted emotional eating and that this relation was mediated primarily by emotion-focused coping. Furthermore, it did not appear that alternative directional pathways were viable in accounting for the observed findings.

Table 10. Means, Standard Deviations, and Zero-order Pearson Correlations Between Perceived Unsupport, Coping Styles, and Emotional Eating Behaviors (N = 221).

	1	2	3	4	5
1. Emotional eating					
2. Unsupport	.31**				
Coping styles					
3. Problem-focused	.10	-.05			
4. Emotion-focused	.35***	.59***	.05		
5. Avoidant	.27**	.44***	.14*	.57***	
Mean	1.64	1.19	2.32	1.97	2.11
Standard Deviation	.97	.63	.63	.72	.60

* p < .05, ** p < .01, *** p < .001

Table 11. *Multiple Mediated Direct and Indirect Effects of Unsupport (IV) on Emotional Eating (EmoEat) Through Emotion-focused (EF) and Avoidant (AV) Coping*

	B	Std. Error	<i>t</i>	<i>p</i>	BCa 95% Confidence Interval	
					Lower	Upper
Effect of Unsupport on EF coping	.67	.07	10.14	.00		
Effect of Unsupport on AV coping	.42	.06	6.72	.00		
Direct effect of EF coping on EmoEat	.40	.12	3.26	.00		
Direct effects of AV coping on EmoEat	.15	.13	1.19	.24		
Total effect of Unsupport on EmoEat	.49	.11	4.59	.00		
Direct effect of Unsupport on EmoEat	.15	.13	1.18	.24		
Total mediated effect					.189	.479
EF coping mediated effect					.097	.443
AV coping mediated effect					-.051	.190

Study 4

The mediating role of coping in the relation between unsupport and emotional eating.

As in Study 3, correlational analyses indicated that encountering unsupport was associated with emotion-focused and avoidant coping, as well as emotional eating (see Table 12). Unexpectedly, perceived availability of social support was also positively associated with emotional eating, as was problem-focused coping (Table 12). An initial analysis was conducted to confirm that the relation between unsupportive interactions and emotional eating was mediated by emotion-focused, but not avoidant, coping. However, in this instance, given the association between perceived social support and emotional eating, perceived social support was controlled in the evaluation of the multiple mediation model.

Consistent with the findings of Study 3, the model examining emotion-focused and avoidant coping as mediators between unsupportive interactions and emotional eating accounted for a significant amount of variance, $R^2 = .127$, $F(4,162) = 5.91$, $p < .001$, and emotion-focused coping was a unique mediator in this regard (Table 13). Again, the alternative model assessing the mediating role of unsupport between coping and emotional eating was assessed, but was found not to be significant ($B = .12$, $t(167) = .88$, $p = .38$; C.I. = $-.021, .107$ when emotion-focused coping was the predictor variable; C.I. = $-.054, .144$).

As it was also possible that problem-focused coping could serve as a mediator between positive support perceptions and emotional eating, a simple mediation analysis was performed. This analysis indicated that the relation between problem-focused coping

and emotional eating was not significant when positive support was included in the model, $B = .21$, $t(168) = 1.54$, *ns*, and hence did not serve in a mediating capacity.

Table 12. Means, Standard Deviations, and Zero-order Pearson correlations between perceived social support, perceived stress, coping styles, and emotional eating behaviors (N = 169).

	1	2	3	4	5	6	7
1. Emotional eating							
2. Perceived stress	.21**						
Social Support							
3. Positive support	.16*	.00					
4. Negative support	.21**	.29***	.15*				
Coping styles							
5. Problem-focused	.17*	-.16*	.39***	.08			
6. Emotion-focused	.34***	.63***	.10	.44***	.17*		
7. Avoidant	.17*	.34***	-.06	.34	.07	.50***	
Mean	1.74	1.89	1.61	1.19	2.34	1.94	2.14
Standard Deviation	1.06	.52	.63	.64	.64	.72	.67

* p < .05, ** p < .01, *** p < .001

Table 13. *Multiple Mediated Direct and Indirect Effects of Unsupport on Emotional Eating (EmoEat) Through Emotion-focused (EF) and Avoidant (AV) Coping, while Controlling for Positive Support*

	<i>B</i>	Std. Error	<i>t</i>	<i>p</i>	BCa 95% Confidence Interval	
					Lower	Upper
Partial effect of Support on EmoEat	.20	.13	1.60	.11		
Effect of Unsupport on EF coping	.47	.08	5.96	.00		
Effect of Unsupport on AV coping	.36	.07	4.85	.00		
Direct effect of EF coping on EmoEat	.44	.13	3.25	.00		
Direct effect of AV coping on EmoEat	.03	.14	.19	.85		
Total effect of Unsupport on EmoEat	.31	.13	2.40	.02		
Direct effect of Unsupport on EmoEat	.09	.14	.67	.51		
Total mediated effect					.071	.391
EF coping mediated effect					.079	.381
AV coping mediated effect					-.093	.117

Moderated effects of perceived stress on the mediation of emotion-focused coping between unsupport and emotional eating.

It was of interest to determine whether perceived stress would moderate the mediational role of coping in the relation between unsupportive interactions and emotional eating. Since emotion-focused coping was a unique mediator between unsupport and emotional eating, it was used as the sole mediator in this analysis. As suggested by Preacher and colleagues (Preacher et al., 2007), there are multiple ways that perceived stress could moderate the mediated relation. Three models defined by Preacher et al., were tested, wherein, 1) perceived stress would moderate the strength of the relation between unsupport and emotion-focused coping, 2) perceived stress would moderate the strength of the relation between emotion-focused coping and emotional eating, and 3) perceived stress would moderate both the strength of the relation between unsupport and emotion-focused coping, and the relation between emotion-focused coping and emotional eating. As indicated in Table 14, perceived stress was found to serve as a moderator primarily through its effect on the relation between unsupportive interactions and emotion-focused coping. The Johnson-Neyman significance region cut-off was 2.17, indicating that the mediated model was significant only when perceived stress was less than 2.17. In effect, when perceived stress was low, encountering unsupport influenced the degree of emotion-focused coping endorsed, which was associated with emotional eating behaviors. However, under conditions of relatively high perceived stress the contribution of encountering unsupport was no longer evident.

The models evaluating whether perceived stress moderated the relations between coping and emotional eating behaviors, or the relations between both unsupport and coping, as well as coping and emotional eating were not significant.

Table 14. *Model 2: Moderated Mediated Direct and Indirect Effects of Unsupport on Emotional Eating (EmoEat) Through Emotion-focused Coping (EF) with Perceived Stress (PerStr) as a moderator, while Controlling for Positive Support (PosSup)*

	B	Std. Error	t	p	BCa 95% Confidence Interval	
					Lower	Upper
Mediator Variable Model						
Partial effect of Support on EF	.09	.06	1.34	.182		
Effect of Unsupport on EF	.94	.25	3.77	.000		
Effect of PerStr on EF	1.14	.16	6.94	.000		
Effect of Unsupport x PerStr on EF	-.33	.06	-2.64	.009		
Dependent Variable Model						
Partial effect of PosSup on EmoEat	.21	.12	1.71	.089		
Direct effects of EF on EmoEat	.43	.15	2.81	.006		
Direct effects of IV on EmoEat	.59	.51	1.17	.243		
Direct effects of PerStr on EmoEat	.30	.36	.82	.412		
Direct effects of IV x PerStr on EmoEat	-.26	.25	-1.01	.313		
Conditional Indirect effects					.065	.585

Discussion

The impact of stressful events on disturbed eating behaviors might be related to how individuals cope with stressors (Aimé et al., 2006; Blaase and Elklit, 2001; Koff and Sangani, 1997; Spoor et al., 2007). Social support is considered to be among the most important resources for effective coping, and the lack of social support has been associated with disordered eating (Stice et al., 2002; Wonderlich-Tierney and Vander Wal, 2010). Relatively little information, however, has been available concerning the influence of encountering unsupportive responses (negative support) on eating behaviors, although this factor was associated with emotional responses related to HIV infection, breast cancer diagnosis and immigration from war torn regions (Figueiredo et al., 2004; Manne et al., 2005; Matheson et al., 2008; Song and Ingram, 2002). It will be recalled that unsupportive interactions do not simply mean the absence of support, but might in themselves serve as a powerful stressor that exacerbates poor well being (Boutin-Foster, 2005; Cranford, 2004). Indeed, in the present investigation unsupportive experiences were also uniquely related to increased emotional eating behaviors in a female, nonclinical, university population.

It was hypothesized that the relation between unsupportive interactions and emotional eating would be mediated by a propensity to turn to forms of emotion-focused and avoidant coping, and indeed, emotion-focused, but not avoidant or a problem-focused coping served in this capacity. It seems that as the breadth and intensity of unsupportive interactions increased, so did the reliance on emotion focused coping, which in turn, was

associated with increased eating⁵. It is possible that eating served as means of diminishing the adverse effects that accompany emotional coping (e.g., rumination, emotional expression, wishful thinking, self- and other-blame), essentially serving as a either a way of diminishing distress or negative mood stemming from stressors or ineffective coping (self-medication), or by increasing positive feelings (eating makes me feel better). Interestingly, neither problem- nor avoidant-focused coping mediated the relation between unsupport and emotional eating. It may be that problem-focused coping would serve to eliminate the source of the distress or at least would promote a search for solution to eliminate it, and avoidance-focused efforts, by having individuals not think about the problem, would similarly not favour emotional eating. This said, it was previously reported that both emotion- and avoidant-coping methods were related to emotional eating (Spoor et al., 2007). When these coping styles were assessed independently in the present investigation, both emotion- and avoidant coping were indeed correlated with eating. However, given the large amount of shared variance between these coping methods, only emotion-focused coping was uniquely related to emotional eating.

Essentially, the present findings are consistent with the perspective that encountering unsupport leads to emotional eating, and that this occurred due to the promotion of ineffective coping mechanisms. Of course, the data are correlational, precluding such causal attributions, and even if there was a causal connection, the present

⁵ The measure of unsupportive interactions included dimensions of blaming, bumbling, distancing, and minimizing, but the present investigation examined a total measure of unsupport, collapsing across the dimensions. When examined separately, the individual dimensions of unsupportive interactions demonstrated similar results to those obtained when using a total score.

data do not speak to whether eating should be viewed from the perspective of self-medication. Nevertheless, the view that eating serves as a method of coping with emotional distress is a viable and testable hypothesis (Kubiak et al., 2008; Spoor et al., 2007), and it was observed that alternative models (e.g., the relation between coping style and emotional eating being mediated by unsupport) were not viable.

It has been reported that perceiving social support as available was inversely related to disturbed eating patterns (Stice et al., 2002; Wonderlich-Tierney and Vander Wal, 2010). Yet, in the present investigation having social support was mildly, positively related to emotional eating behaviors, although this accounted for a small proportion of the variance (~2.5%). Why this outcome was present is uncertain, but it ought to be considered that social support may serve several functions (e.g., emotional support; providing resources, providing information) (Bertera, 1997; Weiss, 1974; Weiss, 1976), and typically does not occur in isolation of other strategies. Contextualized in this way, it might be considered that in response to stressful events women with a social support network might be more likely to meet as a group, and in doing so might engage in social eating. This said, it appeared that despite the relation between positive support and eating, when social support and unsupport were concurrently assessed, only the contribution of unsupport was tied to emotional eating.

As frequently reported with respect to eating disorder symptomatology (Ball and Lee, 2002; Pike et al., 2006; Schmidt et al., 1992), perceived stress was also related to increased emotional eating. Moreover, perceived stress moderated the effects of unsupport in relation to emotion-focused coping, and hence on emotional eating. Essentially, when perceived stress was low, increasing levels of unsupport were

associated with elevated levels of emotion-focused coping, possibly because unsupportive relations are themselves perceived as being stressful. However, under conditions of high perceived stress, which elicits high levels of emotion-focused coping, unsupportive interactions were not accompanied by a further elevation of emotion-focused coping.

The findings of the present investigation came primarily from a Caucasian female undergraduate population (~55%), and may not necessarily reflect individuals of different ages or ethnic groups. Additionally, as mentioned earlier, due to the cross-sectional nature of the studies, a causal relationship between unsupport and emotional eating behaviours cannot be assumed. Despite this limitation, however, it seems clear that a strong relation exists between the two variables, and that this relation might be subserved by the engagement of ineffective coping strategies.

Conclusions

The current investigation supports the view that unsupportive interactions serve as a powerful predictor of health outcomes, acting beyond the potential effects attributable to positive social support. Indeed, it appeared that encountering unsupport may act as a stressor in and of itself, and that, even when general stress is relatively mild, it was associated with the adoption of ineffective coping styles. Although the data of the present investigation are correlational in nature, the possibility ought to be considered that emotional eating serves as a method of diminishing the adverse effects that accompany emotion-focused coping triggered by unsupportive interactions. If this, in fact, is correct, then interventions for eating disturbances ought to consider identifying the specific

sources of unsupportive interactions that individuals encounter, and limiting their occurrence or their impact.

Statement Regarding Chapter 3

Studies 3 and 4 indicated that self-reported unsupportive social interactions were related to emotional eating behaviors, and that this relationship was mediated by emotion-focused coping behaviors. In combination with the results of Studies 1 and 2, these data suggest that emotional eating serves as a coping mechanism for many individuals, particularly women. However, although some individuals might be cognizant that they use eating as a method of coping, stressor-induced changes in negative emotions and hormone levels might underlie stress-related eating behaviors among others. In this regard, cortisol is a stressor-related hormone that has been associated with increased eating, and ghrelin is an eating-regulatory peptide that might increase in the face of a stressor. As such, it was of interest to determine whether an acute stressor event would evoke changes in hormone levels, as well as food choices and intake, and whether these effects would vary as a function of emotional eating status.

Chapter 3

Psychosocial Stressor effects on Cortisol and Ghrelin in Emotional and Non-emotional Eaters: Influence of Anger and Shame⁶

⁶ Raspopow, K., Abizaid, A., Matheson, K., & Anisman, H. (2010). Psychosocial Stressor effects on Cortisol and Ghrelin in Emotional and Non-emotional Eaters: Influence of Anger and Shame. *Hormones and Behavior*, 58(4), 677-684.

Abstract

Food consumption in stressful situations varies as a function of individual difference factors (e.g., emotional vs. non-emotional eating), and may be related to hormonal responses elicited by the stressful event. These hormonal responses may be tied to specific emotions elicited by the stressful event. The present investigation examined the emotional and hormonal (cortisol, ghrelin) responses of emotional and non-emotional eaters following a laboratory stressor (Trier Social Stress Test; TSST). Women (N = 48) either of emotional or non-emotional eating status were tested in a TSST or served as controls during which blood samples were taken for analysis cortisol and ghrelin, both of which have been implicated in eating, and in response to stressors. The TSST promoted elevated cortisol levels, being somewhat more pronounced in emotional than in non-emotional eaters. Both shame and anger were provoked by the TSST, and although both these emotions were correlated with cortisol levels, only anger significantly mediated the relationship between the stressor and cortisol levels. As well, baseline ghrelin levels in non-emotional eaters exceeded that of emotional eaters, and increased moderately in response to the stressor situation, irrespective of emotional eating status. Interestingly, when provided with food, ghrelin levels declined in the non-emotional eaters, but not in emotional eaters. The possibility is offered that the lack of a decline of ghrelin in emotional eaters may sustain eating in these individuals.

Introduction

Stressful events have been associated with a variety of behavioural and hormonal responses that may be moderated by individual difference factors, including previous traumatic experiences, and the coping styles endorsed (Anisman et al., 2008; Heim et al., 2000; Heim et al., 2002). It is generally thought that these coping methods fall into several basic categories, namely problem-focused (aimed at changing the situation or eliminating the stressor), emotion-focused (using emotional strategies to contend with stressors and their evoked emotional responses) and avoidant-focused strategies (attempting to psychologically or physically avoid, or disengage from the stressor event, and related emotional responses) (Carver et al., 1989; Lazarus and Folkman, 1984). Although not frequently considered within this context, eating might also serve as a coping strategy (e.g., as an escape, or a means by which individuals might reduce the aversive effects of high self-awareness) (Heatherton and Baumeister, 1991) or as a way to attenuate stressor-induced negative emotions (Kubiak et al., 2008; Spoor et al., 2007). Thus, it is possible that emotional eating could serve as both an avoidant and emotion-focused coping strategy (Spoor et al., 2007). Among some individuals (emotional eaters), food craving and consumption of food high in carbohydrates and fats increase in response to stressors of moderate severity or in association with negative affect (Epel et al., 2001; Macht and Simons, 2000; Oliver and Wardle, 1999; Wurtman and Wurtman, 1995), and particularly in ego threatening situations (Wallis and Hetherington, 2004). In contrast, among non-emotional eaters, stressors elicit a reduction or no change of eating (Oliver et al., 2000; Wallis and Hetherington, 2004, 2009; Wardle et al., 2000).

Several hormones and peptide factors have been implicated in eating processes, and have been associated with stressor reactions as well as depressive illness. For instance, in rodents stressors typically result in reduced eating, but it was observed that the prototypical stress hormone, cortisol, was associated with greater food intake under chronic stress conditions (Dallman, 2010; Dallman et al., 2005). In humans stressor-elicited corticoid changes might contribute to altered food intake (Dallman, 2010; Epel et al., 2001; Newman et al., 2007), but it seems that cortisol responses elicited by stressors may be tied to the emotional responses that are evoked. For example, it was suggested that within a laboratory context the greatest cortisol effects and lengthiest times to normalization were provoked by stressors that involved a social-evaluative threat, e.g., one that could promote shame or humiliation (e.g., the Trier Social Stress Test, which comprises public speaking coupled with an arithmetic challenge in front of a panel of judges,) and were uncontrollable (Dickerson et al., 2004; Dickerson and Kemeny, 2004). As well, it has been reported that anger and anxiety were especially likely to be associated with elevated cortisol levels (Biondi and Picardi, 1999; Moons et al., 2010).

In addition to cortisol, several peptides (e.g., corticotropin releasing hormone, leptin) that are activated following acute stressor experiences are known to affect eating processes (Konishi et al., 2006; Richard, 1993; Richard et al., 2000), presumably acting as satiety signals and thus promoting the cessation of eating (Heinrichs et al., 1992; Heinrichs et al., 1993; Konishi et al., 2006). The actions of yet another peptide, ghrelin, a 28-amino acid peptide produced primarily in the stomach (Cummings, 2006; Kojima et al., 1999), seems to contribute to the initiation of eating (Aydin, 2006; Cummings et al., 2001; Yildiz et al., 2004). In this regard, ghrelin levels have been directly associated with

food visualization, eating initiation, increased caloric intake at meals, and increased daily caloric intake (Cummings et al., 2005; Cummings et al., 2004b; Cummings et al., 2001; Tang-Christensen et al., 2004). Like satiety peptides, ghrelin levels vary with stressor exposure, increasing in rodents in response to physical and psychological stressors (Asakawa et al., 2001; Kristensson et al., 2006). There have also been reports of stressor-induced ghrelin variations in humans but the data in this regard were inconsistent (Rouach et al., 2007; Zimmermann et al., 2007).

Inasmuch as stressors influence ghrelin and cortisol levels, both of which may affect eating, and stressful events influence initiation of food consumption in a subset of individuals, the present investigation was conducted to assess basal and stressor-provoked cortisol and ghrelin levels under control conditions or in response to a laboratory stressor in emotional versus non-emotional eaters. It was hypothesized that the effects of a laboratory stressor on food consumption would be associated with elevated ghrelin and cortisol levels, and would be more pronounced among emotional than non-emotional eaters. Moreover, it was expected that emotional responses, including anger, shame and anxiety, would mediate the relation between the stressor encountered and the neuroendocrine changes that ensued.

Methods

Participants

Undergraduate women ($N = 65$), 17-28 years of age, ($M = 19.28$, $SD = 2.25$) were recruited from an online subject pool (see Appendix C). Several participants were lost during the course of study, either because of the catheter (used to take blood) blocking or being dislodged, or discomfort on the part of the participant during the course of the

blood withdrawal session. Thus, although behavioral and emotional responses were obtained from all participants, blood samples were only obtained from 48 of these participants. Women participated in an introductory session assessing height and weight, and emotional eating behaviours (see Appendix E for measures), and invited to return for a laboratory session involving either a control or an acute stressor task during which continuous blood sampling would be undertaken. Exclusionary criteria included taking medications that would influence hormone levels, fear of needles or previous problems with blood donation or sampling. Of those who reported ethnic status 51.6% were Euro-Caucasian (n = 32), 16.1% were Black (n = 10), 8.1% were Aboriginal (n = 5), 6.5% were East Asian (n = 4), 6.5% were Middle Eastern (n = 4), 6.5% were Hispanic (n = 4), 3.1% were Asian (n = 2).

Procedure

Introductory session.

Study materials and procedures were reviewed by the Carleton University Ethics Committee for Psychological Research, and followed the Canadian Tri-Council policy statement of Ethical Conduct for Research Involving Humans. During an introductory session women were told what would be asked of them during the full study, and an informed consent was read and signed (Appendix C). They then completed background information, including height and weight, and a measure of emotional eating behaviour (Dutch Eating Behavior Questionnaire; (van Strien et al., 1986). Eligible women willing to participate in the laboratory session were contacted, and a time was arranged for them to come to the lab.

Laboratory session.

All sessions were conducted between 1330 and 1700 hr, and the women were asked not to eat, drink (other than water), or smoke for at least an hour before the session. Figure 3 is a visual depiction of the session procedure. During the laboratory session women were reminded of the purpose of the study, and what they would be asked to do during the session. After signing informed consent forms for general participation and for the collection of blood samples for cortisol and ghrelin analyses (Appendix C), participants indicated the time they last ate, and their current perceived hunger level (Appendix G). A nurse then inserted a butterfly catheter into a vein of the subject's arm, permitting blood samples to be drawn continuously over a 50-minute period by a Dakmed pump. Once the butterfly was inserted, women were able to relax for 5-minutes in order to adapt to the testing room. Neutral content magazines (i.e., home decor magazines, not expected to induce significant changes in affect) were provided for participants to read during this period.

Women were then given a description of their next task (stress vs. control). Those in the stress condition ($n = 31$) were told that undergraduates often seek part-time work during their degree to help with costs of school or for spending money, and that they would be giving a speech about their employability to a panel of graduate students for a period of 5 min, after which they would be tested in a mental math task for 5 min (modified Trier Social Stress Test) (Kirschbaum et al., 1993). They were given the next 5 min to prepare their speech (although they were told that they would not be able to use notes while giving their speech). Those in the control condition ($n = 30$) were told that they would be asked to listen to a 10-min audio clip as if it were part of a lecture or

course readings, although they would not be tested on the material. They were then given the next 5 minutes to relax and look through neutral content magazines.

At the start of the 5-min preparation or waiting period, the first blood sample was collected (baseline sample). Following the 5 min preparation period, they began the public speaking followed by the arithmetic challenge (counting backwards from 2013 by seventeen, and were required to start again after an error was made), or in the case of control participants, they listened to the audio clips. Following the task, women completed mood measures (Appendix G), and then 10 min post-task, the second blood sample was taken. Women were then told that because a blood sample was being taken, they would be provided with food to offset effects of the blood withdrawal. They were told they could choose from carrot muffins, Hershey Kisses (high-fat, carbohydrates), grapes or caramel rice crisps (low-fat and carbohydrates). Participants were then permitted to read neutral content magazines and/or listen to a neutral audiotape. Twenty minutes following the stressor (or control audio condition) the third blood sample was taken, after which they were given the food they had chosen. Another blood sample was collected 10 min later (30 min post-task), and the butterfly catheter was removed. The participants were then fully debriefed (Appendix C) and compensated with course credits, money (\$40), or a combination of the two.

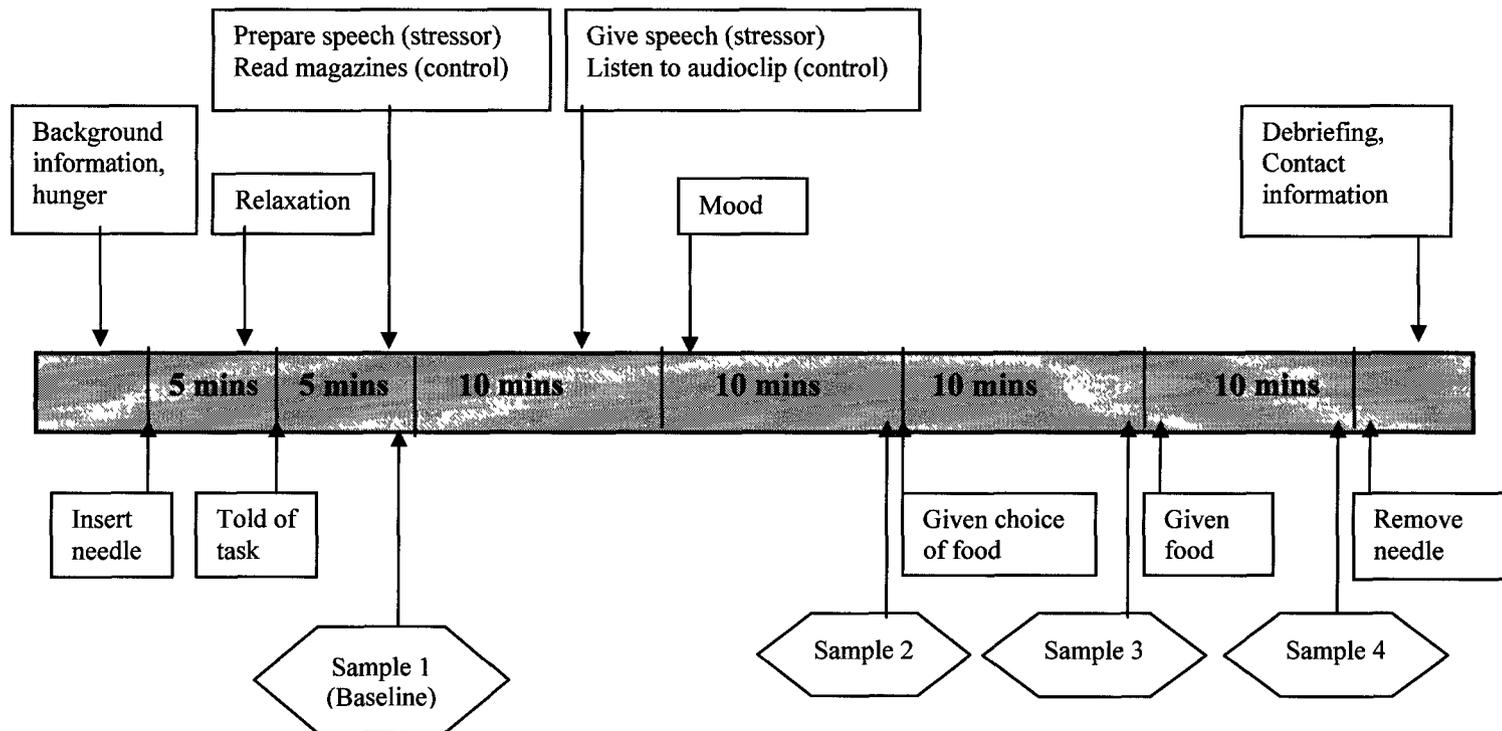


Figure 3. Sequence of procedures for the laboratory session procedure

Measures

Emotional eating. The 13-item emotional eating subscale of the Dutch Eating Behavior Questionnaire (van Strien et al., 1986) was used to assess emotional eating behavior. This subscale is recommended for general assessment of emotional eating, and asks individuals about their desire to eat in response to both diffuse (e.g., lonely, bored) and clearly labelled (e.g., anxious, cross) negative emotions. Reliability for this subscale was high (Cronbach's $\alpha = 0.96$).

Body Mass Index. Women self-reported their weight and height during the introduction session. The formula $[\text{weight}(\text{lbs}) * 703 / \text{height}(\text{in})^2]$ was used to calculate Body Mass Index (BMI).

Hunger. A single item "How hungry are you *right now*?" assessed women's current perceived hunger at the beginning of the laboratory session. Participants responded on an 11-point Likert scale ranging from 0 "extremely full" to 10 "extremely hungry".

Mood. Negative emotions (anger, shame and anxiety) were examined using a series of mood adjectives making up the Positive and Negative Affect Schedule (Watson et al., 1988), which were rated on a 7-point Likert scale ranging from 0 "not at all" to 6 "extremely". Means of the items making up the subscales were calculated, with higher scores indicating a greater intensity of the emotion experienced by participants. Each subscale displayed strong reliability: anger (angry, annoyed, enraged, frustrated, hostile, infuriated, irritable; Cronbach's $\alpha = .87$), shame (ashamed, embarrassed, humiliated; Cronbach's $\alpha = .95$), and anxiety (afraid, anxious, confused, jittery, nervous, scared, worried; Cronbach's $\alpha = .87$).

Food Selections. To assess whether participating in a stressor task (vs. control task) would influence women's food choices, they were offered a choice between low-fat (i.e., grapes, caramel rice crisps) and high-fat (i.e., Hershey Kisses, carrot muffin) carbohydrate snacks. Each of the low- and high-fat categories contained a seemingly healthy and unhealthy option to avoid having women make their food choices based solely on the outward appearance of the food being healthy or not. Foods were not described, only mentioned by name to participants, who were able to select their snack of choice. Participants were presented unwrapped foods in a bowl (food filled the bowl), and were able to eat freely. The principle interest of this manipulation was to examine the type of food (i.e., high fat vs. low fat carbohydrate) that women would prefer following a stressor (vs. control) task, thus women were required to choose either a low- or high-fat carbohydrate food, and the amount eaten was recorded in units as each food had different caloric value and density.

Blood sampling.

A 19-gauge needle with a 5 foot line was used for blood withdrawal, and the rate of withdrawal over the 50-minute sampling period was controlled by a Dakmed continuous withdrawal pump (Dakmed Inc., Buffalo, NY). The needle and line were covered by a drape to prevent participants from viewing the blood being withdrawn. Samples were taken at baseline and again at 10-, 20-, 30-minutes post-task directly into vacutainers coated with EDTA, with each sample consisting of approximately 2.75mL of blood, and a total of 35mL being taken across the 50-minute period, including the minimal amount drawn between sampling times to prevent the line clogging. The samples were immediately centrifuged for 15 min at 2100g and 4°C. Plasma was then

aliquoted into individual sample tubes, 1N HCl was added to plasma samples to be processed for the active ghrelin radioimmunoassay in order to prevent the degradation of the active ghrelin molecule, and all samples were frozen at -80°C until needed for assays.

Radioimmunoassay kits were used to measure levels of cortisol (H^3 MP Biomedicals, Solon, OH) and ghrelin (I^{125} Linco, St. Charles, MO). Assays were conducted in duplicate, and intra-assay variability was less than 8%. All samples were assayed in a single run to preclude inter-assay variability. The sensitivity of the cortisol assay was 0.25 µg/100mL, and was 7.8 pg/mL for the ghrelin assay.

Statistical Methods

Chi-squared analyses assessed whether women's food choices differed as a function of stressor condition and emotional eating subtype. A series of 2 (stressor condition: control vs. stressor) x 2 (emotional eating: non-emotional eaters vs. emotional eaters) between groups analyses of variance (ANOVA) was conducted to assess the moods of participants. As well, separate 2 (stressor condition: control vs. stressor) x 2 (emotional eating: non-emotional eaters vs. emotional eaters) ANOVAs compared the amount of each food eaten (carrot muffin, Hershey Kisses, grapes, caramel rice crisps). The hormone levels were similarly analyzed through ANOVA, but hormonal level at the 4 time points in relation to the stressor was treated as a within group factor. Finally, we used the Preacher and Hayes' (2004, 2008) method for assessing multiple mediation using 5000 bootstrap iterations and 95% bias corrected confidence intervals to assess the mediating role of mood in determining the relation between the stressor experience and hormone levels.

Results

Characteristics of Emotional and Non-Emotional Eaters

Using a median split ($M = 1.69$, $SD = 0.98$; $Md = 1.60$), women were categorized as emotional ($M = 2.53$, $SD = 0.73$) or non-emotional eaters ($M = 0.90$, $SD = 0.52$). Despite the difference in levels of emotional eating, $t(63) = -10.29$, $p < .001$, emotional and non-emotional eaters had similar BMI scores ($M_{EE} = 24.61$, $SD_{EE} = 4.63$; $M_{nEE} = 23.20$, $SD_{nEE} = 4.73$) and hunger ratings ($M_{EE} = 5.18$, $SD_{EE} = 1.71$; $M_{nEE} = 5.40$, $SD_{nEE} = 1.83$) at the beginning of the laboratory session.

Food Choices in Response to an Acute Stressor

Cross tabulations and Chi squared analyses across emotional eating status and stressor condition were performed to assess women's food choices (carrot muffin, Hershey Kisses, grapes, caramel rice crisps) following the stressor. Overall, women seemed to prefer some foods more than others, and these preferences did not vary as a function of stressor condition or emotional eating status. Additionally, the food choices that were high (carrot muffin and Hershey Kisses) versus low (grapes and caramel rice crisps) fat groupings did not vary with the stressor condition or emotional eating status (data not shown). Further, a 2 (stressor condition) x 2 (emotional eating) ANOVAs of the amount of each type of food eaten (carrot muffin, Hershey Kisses, grapes, caramel rice crisps; measured as units of food presented) revealed that there were no significant effects of either condition or emotional eating status (data not shown). Given that there were no group differences in food choices or amount eaten, despite the difference in the energy density of the foods, it was expected this potential confound would not affect hormone responses.

Evoked Emotional Responses to an Acute Stressor

A 2 (stressor condition: control vs. stressor) x 2 (emotional eating: non-emotional eater vs. emotional eater) within groups ANOVA was conducted using the separate emotions (anger, shame, anxiety) as a within subjects variable. This analysis revealed a significant 3-way interaction between stressor condition, emotional eating status, and emotion, $F(2,116) = 4.45, p < .05, \eta^2 = .071$. Follow-up analyses indicated that among non-emotional eaters the moods of participants in the absence of the stressor were comparable. Those individuals that were tested in the stress situation exhibited considerable greater levels of anger, shame and anxiety than did the participants that had served as non-stress controls ($ps < .001$). The degree of shame exhibited in stressed individuals was also greater than that of anger and anxiety ($ps < .01$). The emotions of the emotional eaters were virtually the same with the exception being that anxiety in the non-stress condition was greater than among non-emotional eaters ($p < .01$), and was comparable to that evident in the stress condition (Figure 4).

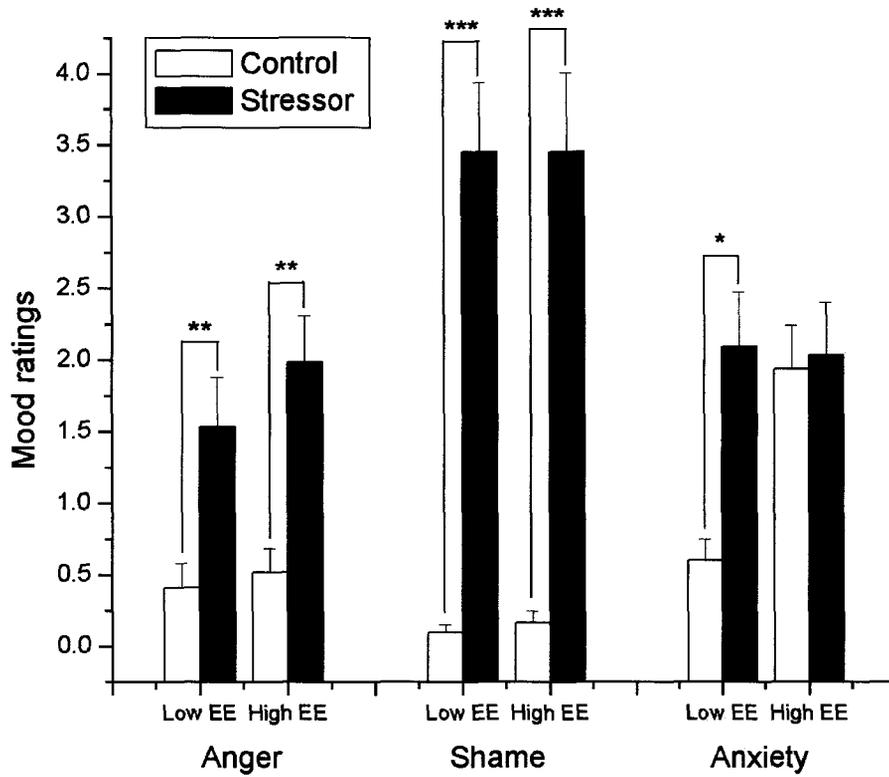


Figure 4. Mean (\pm SEM) of mood ratings following a stressor vs. control task among emotional and non-emotional eaters. * $p < .05$, ** $p < .01$, *** $p < .001$ relative to the control condition.

Cortisol Responses to an Acute Stressor

A 2 (stressor condition: control vs. stressor) x 2 (emotional eating: non-emotional eaters vs. emotional eaters) x 4 (time points over the session) mixed measures ANOVA revealed, as expected, that cortisol levels varied over time as a function of the stressor condition, $F(3,126) = 9.18, p < .001, \eta^2 = .179$. As well, the stressor x emotional eating status x time interaction approached significance, and accounted for a moderate amount of the variance, $F(3,126) = 2.46, p = .06, \eta^2 = .055$ (Figure 5). Based on a priori hypotheses, simple effects analyses indicated that among non-emotional eaters, those exposed to the stressor condition showed a significant increase of cortisol at 10 min post-stressor, and this was maintained at 20 min, but began to normalize by 30 min post stressor (the last time point being 10 min after participants ate). A similar pattern was seen in emotional eaters, but the increase at 10 min post-stressor was especially marked. There was no cortisol change among either emotional or non-emotional eaters in the control condition.

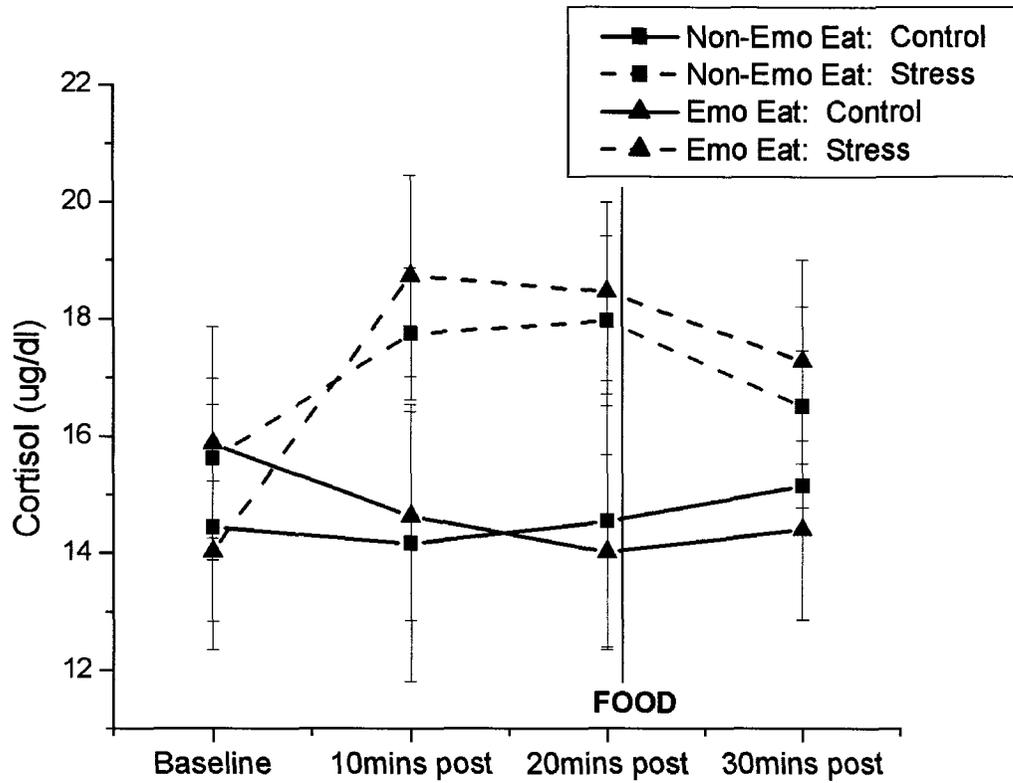


Figure 5. Mean (\pm SEM) of women's cortisol levels over a laboratory session as a function of stressor condition and emotional eating status. Food was introduced immediately after the 20 min blood sample was collected.

Ghrelin Responses to an Acute Stressor

A square root transformation of ghrelin levels was applied in order to reduce the variance present (raw values presented in figures and means). A 2 (stressor condition: control vs. stressor) x 2 (emotional eating: non-emotional eaters vs. emotional eaters) x 4 (time) mixed measures ANOVA of the transformed scores revealed that ghrelin levels varied over the session, $F(3,132) = 2.74, p < .05, \eta^2 = .059$. As well, the interaction between emotional eating x time relative to the stressor, approached significance and accounted for a moderate amount of the variance, $F(3,132) = 2.24, p = .086, \eta^2 = .048$ (Figure 6). Inasmuch as it had been predicted that ghrelin levels at baseline would differ between emotional and non-emotional eaters, follow-up tests were conducted to assess whether these groups differed at baseline and at various times following the treatments. These analyses, in fact, confirmed that ghrelin levels in emotional eaters ($M = 30.53, SD = 19.99$) were significantly lower than among non-emotional eaters ($M = 47.87, SD = 40.51$), $t(46) = 2.13, p < .05$. However, 10 min later, ghrelin levels among emotional eaters (irrespective of stressor condition) increased by about 40%, and hence the difference between the emotional and non-emotional eaters was reduced. Interestingly, at the fourth sampling time, which occurred 10 min after food consumption, ghrelin levels declined significantly among the non-emotional eaters, but remained stable among emotional eaters. As a result, following eating, differences in the levels of ghrelin between the two groups were entirely absent.

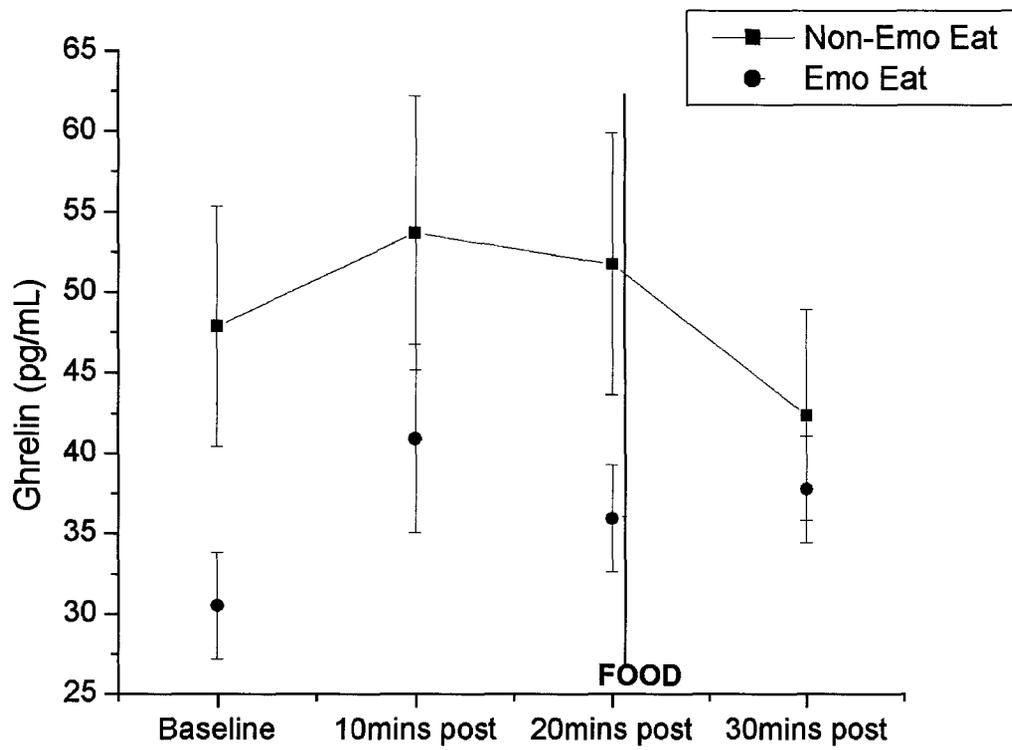


Figure 6. Mean (\pm SEM) of women's ghrelin levels over time as a function of emotional eating status. Food was introduced immediately after the 20 min blood sample was collected.

The Mediating Effect of Emotions on Cortisol Responses

Given the effect of the stressor condition on emotional and cortisol responses (and in particular, cortisol levels at 10 min post stressor), it was of interest to examine whether emotions mediated this relation. As shown in Table 15, cortisol reactivity (measured by subtracting baseline values from the values obtained 10 min post-task) was positively correlated with both anger and shame (but not anxiety). Thus, either of the former emotions could act as potential mediators. Preacher and Hayes' (2004, 2008) method for assessing multiple mediation was followed, with 5000 bootstrap iterations and 95% bias corrected confidence intervals.

As shown in Figure 7, the direct relation between the stressor condition and cortisol was significant, but this effect was significantly reduced when anger and shame were entered as mediators. Inasmuch as this effect remained significant, it seems that these emotions might have served as partial mediators in the effect of stressor condition on cortisol changes. Examination of the 95% confidence limits for the mediated paths through anger and shame further indicated that reported anger uniquely served as a mediator in the relation between stressor condition and cortisol. Finally, in contrast to cortisol, ghrelin levels did not correlate with any of the moods, and thus these emotions could not act as mediators.

Table 15. *Bivariate zero-order Pearson correlations between evoked emotions, and hormone reactivity*

	1	2	3	4	5
1. Anger	-				
2. Anxiety	.65 ^{***}	-			
3. Shame	.64 ^{***}	.57 ^{***}	-		
4. Cortisol Reactivity	.49 ^{***}	.19	.43 ^{**}	-	
5. Ghrelin Reactivity	-.04	.04	.00	-.16	-

Cortisol and ghrelin reactivity represent the post stress – baseline hormone levels.

** p < .01, *** p < .001

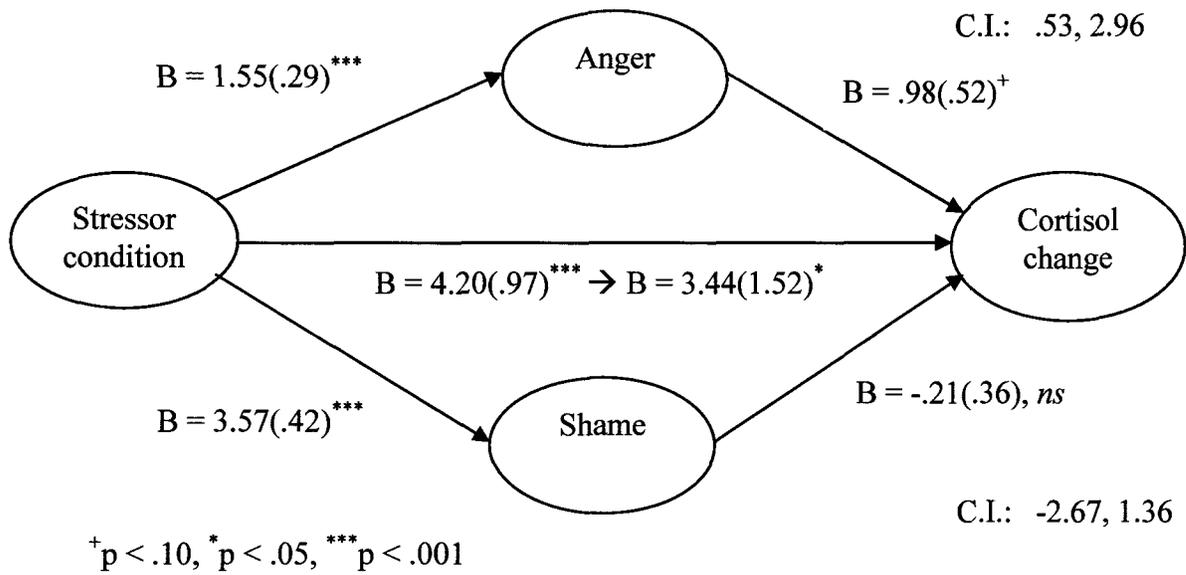


Figure 7. The mediating effects of anger and shame on the relationship between the stressor condition and change of cortisol level. Coefficients are the unstandardized path coefficients, with standard errors indicated in brackets. C.I. represents the 95% bias corrected confidence interval around the mediated path coefficient.

Discussion

It was expected in the present investigation that the laboratory stressor would increase plasma cortisol levels, and that this effect would be mediated by the intensity of emotional responses elicited by the stressor. Moreover, it was hypothesized that following a stress test food consumption would be associated with elevated ghrelin and cortisol levels, and would be especially notable among emotional eaters. Further, the emotional responses elicited by the stress test (anger, shame and anxiety) would mediate the relation between the stressor experience and the neuroendocrine changes that ensued.

As frequently observed (Dickerson et al., 2004; Dickerson and Kemeny, 2004; Het and Wolf, 2007; Kirschbaum et al., 1999), circulating cortisol levels were indeed elevated following engagement in the TSST. It has been suggested that this psychosocial stressor is effective in promoting the cortisol elevations, in part, because it involves a self-evaluative threat (Dickerson and Kemeny, 2004; Het and Wolf, 2007), which elicits negative self-evaluative emotions, such as shame (Dickerson et al., 2004; Gilbert, 1997; Gruenewald et al., 2004; Tangney, 1995; Tangney and Fischer, 1995). It has also been reported that anger is provoked in response to the TSST (Kelly et al., 2008), an emotional response that has also been found, in other contexts, to be associated with increased cortisol levels (Matheson and Anisman, 2009). In line with these studies, in the present study the TSST was associated with anger, shame and anxiety, with the self-reported shame being most prominent. Moreover, as previously observed (Dickerson et al., 2004; Dickerson and Kemeny, 2004), shame was correlated with cortisol levels in the present study, as was anger, whereas self-rated anxiety was not related to cortisol even though it was moderately related to both shame and anger. Interestingly, the relationship between

the stressor and cortisol changes was partially mediated by anger and not by shame, despite the particularly marked rise of self-reported shame following the TSST.

Even though anger was a partial mediator in the relationship between the laboratory stressor and cortisol responses, it is possible that ‘anger’ actually had alternative meanings across participants. Anger is typically thought of as an other-directed emotion, but there are instances where it may be directed at the self, or at one’s reference group (Hansen and Sassenberg, 2006; Weiner, 1985). It is possible that feelings of anger might have reflected women’s frustration with the task itself (giving the speech and performing the math subtractions), or women might have experienced self-directed anger (or frustration) for not have performed as well as they would have liked or anticipated. It is uncertain whether the relation to cortisol in the present investigation involved anger directed outward or at the self.

The influence of the stressor on mood varied as a function of the individual’s emotional versus non-emotional eating status. In the case of both shame and anger, these emotions were elicited to a comparable extent in the emotional and non-emotional eaters. In contrast, baseline anxiety levels were higher among emotional than among non-emotional eaters. In response to the stressor, anxiety increased in non-emotional eaters, but the levels of this emotion were not augmented further in the emotional eaters. In effect, these women seemed to report relatively high levels of anxiety irrespective of the stressor condition. It is uncertain, however, whether the high anxiety evident in emotional eaters in the absence of the TSST reflects a stable characteristic of these individuals, or whether it was a reflection of the test situation, in general, including having a catheter inserted into their arm. In effect, it is possible that emotional eaters, who often exhibit

characteristics of a subclinical version of binge eating (binge episodes are likewise triggered by negative affect) (Barker et al., 2006), may also be particularly stressor sensitive (Crowther et al., 2001; Wolff et al., 2000), thus leading to elevated anxiety even in the absence of the stressor within the present investigation.

It was expected that being an emotional eater would moderate hormonal responses to a stressor. Although altered cortisol responses following stressors have been reported in some eating disorders, such as anorexia and bulimia (Abell et al., 1987) and in binge eaters (Gluck et al., 2004), there has been limited information concerning cortisol changes in emotional eaters. It seems that individuals who exhibit high cortisol reactivity following stressor exposure consumed more calories on stress days than did low cortisol reactors, and they also exhibited a preference for sweet foods (Epel et al., 2001), just as emotional eaters show this preference following stressor experiences (Oliver et al., 2000). The present finding of a greater cortisol change in emotional than non-emotional eaters following the TSST is consistent with these earlier reports. Yet, it ought to be noted that at baseline cortisol levels among emotional eaters was somewhat lower than in non-emotional eaters, and following the stressor rose only somewhat above that of non-emotional eaters. Thus, while the actual change of cortisol was greater in emotional than non-emotional eaters, the actual post-stress hormone levels were not different between groups. Given the limited post-stressor differences of cortisol levels between emotional and non-emotional eaters, it is still premature to ascribe the behavioral differences to this hormone.

It will be recalled that ghrelin elevations are thought to stimulate hunger and food intake (Cummings et al., 2004a; Cummings et al., 2002a; Malik et al., 2008; Schmid et

al., 2005a; Wren et al., 2001a). Thus, it was expected that basal ghrelin differences might be present between emotional and non-emotional eaters, and that levels of ghrelin would decline following food consumption. Further, it was expected that as emotional and non-emotional eaters might be differentially stressor-sensitive, this might be manifested in the ghrelin response to stressors. Paralleling studies conducted in patients with eating disorders, such as bulimia and binge eating disorder (Geliebter et al., 2005a; Monteleone et al., 2005), we observed that baseline ghrelin levels among emotional eaters were appreciably lower than in non-emotional eaters. Moreover, in non-emotional eaters a 25% decline of ghrelin was apparent within 10 min of participants having a snack, whereas this decline was not apparent among emotional eaters. Together, these findings raise the possibility that among non-emotional eaters food consumption reduces ghrelin, whereas in emotional eaters the sustained levels of ghrelin would continue to provide a feeding signal, much as has been suggested to occur in women with binge eating disorder (Geliebter et al., 2005b). Additionally, as eating initiation in emotional eaters is tied to emotional responses, it is possible that lower and more stable ghrelin levels in these individuals reflected a decrease in reliance on hunger signals to initiate food intake.

As hunger itself is typically associated with increased ghrelin levels (Blom et al., 2005; Cummings et al., 2004b), it was thought that differences in hunger levels between emotional and non-emotional eaters might be evident at the start of the session. As indicated previously, this was not the case, and thus the between-groups difference of ghrelin could not be attributed to this factor. A second possibility was that differences in BMI (or factors related to BMI) were responsible for the different baseline ghrelin levels, as BMI was reported to be inversely correlated with ghrelin levels, i.e., overweight and

obese individuals display lower ghrelin levels than normal weight individuals (Beasley et al., 2009; Schur et al., 2008; Yildiz et al., 2004). However, this explanation did not hold for the present investigation, as there was no significant difference in the BMI of these two groups, and both were within the normal weight category.

Contrary to research indicating that food intake is increased during stressful times (Epel et al., 2001; Wallis and Hetherington, 2004), in the current investigation, the stressor condition was not significantly associated with women choosing the high fat carbohydrate foods. The reason for this discrepancy, from an evolutionary perspective, may be that it is potentially detrimental for an organism to seek food during or immediately following a stressor, as it may impact on the organism's abilities to engage in defensive behaviors (Merali et al., 1998). During these times food seeking behaviour is suppressed, as efforts focus on dealing with the stressor at hand. It is conceivable that food intake would increase as time passes after the stressor, when a threat was no longer perceived. Thus, it is possible that the between study differences may reflect the timing of food presentation, as well as the duration of the threat presentations. Further to this same issue, the nature of the stressor experienced (e.g., stress tests that require active vs. passive responses; tests that involve or do not involve ego threats; anticipatory versus performance stressor) may also be important in influencing this relationship, as not all stressors elicit similar responses (Lattimore and Caswell, 2004; Wallis and Hetherington, 2009). It ought to be considered, as well, that assessing food consumption, especially that of comfort foods, may not be amenable to assessment in contrived laboratory tests, especially when these involve relatively brief sessions (cf. (Wallis and Hetherington, 2004) vs. the present study). One can readily imagine that consumption of comfort foods

might occur less readily in a laboratory context relative to that which might occur in the individual's home while they were winding down from daily stresses that might have been experienced.

Limitations and Conclusions

The present investigation provided indications of the relations between a stressor experience and cortisol and ghrelin levels in emotional and non-emotional eaters. The nature of the study, including several of the procedures employed, pose several limitations to the conclusions that can be drawn. Specifically, the sample size was relatively low and homogeneous, and hence the findings ought to be considered cautiously. Also, it is not optimal to use a median split to categorize individuals as emotional and non-emotional eaters, as it results in the artificial differentiation of individuals close to the median. However, the small sample size of the current investigation did not permit the use of hierarchical regression analyses (i.e., power was too low), and as such a median split was employed. Additionally, body image as well as food preferences may vary across cultures, and hence the impact of stressors on consummatory behaviors may vary accordingly. Unfortunately, in the present investigation, the small number of participants from diverse cultures did not permit an analysis that included this variable.

Although participants were instructed not to eat or drink for at least an hour before testing, and perceived hunger ratings were reported, the lack of standardization of eating in the hours before the blood sampling (i.e., amount and type of food eaten), could potentially confound the results. In a similar vein, BMI was measured through self-report, which was shown to provide a conservative estimate of actual weight (Gorber et al.,

2007). As well, as already mentioned, the fact that the study was conducted in a laboratory setting begs the question of whether similar results would be found in natural settings where additional food cues and psychosocial factors. Finally, emotional eating scores in the present investigation were somewhat lower than those frequently observed, although considerable inter-laboratory differences have been reported in this regard (cf. (Anschutz et al., 2009; Hasenboehler et al., 2009; Lebel et al., 2008; Wallis and Hetherington, 2009). The factors responsible for the diversity of scores across studies are uncertain, nor is it clear whether the marginally lower emotional eating scores in the present investigation influenced the observed outcomes.

These caveats notwithstanding, this investigation offers new perspectives on stress and eating-related hormone responses among women with non-clinical disturbed eating patterns. The present results suggest that cortisol responses to a stressor challenge, particularly the TSST, are tied to variations of shame and anger, and the latter served as a partial mediator in the relationship between the stressor and cortisol changes. Moreover, among individuals who were not yet overweight or obese, those considered emotional eaters displayed a ghrelin profile akin to that of overweight and obese individuals (Vazquez Roque et al., 2006; Zwiriska-Korczała et al., 2007). They demonstrated lower baseline levels of the peptide, and the normalization of ghrelin levels following eating was blunted. Although highly speculative, these findings raise the possibility that emotional eating, and its associated hormone alterations, represents a risk factor in the development of obesity.

Statement Regarding Chapter 4

Study 5 provided support for the suggestion that emotional eaters, like binge eaters, might be especially stressor sensitive. Furthermore, emotional eaters demonstrated altered ghrelin patterns during the food presentation period, in that their ghrelin levels did not exhibit the expected decrease that is typical following food consumption, and which was in fact observed among non-emotional eaters. These findings suggested the possibility of an altered ghrelin feedback regulation system, although these findings were preliminary and warranted replication. As such, Study 6 was conducted, in part, to replicate these findings, as well as to verify that the effects of emotional eating status on ghrelin levels were not due to the differing nutrient contents of the food choices offered in Study 5. Accordingly, in Study 6 women were offered a single food choice, and also had a control condition in which participants were not provided food during the blood sampling procedure. Additionally, as stress-related food consumption might vary in *anticipation* of a psychosocial stressor, rather than the primary stressor itself, this study focused on changes that occurred during anticipation of an aversive event.

Chapter 4

Anticipation of a psychosocial stressor differentially influences ghrelin, cortisol and food intake among emotional and non-emotional eaters

Abstract

Negative emotions trigger eating in some individuals (emotional eaters) possibly by influencing stress hormones that contribute to eating regulation (e.g., cortisol), or eating-related peptides (e.g., ghrelin) signalling food initiation. The present study assessed whether stressor-elicited cortisol and ghrelin changes would differ between emotional and non-emotional eaters, and whether eating would be associated with neuroendocrine responses. Undergraduate women (N=103) who completed measures of emotional eating, were assigned to *anticipate* either a stressful or non-stressful event. During this period, participants were or were not offered food. Blood samples were taken continuously over a 40-minute period to assess changes of cortisol and ghrelin levels across the session, and mood was assessed after the anticipation period. Ghrelin levels were elevated among women anticipating a stressor, compared to those in the control condition. Initial levels of ghrelin were lower in emotional eaters than non-emotional eaters, and this relation was mediated by percent body fat. Additionally, the normal decline of ghrelin following food consumption was not apparent among emotional eaters. Food intake was not tied to hormone responses, however reported hunger was associated with greater food intake for women in the stressor condition. Psychological factors coupled with subjective feelings of hunger, might contribute to eating in response to an acute stressor. Additionally, feedback mechanisms controlling the normalization of ghrelin levels might be disturbed in emotional eaters. The similarity of the ghrelin profile of emotional eaters to that of binge eaters and obese individuals, raises the possibility that altered ghrelin patterns might be a risk factor for such conditions.

Introduction

Stressful events may promote either reduced or increased eating, depending on the nature and/or severity of the stressor (Lattimore and Caswell, 2004; Newman et al., 2007; Stone and Brownell, 1994), and whether the individual is prone to being an emotional eater (Newman et al., 2007; Oliver et al., 2000). In this regard, emotional eaters are those individuals for whom negative emotional states trigger a desire to eat (van Strien, 2010; van Strien et al., 1986), perhaps as a form of affect-regulation, either through self-medication or reward processes (Corsica and Spring, 2008; Davis et al., 2004; Stice et al., 2008). Studies in rodents likewise indicated that although stressors typically elicit reduced eating, under some conditions (i.e., chronic stress) stressful events may provoke elevated consumption (Dallman et al., 2003b), particularly in the form of highly palatable foods (Dallman et al., 2005; Kandiah et al., 2006; Zellner et al., 2006).

The release of stress-hormones, such as corticosterone, might contribute to increased consumption of palatable foods (Dallman et al., 2005; Epel et al., 2001). This could occur through the increased salience of the pleasurable effects of eating stemming from glucocorticoid interactions with the dopamine reward processes (Adam and Epel, 2007; Berthoud and Morrison, 2008), by glucocorticoid stimulation of endocannabinoid receptors and other target neurons of the hypothalamus (Dallman, 2007; Di et al., 2003), and by glucocorticoid inhibition of the anorectic effects of corticotropin releasing hormone (CRH) within the paraventricular nucleus of the hypothalamus (PVN) (Laugero et al., 2002; Nieuwenhuizen and Rutters, 2008).

Ghrelin is known for its involvement in the regulation of eating processes, and has been associated with increased feelings of hunger, eating initiation, as well as caloric

intake (Cummings et al., 2004b; Schmid et al., 2005b; Wren et al., 2001b). Furthermore, ghrelin levels fluctuate over the day, peaking before meals and during fasting (Cummings et al., 2001; Tschöp et al., 2000), and decreasing shortly after food consumption (Aydin, 2006; Cummings et al., 2004b; Cummings et al., 2002b). Like cortisol, ghrelin levels might be affected by stressors, and might thus contribute to eating associated with stressful experiences. Indeed, stressors consistently increase ghrelin levels in rodents (Asakawa et al., 2001; Kristensson et al., 2006; Lutter et al., 2008; Patterson et al., 2010), and in humans, ghrelin levels were elevated by stressors among individuals that showed a high cortisol response to a stressor (Rouach et al., 2007).

Altered ghrelin patterns have been observed among women presenting with clinical levels of eating disorders. Whereas anorexia and bulimia nervosa have been associated with increased ghrelin levels, binge eating was associated with decreased ghrelin (Geliebter et al., 2005b; Monteleone et al., 2005; Tanaka et al., 2002; Tanaka et al., 2003), as well as a diminished postprandial decline of ghrelin (Geliebter et al., 2004). However, there is scant information regarding potentially altered ghrelin patterns among individuals with non-clinical eating disturbances. In this regard, it was reported that levels of ghrelin were relatively low in emotional eaters, and did not decline following food consumption as ordinarily observed (Chapter 3), suggesting that ghrelin levels might be likewise affected among individuals with sub-clinical levels of eating disturbances.

Together, these findings raise the possibility that variations of ghrelin might be fundamental in determining whether individuals exhibit increased vs. decreased food consumption in response to stressful events, and whether such an outcome would vary among individuals who were emotional vs. non-emotional eaters. Typically, however,

food intake and hormone levels have been assessed after exposure to a stressor, even though *anticipation* of a stressor elicits anxiety, and could potentially promote eating among emotional eaters. The present investigation assessed whether anticipation of a stressor was related to ghrelin and cortisol levels, and whether this effect would be moderated by emotional eating status. More specifically, it was expected that cortisol and ghrelin levels would increase in anticipation of the stressor, compared to the control task, and that this effect would be exaggerated among emotional eaters. Additionally, it was expected that emotional eaters would have lower levels of basal ghrelin than non-emotional eaters, and that ghrelin levels would not decrease among emotional eaters following food intake. Finally, it was of interest to examine, the association of food intake with stressor-elicited changes in cortisol and ghrelin levels, and whether these associations would differ between emotional and non-emotional eaters.

Methods

Participants

Undergraduate women ($N = 103$, $M_{age} = 20.72$ years, $SD_{age} = 2.43$ years) were recruited via an online study recruitment system for a two-part study allegedly examining student responses to an employment task (see Appendix D for recruitment notice). Of those who reported their ethnicity, 51% ($n = 52$) were Caucasian, 13.7% ($n = 14$) were Middle Eastern, 11.8% ($n = 12$) were East Asian, 11.8% ($n = 12$) were Black, 2.9% ($n = 3$) were Hispanic, 2.9% ($n = 3$) were Asian, 2.0% ($n = 2$) were Aboriginal, and 3.9% ($n = 4$) were Other. Exclusionary criteria for the blood sampling session included medical conditions or medications that could affect hormone release (assessed in background information questionnaires), as well as extreme fear of needles or previous bad

experiences (e.g., nausea, fainting) while providing blood samples, which was assessed by the researcher at the end of the first session.

Measures

Emotional Eating Behavior. The Emotional Eating subscale of the Dutch Eating Behaviors Questionnaire (van Strien et al., 1986) assessed women's emotional eating behaviors. This 13-item scale uses a 5-point Likert scale ranging from 0 "Never" to 4 "Very Often" to rate the degree to which women endorsed each of the statements assessing the desire to eat in response to diffuse negative emotions (e.g., upset, irritated, bored). This scale demonstrated excellent reliability (Cronbach's $\alpha = .96$).

Mood. Women's feelings of anger, anxiety, and shame were measured on a 7-point Likert scale of 0 "Not at all" to 6 "Extremely", using a modified Positive and Negative Affect Schedule (Watson et al., 1988) higher scores reflected increased negative emotion. Reliability was strong for all mood subscales of anger (angry, annoyed, enraged, frustrated, hostile, infuriated, irritable), anxiety (afraid, anxious, confused, jittery, nervous, scared, worried), and shame (ashamed, embarrassed, humiliated); Cronbach's α 's ranged from .85 to .87.

Body Mass Index and Percent Body Fat. The height and weight of participants were measured at the end of the laboratory session, and these measurements were used to calculate body mass index (BMI), and percent body fat was assessed using a hand-held bioelectric impedance monitor; Omron BF-306 body fat analyzer. This monitor provides results consistent with more involved methods of body fat measurement such as Tampere and Wageningen densitometry (underwater weighting), and dual energy X-ray absorptiometry (DEXA) (Deurenberg, 2001; Lintsi et al., 2004).

Hunger and Food Eaten. Subjective hunger was assessed at the beginning of the session, before the blood sampling began. Using a scale of 0 “Extremely Full” to 10 “Extremely Hungry”, women were asked to rate how hungry they were at that moment. Half of the women in each condition (i.e., stressor and control) were provided with 6 pre-weighed miniature brownies (~120g of food) in a bowl during the final session and were allowed to eat freely after 15 minutes of task anticipation (the 6 miniature brownies filled the bowl). The food was again weighed after 15 minutes of availability to participants. The nutritional content per brownie (~20g) was 85 calories, 5.5g of fat, 10.5g of carbohydrates, and 1g of protein.

Procedure

Introductory session.

This study was approved by the Carleton University Department of Psychology Ethics Committee, and followed the Tri-Council Policy for the Ethical Conduct for Research Involving Humans. Women were recruited via an online study recruitment system to participate in a study examining women’s responses to an employment task. Upon entering the laboratory, women were informed that the goal of the study was to examine responses to a potentially stressful employment task, and it involved two sessions; the first would assess general perceived stress, general coping with stressful events, factors that can influence coping (e.g., social support), and daily eating patterns changed during these times. If they agreed to participate, they would be invited back for a second session where they would be asked to perform the employment task, and a blood sample would be taken (by a nurse) continuously over a 40 minute period to examine the role hormones play in response to potential stressors.

After completing the Informed Consent, women completed background information (Appendix D), and an emotional eating behavior questionnaire (Appendix E). Women who ended their participation after the first session were then debriefed (see Appendix D for debriefing). Eligible women who agreed to participate in the final session provided the researcher with their contact information to schedule the second session. Women were given \$10, course credit, or a combination of the two for participation in the Introduction session. There was approximately 1 week between women's participation in the Introduction and Final sessions.

Final session.

Upon entering the laboratory the overall purpose of the study was again explained, as well as what would be requested of the women during this session, including being asked to perform the employment task. They were again informed that because this session would investigate the role of hormones in stressor responses, they would be asked to provide a continuous blood sample over a 40-minute period. Written informed consent was again obtained for this session; first for general participation, and then asking permission to take blood samples, and to use them to examine the hormones of interest (Appendix D).

Figure 8 provides a visual representation of the sequence of events that each participant experienced. After signing the informed consent forms women provided information regarding their perceived hunger (Appendix G). The nurse then inserted a catheter needle into the participants arm to begin the blood sampling. Women were given 10 minutes to relax and read neutral content magazines (i.e., home décor magazines), after which the employment task was explained. Those in the control condition ($n = 46$)

were told that they would be given a general interest employment questionnaire (e.g., potential jobs areas of interest, the popularity of various job areas) to get an idea of how student employment perceptions and interests differed. Participants were told that it would be another 15 minutes before they would receive the questionnaire, and they could continue reading the magazines until then. Those in the stressor condition ($n = 57$) were told that they would be asked to give an employment speech to a panel of judges (graduate students) as if they were applying for a job. They were informed that they would have 5 minutes to speak, and were expected to fill the entire time; the panel would not ask questions. After their speech, they would be asked to perform a 5-minute mental math task (together, these tasks comprise the Trier Social Stress Test; TSST). They were told that the task would begin in approximately 15 minutes, and they should use that time to prepare their speech. They could make notes to organize ideas for the speech, but were informed that they could not use these notes during the speech.

After 15 minutes of task anticipation the researcher entered the room and, for those in the control condition, informed the participant that the last questionnaire had been used with the previous participant, and they would print another copy and return in a few minutes. For those in the stressor condition, the researcher told a confederate in the hallway outside the testing room that the employment speech audience was one person short, and asked if they would serve on the panel; the confederate replied that they couldn't. The researcher then entered the testing room and informed the participant that they were missing one person for the audience and would return in a few minutes with a full panel, at which point they would begin the speech. Before leaving the testing room, the researcher put out evaluation sheets and pencils at the far end of the testing room for

the audience members. For those in the food condition, the researcher provided a weighed amount of miniature brownies and a bottle of water. Participants were told they were being given food because this was a requirement when taking a blood sample. The researcher was not in the room when food was available to participants, and the nurse was not visible behind a moveable barrier. After 15 minutes the researcher returned to tell participants that they were unable to find the computer file to print the employment questionnaire (control group), or that there were no additional graduate students available to complete the panel audience (stressor group), and they would not have to do the task after all. The needle was removed at this point. The researcher then removed the brownies (which were subsequently weighed), and participants completed the questionnaire booklet, including the mood assessment (Appendix G). When finished, the nurse measured participant height, weight, and percent body fat. All participants were then given food and water, were verbally debriefed, and provided with take-home debriefing and contact information sheets (Appendix D). Women were given \$15, course credit, or a combination of the two for participating in the final session (this is in addition to the money and/or credit obtained for the Introduction session), and an additional \$15 for providing a blood sample.

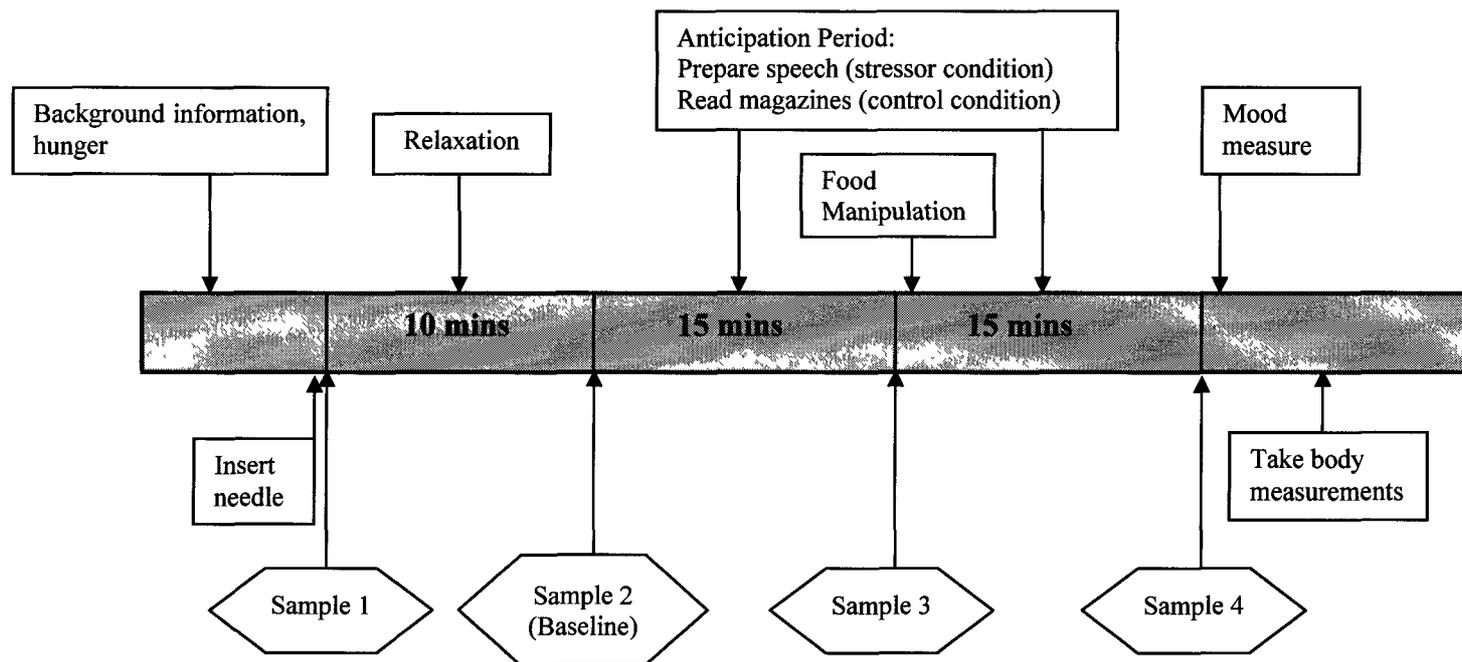


Figure 8. Sequence of procedures for the laboratory session procedure

Blood sampling and hormone analyses.

A Dakmed continuous withdrawal blood sampling pump (Dakmed Inc., Buffalo, NY) and a butterfly catheter with a 5-foot lead were used to collect the blood samples into EDTA coated Vacutainer tubes. The samples used for hormone analyses were taken following initial needle insertion (Initial), before the task anticipation period (Baseline), after 15 minutes of anticipation, and after 30 minutes of anticipation (for half of participants this also included 15 minutes of access to food) (see Figure 8). Each sample contained approximately 2.75mL of blood. Blood samples were immediately centrifuged for 15 minutes at 2100g at 4°C. Plasma was aliquoted into smaller tubes (1N HCL was added into ghrelin tubes), which were frozen at -80°C until they were used in hormone analyses.

Plasma levels of cortisol (H^3 ; MP Biomedicals, Solon, OH) and active ghrelin (I^{125} ; Linco, St. Charles, MO) were determined by radioimmunoassay. Assays were conducted in duplicate, and intra-assay variability was less than 8%. All samples were assayed in a single run to preclude inter-assay variability. The sensitivity of the cortisol and ghrelin assays were 25 μ g/100mL, and was 7.8pg/mL, respectively.

Statistical Analyses

To assess women's mood responses in anticipating the employment task, a 2 (Stressor Condition: Control vs. Stressor) x 2 (Food Condition: No food vs. food) x 2 (Emotional Eating: Non-emotional eaters vs. emotional eaters) multivariate analysis of variance (MANOVA) was performed on feelings of anger, anxiety, and shame following task anticipation. The MANOVA was followed by univariate analyses. Food intake (grams of food eaten) during anticipation of a stressor was analyzed through a 2 (Stressor

Condition: Control vs. Stressor) x 2 (Emotional Eating: Non-emotional eaters vs. emotional eaters) analysis of variance (ANOVA)⁷. Differences between non-emotional eaters and emotional eaters' initial levels of cortisol and ghrelin were assessed using independent-samples t-tests. Owing to the variance of the ghrelin values, the square root of raw ghrelin scores were used in analyses, but the means of the raw scores are provided in the text and figures. Similar ANOVAs⁸ were performed to examine hormone responses to anticipation of the stressor (vs. control condition) by evaluating the change of the hormone levels during the anticipation period (15 min into this period) relative to baseline. In order to assess the effect of food intake on hormone levels, separate 2 (Stressor Condition: Control vs. Stressor) x 2 (Food Condition: No food vs. food) x 2 (Emotional Eating: Non-emotional eaters vs. emotional eaters) ANOVAs of cortisol and ghrelin difference scores were performed. This difference score comprised the value at the end of the 30 minutes anticipation period relative to that evident 15 min into the anticipation period, which corresponded to the food presentation period (see Figure 8). Follow-up analyses of simple effects of significant interactions were conducted using Bonferroni corrected t-tests. Associations between reported hunger, mood, food consumption and hormone reactivity were examined using bivariate zero-order Pearson correlations, and tests of mediation were performed using bootstrapping techniques with 95% bias corrected and accelerated confidence intervals, and 5000 bootstrap iterations (Preacher and Hayes, 2004).

⁷ Food manipulation condition was not included in this analysis as the participants who did not receive food would not have a value for food intake.

⁸ Food manipulation condition was not included in this analysis, and that examining stressor effects on levels of ghrelin, as the manipulation was not yet introduced during the time that the relevant blood samples for this period were taken.

Results

Comparison of Emotional and Non-Emotional Eaters

Women were classified as emotional eaters and non-emotional eaters based on a median split ($M = 1.84$, $SD = 1.06$; $Md = 1.69$). As indicated in Table 16, emotional eating behaviors were significantly higher among emotional eaters, compared to non-emotional eaters, $t(101) = -14.34$, $p < .001$. Although BMI scores did not differ between these groups, $t(98) = -1.54$, *ns*, emotional eaters displayed significantly higher percent body fat than non-emotional eaters, $t(99) = -3.02$, $p < .01$.

Table 16. *Mean (\pm SD) of Participant Emotional Eating Behaviors, Physical Characteristics, and Hunger (N = 103)*

	Non-Emotional Eaters	Emotional Eaters
Emotional Eating	0.94 (0.53)	2.67 (0.68) ^{***}
Body Mass Index	22.84 (4.89)	24.31 (4.61)
Percent Body Fat	22.13 (8.09)	26.56 (6.62) ^{**}
Hunger	5.10 (1.75)	5.38 (1.84)

* $p < .05$, ** $p < .01$, *** $p < .001$, as compared to non- emotional eaters

Mood Responses to Stressor Anticipation

Women's post-task anticipation of feelings of anger, anxiety, and shame were significantly affected by stressor condition, $Pillais = 0.084$, $F(3,91) = 2.80$, $p < 0.05$. Specifically, feelings of anger and anxiety were increased in the stress condition ($M_{anger} = 0.47$, $SD_{anger} = 0.73$; $M_{anxiety} = 1.21$, $SD_{anxiety} = 1.09$), compared to the control condition ($M_{anger} = 0.24$, $SD_{anger} = 0.57$; $M_{anxiety} = 0.66$, $SD_{anxiety} = 0.86$), $F(1,93) = 4.50$, $p < 0.05$, $\eta^2 = 0.046$, and $F(1,93) = 6.52$, $p < 0.05$, $\eta^2 = 0.065$, respectively. Shame, in contrast, was unaffected by the stressor condition (control: $M_{shame} = 0.25$, $SD_{shame} = 0.75$; stressor: $M_{shame} = 0.27$, $SD_{shame} = 0.61$), $F < 1$, *ns*.

Food Intake During Stressor Anticipation

Food intake was not affected by anticipation of a stressor (vs. control task), $F < 1$, but was moderately influenced by emotional eating status, $F(1,51) = 3.76$, $p = 0.058$, $\eta^2 = 0.069$, wherein emotional eaters ($M = 43.77$ g, $SD = 26.17$ g) consumed more grams of food than non-emotional eaters ($M = 31.17$ g, $SD = 25.08$ g). Importantly, although the significance of the difference was marginal, emotional eating accounted for almost 7% of the variance.

Although stressor condition itself did not influence food intake, it was possible that women's hunger affected food consumption during the relatively stressful anticipation period. Accordingly, potential differences in reported hunger between women in the stressor and control conditions were examined, as was the association between reported hunger and food intake among these groups. Despite similar hunger scores between women in the stressor ($M = 5.14$, $SD = 1.78$) and control conditions ($M = 5.33$, $SD = 1.83$), $t(101) = 0.52$, *ns*, reported hunger was associated with greater food

intake for women in the stressor condition ($r = .43, p < .05$), but not the control condition ($r = .03, ns$) (Table 17).

Table 17. *Bivariate Pearson correlations examining associations between emotional eating, body composition measures, hunger, mood, hormone levels, and food eaten as a function of stressor condition.*

	1	2	3	4	5	6	7	8	9	10
1. Emotional Eating		.10	-.03	-.16	.04	.00	-.10	-.11	.09	.21
2. Hunger	-.04		.14	.23 ⁺	-.08	-.15	.10	.02	.46 ^{**}	.43 [*]
3. Anger	.35 [*]	-.09		.47 ^{***}	.56 ^{***}	-.10	-.04	.03	.04	.18
4. Anxiety	.16	-.07	.74 ^{***}		.36 ^{**}	.00	-.19	.14	.18	.13
5. Shame	.23	-.08	.81 ^{***}	.57 ^{***}		.14	-.01	-.07	.05	.20
6. Cortisol (Baseline to 15min)	.27 ⁺	.16	.18	.09	.15		-.65 ^{***}	.23	-.15	-.30
7. Cortisol (15min to 30min)	-.13	-.42 ^{**}	.03	-.01	.01	-.37 [*]		-.18	.14	-.01
8. Ghrelin (Baseline to 15min)	.04	-.17	.12	.19	.09	-.23	-.05		-.09	.08
9. Ghrelin (15min to 30min)	-.03	.14	.11	.11	.08	.15	.15	-.35 [*]		.23
10. Food Eaten	.33	.03	.00	.18	-.01	.25	.22	-.01	.08	

* p < .05, ** p < .01, *** p < .001

Note: Correlations below the diagonal represent those for the control condition, and those above the diagonal represent those for the stressor condition.

Initial Levels of Cortisol and Ghrelin

There was no difference of initial cortisol levels between emotional eaters ($M = 10.57$, $SD = 5.30$) and non-emotional eaters ($M = 10.92$, $SD = 6.49$), $t(91) = 0.28$, *ns*. In contrast, initial ghrelin levels were significantly lower in emotional eaters ($M = 24.47$, $SD = 12.98$) than in non-emotional eaters ($M = 30.71$, $SD = 16.78$), $t(88) = 1.98$, $p = 0.05$.

Cortisol Reactivity in Response to Stressor Anticipation

The change of women's cortisol levels after 15 minutes of stressor anticipation (15 minutes – Baseline) indicated a modest, non-significant tendency for those in the stressor condition to display a larger increase of cortisol than those anticipating a control task irrespective of emotional eating status, $F(1,88) = 2.87$, $p = 0.094$, $\eta^2 = 0.032$ (see Figure 9a).

The analysis examining the change of cortisol over the food presentation period (30 minutes - 15 minutes) revealed no significant influences of emotional eating status or any other factors, on cortisol changes over this period, $F_s < 1$ (Figure 9b).

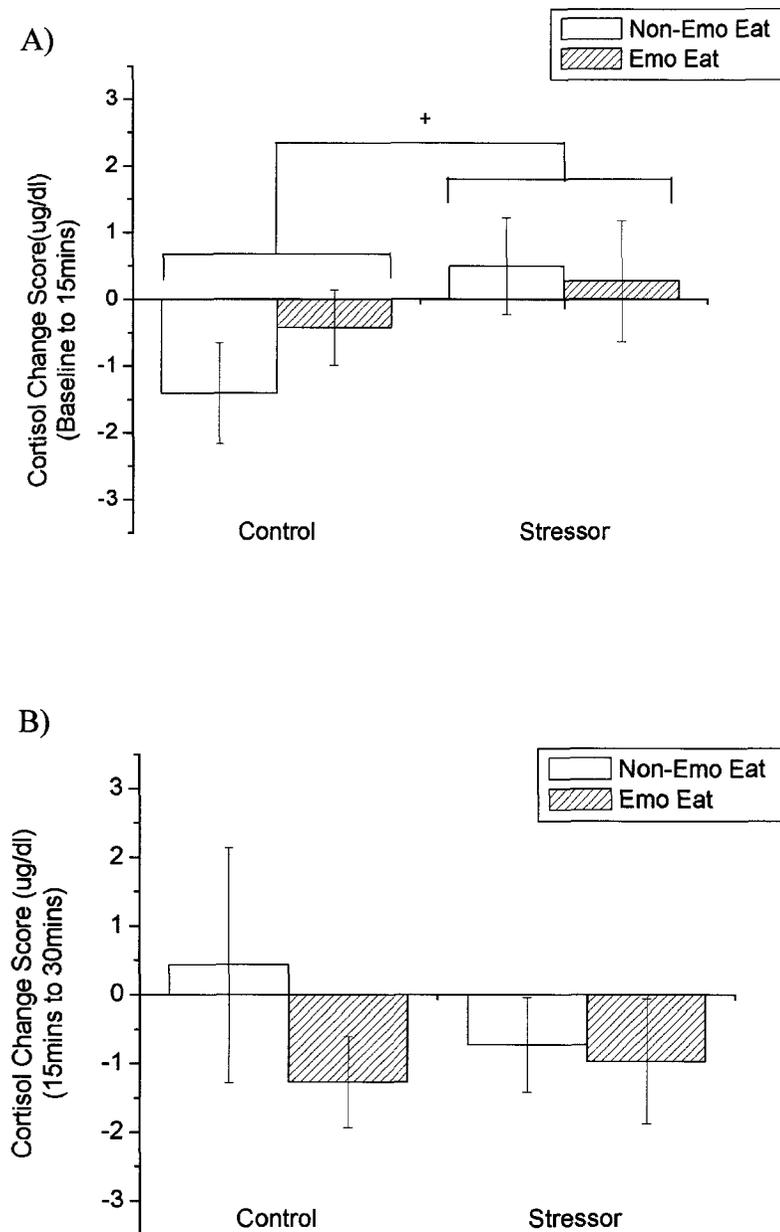


Figure 9. Mean (\pm SEM) change of cortisol levels A) 15-min of anticipation minus baseline to assess anticipatory stress effects, and B) food intake period (30-min of stressor anticipation minus 15-min of anticipation) to assess cortisol levels as a function of food intake on a background of an ongoing anticipatory stressor. Data are displayed as a function of stressor condition and emotional eating status. ⁺p < .10.

Ghrelin Reactivity in Response to Stressor Anticipation

The change of ghrelin levels as a function of stressor and emotional eating status prior to the food manipulation varied as a function of the stressor condition, $F(1,87) = 5.27, p < 0.05, \eta^2 = 0.057$, indicating greater ghrelin elevation in the stressor condition than in the control condition (see Figure 10a). A further analysis was conducted using actual scores rather than change scores to determine whether the rise of ghrelin levels in the stressor condition was significant. A 2 (stressor condition) x 2 (emotional eating status) x 2 (time) mixed measures ANOVA revealed a significant interaction between stressor condition and time, $F(1,87) = 5.27, p < 0.05, \eta^2 = 0.057$. Follow-up analyses indicated that among those in the stressor condition, ghrelin levels following a 15 minute anticipation period ($M = 32.01, SD = 19.30$) were significantly higher than at baseline ($M = 27.93, SD = 16.31$), $F(1,87) = 7.32, p < 0.01, \eta^2 = .100$. A similar change was not apparent among those in the control condition (baseline: $M = 27.99, SD = 16.35$; 15 minutes anticipation: $M = 27.78, SD = 19.04$), $F < 1$.

Women's change of ghrelin levels over the food presentation period (30 minutes - 15 minutes) did not differ as a function of the stressor, food condition, $F < 1$, emotional eating status, $F(1,81) = 1.17, ns$, or the interaction between emotional eating status and food condition, $F(1,82) = 2.51, p = 0.117$. However, as it had been hypothesized that ghrelin levels would differ between emotional eaters and non-emotional eaters provided with food, follow-up analyses of the simple effects were performed. As expected, there was no difference in the change of ghrelin levels between emotional eaters and non-emotional eaters not provided with food $F < 1$. However, among emotional eaters provided with food, the elevated ghrelin levels were maintained, whereas non-emotional

eaters displayed the expected decrease in ghrelin, $F(1,82) = 4.27, p < 0.05, \eta^2 = 0.064$ (Figure 10b). Interestingly, although there was no effect of stressor condition on change in ghrelin levels during the food presentation period, among those in the stressor condition, but not those in the control condition, hunger was associated with the maintenance of ghrelin levels during that time (Table 17).

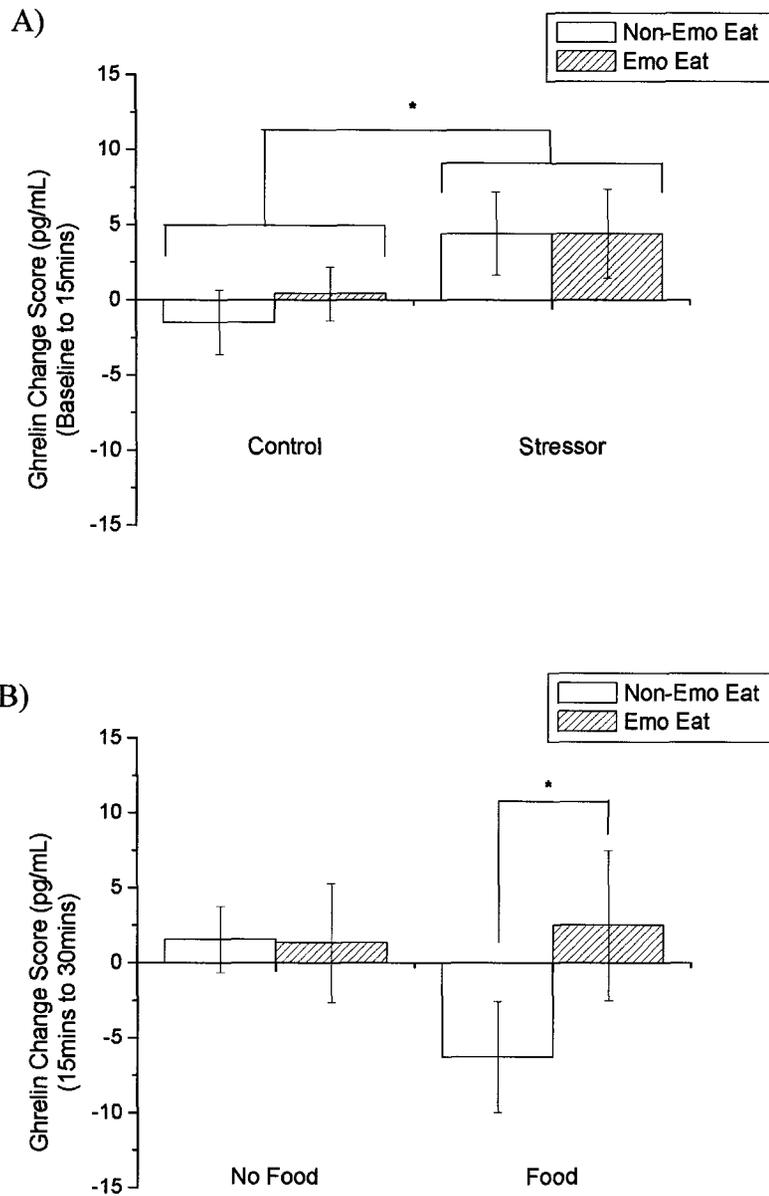


Figure 10. Mean (\pm SEM) change of ghrelin levels A) 15-min of anticipation minus baseline as a function of stress anticipation vs no treatment, and B) food intake period (30-min of stressor anticipation minus 15-min of anticipation) to assess ghrelin levels as a function of emotion eating status and food intake that occurred on the background of stressor anticipation. * $p < .05$.

Mediating Effects of Body Fat on the Relation Between Emotional Eating and Initial Ghrelin

Emotional eaters displayed increased percent body fat, and decreased initial ghrelin levels, compared to non-emotional eaters. As such, we assessed whether percent body fat served as a mediator of the relation between emotional eating and basal ghrelin levels. Bivariate zero-order Pearson correlations indicated that emotional eating scores were significantly associated with percent body fat ($r = .22, p < .05$) and initial ghrelin levels ($r = -.22, p < .05$), and a significant association was also observed between percent body fat and initial ghrelin levels ($r = -.26, p < .05$). Given these significant relations, the mediation was tested, and analyses indicated that the model accounted for 9.5% of the variance. Percent body fat significantly mediated the relation between emotional eating and basal ghrelin levels, (95% BCa C.I.: -2.24, -.12); in effect, the relation between emotional eating and basal ghrelin levels was indirect (see Figure 11).

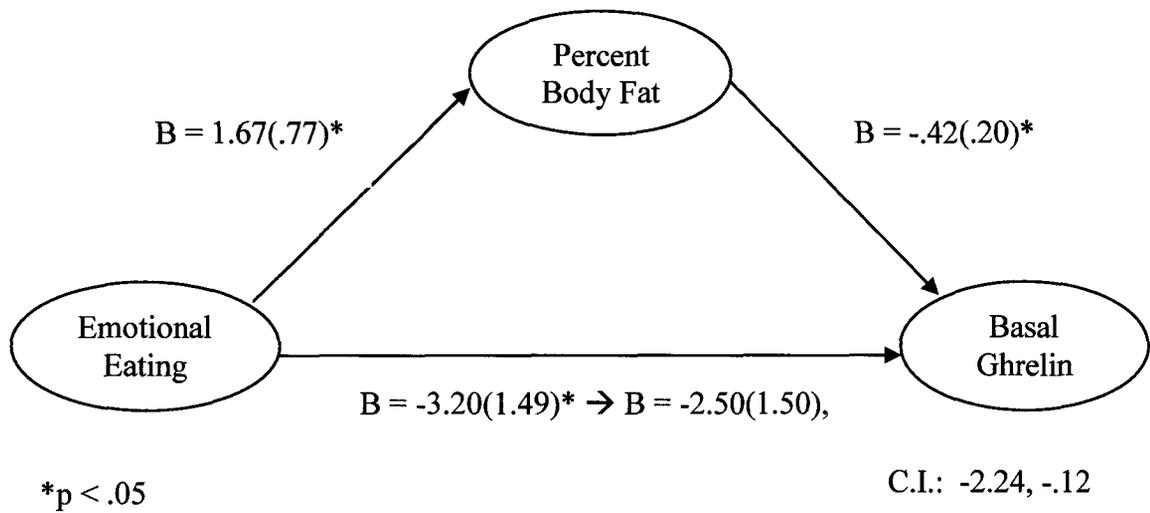


Figure 11. Mediating effects of percent body fat on the relation between emotional eating and basal ghrelin levels. Coefficients are the unstandardized path coefficients, with standard errors in brackets. C.I. represents the 95% bias corrected and accelerated confidence interval around the mediated path coefficient.

Discussion

When threatened with a psychosocial stressor (anticipation of performing the TSST), women reported increased feelings of anger and anxiety, whereas feelings of shame did not differ between women in the control and stressor conditions. We previously reported (Chapter 3), as have others (Gruenewald et al., 2004; Moons et al., 2010) that in response to performing the TSST, levels of shame and anger were particularly marked. Thus, it seems that shame, a negative self-evaluative emotion (Dickerson et al., 2004; Tangney, 1995), was not elicited in the present investigation, as it is likely that this emotion stems from actually performing the public speaking task, rather than its anticipation (Gruenewald et al., 2004). Nevertheless, relative to those in the control condition, feelings typically elicited by stressor events (i.e., anger and anxiety) were elevated among those anticipating the public speaking task, suggesting that anticipation of the task served as an effective stressor.

It was expected that cortisol levels would be elevated among women in the stressor compared to those in the control condition, and that emotional eaters would be particularly stressor-sensitive, displaying exaggerated cortisol responses compared to non-emotional eaters. Although there was a tendency for those in the anticipatory stressor condition to display increased cortisol levels, supporting reports that anticipation of a psychosocial stressor is sufficient to elicit cortisol responses (Kelly et al., 2007a; Kirschbaum et al., 1992; Smyth et al., 1998), this effect was modest and did not reach statistical significance. Anticipation of public speaking resulted in an increase of cortisol levels by only ~10%, in comparison to the 50%-100% increase more typically observed among individuals that actually performed the public speaking task (Kirschbaum et al.,

1992). It should be remarked that cortisol responses aren't elicited in response to all stressor events (Michaud et al., 2008), and it has been suggested that stressors that evoke feelings of shame might be particularly effective at eliciting changes of cortisol (Dickerson et al., 2004). The limited cortisol response observed in the current investigation is in keeping with this suggestion, namely that the negative self-evaluative threat (e.g., shame) associated with the TSST was fundamental in eliciting the cortisol rise (Dickerson and Kemeny, 2004; Dickerson et al., 2008). This said, although women anticipating the public speaking task reported higher anger and anxiety than women anticipating the control task (suggesting that anticipating the public speaking task was indeed aversive), their emotional responses were less pronounced compared to those we previously observed among women who actually performed the task (cf Chapter 3). Thus, it is premature to dismiss a role for anger in subserving the cortisol changes associated with the TSST (see Chapter 3) and the modest changes of the hormone evident in task anticipation. Likewise, the same factors might have been responsible for the absence of an exaggerated cortisol change among emotional vs. non-emotional eaters that we previously observed in response to performance of the TSST (Chapter 3).

As we previously observed (Chapter 3), basal ghrelin levels were significantly lower among emotional compared to non-emotional eaters, despite similar BMIs and hunger levels, both of which have been associated with ghrelin levels (Aydin, 2006; Cummings et al., 2004b; Tschöp et al., 2001). Interestingly, as previously reported (Konttinen et al., 2010), emotional eaters exhibited higher body fat than non-emotional eaters. As ghrelin levels have been inversely related to percent body fat (Tanaka et al., 2002; Tschöp et al., 2001), the possibility was considered that the differences of ghrelin

levels in emotional and non-emotional eaters were secondary to body fat differences. Indeed, hierarchical regression analyses using bootstrapping methods revealed that the relationship between emotional eaters and basal ghrelin levels was mediated by body fat. In effect, the low ghrelin levels evident among emotional eaters stemmed from the higher body fat that has been observed in these individuals (Kontinen et al., 2010). It is uncertain whether the relation between body fat and ghrelin is a reflection of regulatory processes.

As previously observed (Cummings et al., 2004b; Cummings et al., 2002b; Yildiz et al., 2004), once non-emotional eaters consumed a selected food their ghrelin levels declined (~20%), but a similar outcome was not apparent among emotional eaters (Figure 10b). Indeed, the absence of a decline of ghrelin levels in emotional eaters was all the more notable given that they exhibited a trend towards greater food consumption than non-emotional eaters. This prolonged elevation of ghrelin levels following food intake is similar to that observed among obese individuals (English et al., 2002; le Roux et al., 2005), and among binge eaters (Geliebter et al., 2005b) in whom normalization of ghrelin levels requires an extended period. It might be that the feedback mechanisms signaling food intake, which results in the postprandial decrease of ghrelin levels, are disturbed among emotional eaters, thus resulting in sustained high ghrelin levels following food intake. However, a role for other peptides in the response of emotional eaters cannot be discounted. In the current investigation assessments were not made of satiety signals, such as leptin or obestatin, and it is possible that these peptides were correspondingly altered among emotional eaters, thus influencing their continued food intake.

It has been reported that ghrelin levels in humans increased in response to a stressor (Rouach et al., 2007), just as they did in rodents (Asakawa et al., 2001; Kristensson et al., 2006). In line with these findings, ghrelin levels in the present study increased in anticipation of a stressor, but the extent of the rise was unrelated to emotional eating status. Thus, even though emotional eating was related to basal ghrelin levels, the change in eating appeared to be independent of the change in ghrelin levels. Likewise, changes of cortisol were unrelated to eating. It is conceivable that the test situation was not conducive to detecting changes of eating, as women in the stressor condition were working on their speeches, which might have precluded greater eating than women who were in the control condition.

Limitations and Conclusions

The present investigation reinforces findings regarding the ghrelin patterns of emotional eaters versus non-emotional eaters, and together with our earlier findings (Chapter 3), the data provide insight into the relation between food intake and the anticipation vs. performance of an actual stressor experience. Specifically, food intake during the brief period of anticipation of a stressor was somewhat related to emotional eating behaviors, and less reliant on physiological signals, such as hormone reactivity, pertaining to food intake. However, as we did not examine women's food intake in the hours following the laboratory stressor, it remains possible that detection of post-stress hormonal influences on eating were precluded. Additionally, it is possible that eating responses that might occur during times of distress were not evoked in the artificial laboratory setting. Consequently, it might be more profitable to monitor eating behaviors during a ruminative period following a stressor encounter, and to do so in a natural

context where psychosocial triggers exist, and preferred foods are available.

A further limitation was that only one food choice (miniature chocolate brownies) was offered to women in order to eliminate potentially confounding effects of varying nutrient contents on ghrelin responses; however, this food might not have been equally palatable to all women. Likewise, even if the brownies were a typically enjoyed food, it is possible that this might not have been their food of choice, or a comfort food they would turn to during stressful circumstances, and thus might not have actually reflected their stressor-induced eating behaviors.

Taking into account these potential limitations, the current investigation nevertheless raises several cogent points concerning the hormonal responses of emotional eaters and non-emotional eaters to the anticipation of a stressor. Specifically, it seems that feedback mechanisms and regulatory pathways might differ between emotional eaters and non-emotional eaters. The question remains, however, as to whether naturally differing ghrelin patterns might influence emotional eating behaviors, or whether the development of emotional eating behaviors, perhaps as a coping strategy to negative life events, might incrementally influence body composition, as well as ghrelin levels. Regardless of the causal direction, it nevertheless seems that emotional eaters exhibit a ghrelin profile reminiscent of that observed during binge eating and in obese individuals (English et al., 2002; Geliebter et al., 2005b; le Roux et al., 2005), and it is possible that this ghrelin profile might serve as a risk factor for one, or both, of these conditions.

General Discussion

Stressful experiences can elicit either suppressed or increased eating, but the factors that determine the direction of this change remain uncertain. Although animal studies suggest that hormone responses are largely responsible for altered eating patterns (Asakawa et al., 2001; Dallman et al., 2005; Kristensson et al., 2006), contextual factors (e.g., stressor type, food offered) also seem to influence food intake (Torres and Nowson, 2007). The relations between stress and eating are even more complex among humans, and likely involve contextual, psychological, and physiological factors. In this regard, psychological factors that influence eating include, but are not limited to, negative affect (Christensen and Brooks, 2006; Macht and Simons, 2000), coping processes (Macht et al., 2005; Spoor et al., 2007), social support and unsupportive interactions (Pollard et al., 1995; Steiger et al., 1999; Stice et al., 2002), and emotional eating (Epel et al., 2001; Oliver et al., 2000; van Strien, 2010). Additionally, it seems that individual difference factors related to eating disturbances are associated with altered hormone patterns (Geliebter et al., 2005b; Tanaka et al., 2002; Tanaka et al., 2003). Given the considerable overlap between stress and eating neuroendocrine systems, and the potential for alterations among individuals who engage in stress-eating behaviors, it was viewed as important to examine stressor-induced eating from both psychological and neuroendocrine perspectives (see Figure 12).

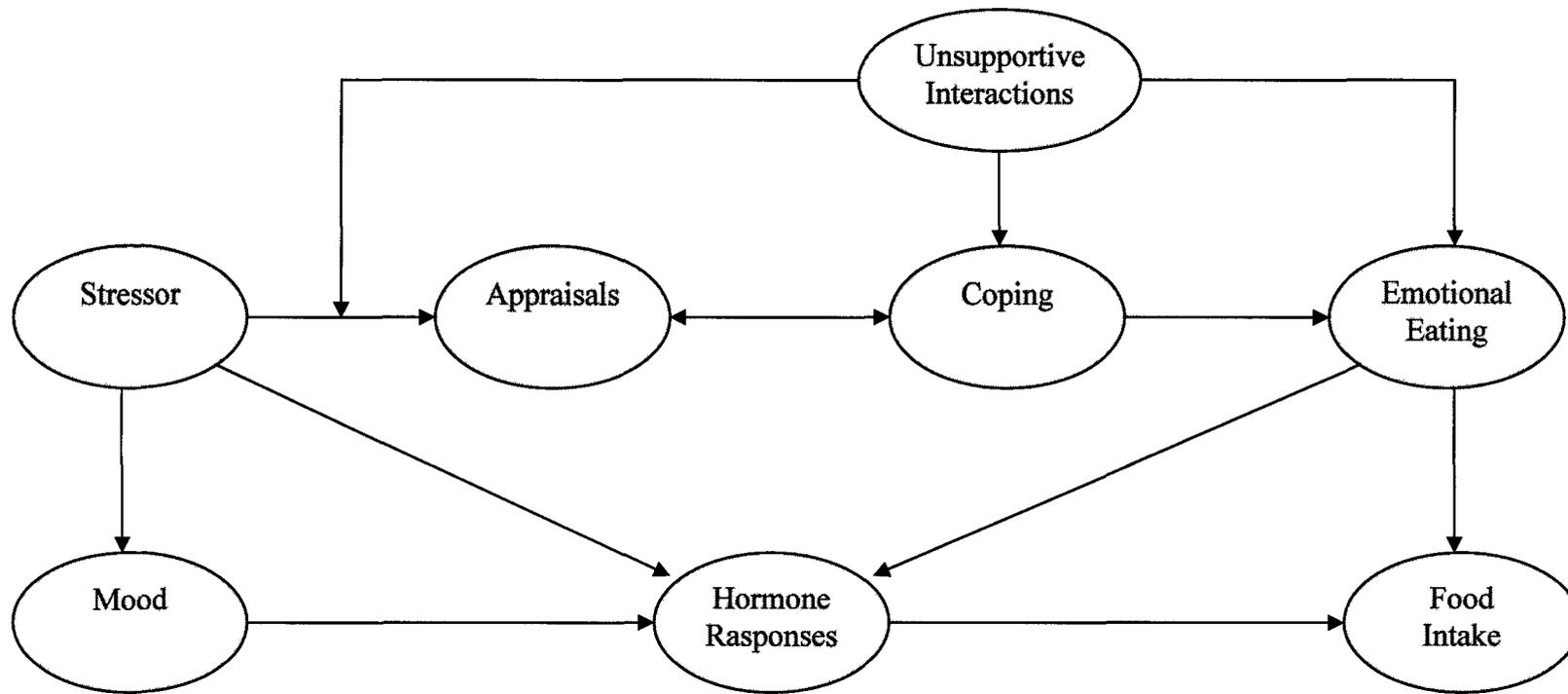


Figure 12. Hypothetical model depicting the relations between psychological and neuroendocrine factors being investigated with respect to stressor-induced eating.

Stress, Appraisals, Coping, and Eating

The current investigation confirmed previous reports (Essex et al., 1999; Matud, 2004; McDonough and Walters, 2001; Ptacek et al., 1994; Ptacek et al., 1992; Tamres et al., 2002) indicating that relative to men, women reported increased general stress, stressor-specific stress appraisals, as well as a greater general tendency to endorse emotion-focused, problem-focused and avoidant coping styles and strategies. It also appeared that eating as a coping method was a conscious choice, more so for women than men. Furthermore, as with other methods of coping, the current investigation indicated that the endorsement of eating as coping was predictably more common among women than men, and also varied as a function of the nature of the stressor. These findings raise some important considerations for stress-eating research, as researchers might use different stress- and affect-induction paradigms to determine tendencies to eat in response to stressors. These findings fuelled the decision to examine two different stressor manipulations to investigate stressor-induced hormone and eating changes in studies in Chapters 3 and 4.

Interestingly, men and women demonstrated different patterns of association between appraisal processes and eating as coping, and these associations also differed according to the nature of the stressor situation. Of particular interest was that men's endorsement of eating as a coping strategy was only associated with stressor appraisals in the social situation, whereas among women, stressor appraisals were associated with the endorsement of eating as a coping strategy for multiple stressor types (i.e., social, academic, time pressure). Thus, it seems that eating as a coping mechanism was more

closely aligned with specific stressor appraisals among women than men, and thus targeting these appraisals and coping processes might be an especially relevant treatment intervention point among women who engage eating as coping to a risky degree (i.e., when relying on eating to cope with stressors might lead to physical and mental health problems).

Women reported greater stress appraisals than men, and it is possible that their endorsement of eating was due to increased negative affect, and eating represented a method to regulate those emotions. Individuals for whom negative emotional states (diffuse and specific) trigger a desire to eat are considered emotional eaters (van Strien, 2010; van Strien et al., 1986), and women in the current investigation also reported greater emotional eating than men. It follows that if eating to cope with stressors serves as a method of affect-regulation for women, then emotion-focused coping should be more strongly related to emotional eating behaviors than avoidant or problem-focused coping methods. In this regard, relationships between self-reported unsupportive social interactions (a stressor in their own right), coping responses, and emotional eating behaviors will be discussed.

Seeking social support is a coping mechanism that is frequently engaged to contend with stressors. In particular, social support can have multiple functions such as providing information or advice, being a shoulder to cry on, providing a distraction, or supplying resources such as money or transportation (Weiss, 1974). Social support acts as a buffer against negative affects on health, in that it can dampen negative stressor-related psychological outcomes such as depression, anxiety, and PTSD symptomatology (Coker et al., 2002; Holahan et al., 1995, 1997; Kaufman et al., 2004; Matheson and

Anisman, 2003), and also exerts positive physiological effects, such as more favorable immune, cardiovascular, and neuroendocrine functioning (Stowell et al., 2001; Uchino et al., 1996). It will be recalled that unsupportive social interactions involve instances when there was a reasonable expectation of support, but the responses provided did not match the needs of the individual, or were negative in nature (i.e., blaming, bumbling, distancing, minimizing). In contrast to the beneficial actions of supportive social interactions, unsupportive interactions exacerbate stressor-related health outcomes (Ingram et al., 2001a; Lakey et al., 1994; Matheson et al., 2008). It is possible that the effects of positive and negative support responses on well-being are related to actions on appraisal and coping processes (Ingram et al., 2001b; Song and Ingram, 2002; Valentiner et al., 1994). Indeed, social support has been associated with more adaptive forms of coping (Leserman et al., 1992; Valentiner et al., 1994), whereas unsupportive interactions demonstrate associations with appraisals of threat and coping methods that are typically considered ineffective, namely emotion-focused and avoidant strategies (Ingram et al., 2001b; Mindes et al., 2003; Song and Ingram, 2002).

Chapter 1 examined the effects of support responses following various stressors on appraisal and coping responses, but the results for appraisals were inconsistent, and were non-significant for coping. However, as already mentioned, it is possible that the limited effect of the support manipulation was related to participants' individual interpretations of the support responses (i.e., the (un)supportive responses were not perceived as such). As previously suggested in regard to supportive interactions (Haber et al., 2007; Thoits, 1995), this highlights the importance of assessing *perceptions* of unsupportive responses (i.e., the perceived incidence of unsupportive interactions and the

degree to which they are deemed as inappropriate or negative), and not relying on reports of received unsupport (i.e., the factual recounting of an unsupportive interaction), or assumptions about what behaviors qualify as being unsupportive. The studies in Chapter 2 assessed the general social support and unsupportive interactions participants perceived in their daily lives, and their associations with coping styles and emotional eating behaviors. However, it might have been beneficial to couple the quantitative data with qualitative analyses of what participants viewed as supportive and unsupportive in their dealings with stressors.

As mentioned earlier, supportive and unsupportive responses demonstrate opposing associations with physical and mental health outcomes, and it is possible that these associations might be explained by the effects of support responses on coping methods. In line with this perspective, Studies 1 and 2 confirmed associations between general coping styles, particularly eating as a method of coping, and emotional eating. However, as emotional eating seems to be serving, at least in part, as a coping mechanism, it was of interest in Studies 3 and 4 to assess whether it was acting principally as an emotion-focused or avoidant strategy. Moreover, Studies 3 and 4 were performed to determine whether there was, in fact, an association between unsupportive interactions and emotional eating, and whether this relation was mediated by coping.

Social support has shown consistent relations with disordered eating pathologies and symptoms. Specifically, women presenting with eating disorders generally reported less social support, and smaller social networks than their non-pathological counterparts, and a lack of social support has been associated with increased symptoms of eating disturbances among sub-clinical populations (Aimé et al., 2006; Bodell et al., 2011;

Freeman and Gil, 2004; Ghaderi, 2003; Limpert, 2010; Pollard et al., 1995; Stice et al., 2002). Furthermore, it seems as though binge eaters might be particularly sensitive to negative social interactions (Steiger et al., 1999), which in themselves are powerful stressors (Boutin-Foster, 2005; Cranford, 2004) that have been associated with future binge-episodes (Steiger et al., 1999). Indeed, the present investigation (Chapter 2), indicated that unsupportive interactions were associated with emotional eating, and when both positive social support and unsupportive interactions were considered, unsupportive interactions demonstrated a unique effect on emotional eating, reinforcing the notion that unsupportive interactions represent more than a lack of positive social support, and are instead an independent negative psychological construct (Ingram et al., 2001a; Lakey et al., 1994). Importantly, coping mediated the relation between unsupportive responses and emotional eating. It has been considered that emotional eating is a form of coping to deal with negative emotional states (Arnouk et al., 1995), and the few studies that have examined the relations between coping and emotional eating indicated that emotional and avoidant coping methods, including rumination, were associated with emotional eating (Kubiak et al., 2008; Spoor et al., 2007). In this regard, when simultaneously assessing the impact of emotion-focused and avoidant coping on emotional eating, the present investigation revealed that emotion-focused coping was the unique predictor of emotional eating. These findings tend to support the view that eating is being used as a method of self-medication or negative affect regulation, as opposed to an escape mechanism. Thus, it seems that emotional eating might be acting primarily to combat negative emotional states, or in conjunction with other emotion-focused coping methods (e.g., seeking emotional support and emotional expression), in order to decrease negative affect and/or

increase positive affect.

Parenthetically, stressor events are often related to changes in food selection such that a greater preference is evident for foods high in carbohydrates and fat, and which are sweet (i.e., highly palatable foods) (Kandiah et al., 2006; Oliver et al., 2000; Zellner et al., 2006). It is possible that this shift in food choices might influence eating-related affect regulation, as the foods chosen under stress have highly rewarding properties (Corsica and Pelchat, 2010; Martel and Fantino, 1996; Spring et al., 2008). Indeed, the self-medication hypothesis focuses on the consumption of carbohydrates, the precursor to serotonin, as a pathway to mood regulation (Sayegh et al., 1995; Wurtman and Wurtman, 1995). Alternatively, food intake among rodents and humans has been associated with the release of dopamine at the nucleus accumbens and dorsal striatum (Bassareo et al., 2011; Small et al., 2003), representing an essential component involved reward systems (Wise, 2006). Therefore, as with other highly rewarding substances, such as alcohol or amphetamines, with extended use, it is possible to become ‘addicted’ to food, in order to achieve positive reward states (Spring et al., 2008; Wise, 2006). Indeed, there seems to be a decrease of dopamine receptors and activity in reward areas among obese individuals (Davis et al., 2008) and enhanced dopamine activity among binge-eating individuals presented with food stimuli (Wang et al., 2011). Additionally, female emotional eaters, but not non-emotional eaters, displayed increased activation of brain regions associated with stressor appraisals and rewards when anticipating and presented with a chocolate milkshake, but this was true only after negative mood was induced (Bohon et al., 2009). Thus, it seems that for some individuals, eating might serve to alleviate stressor-induced negative affect through strong associations with appraisal and

reward processes. In this regard, in the short term, using eating as a method of coping can be associated with positive outcomes, but with increased use, eating can become a reinforcing behavior with long-lasting effects on reward pathways in the brain, and implications for eating-related pathology (Corsica and Pelchat, 2010; Pelchat, 2002).

Stress is associated with changes in reward processes, and anhedonia (i.e., diminished sensation of pleasure from typically rewarding incentives (Anisman and Matheson, 2005), is a characteristic of illness involving reward dysregulation (i.e., depression), and may involve a dopaminergic mechanism (Davis et al., 2007; Davis et al., 2004). Indeed, studies in animals revealed that stressors alter dopamine functioning, as well as other transmitters, within brain regions such as the nucleus accumbens (NAcc) (Doherty and Gratton, 1996), that have been implicated in subserving reward. Additionally, glucocorticoids and several neuropeptides have also been linked to reward, and ghrelin, which has been associated with eating initiation, is one of these peptides (Abizaid et al., 2006). Thus it was of particular interest to examine stressor-evoked cortisol and ghrelin responses among emotional and non-emotional eaters (i.e., those who use eating to cope), and determine whether these hormone responses were associated with food preferences and intake.

Stress, Emotional Eating, and Neuroendocrine Processes

Although some individuals recognize their desire to eat following stressors or when experiencing negative emotions, as indicated earlier it has been uncertain whether increased eating results from a conscious decision to engage eating as a method of coping with negative emotional states. In this regard, emotional eating is considered a method of contending with such negative emotional states, and seems to be a differentiating factor

with respect to predicting eating behaviors in response to stressful events. Whereas individuals reporting low levels of emotional eating typically exhibit suppressed eating behaviors in response to stressor events, individuals reporting high levels of emotional eating show no change, or even increase their eating during these times (Oliver et al., 2000; van Strien, 2010; Wallis and Hetherington, 2004). The current investigation, however, revealed that emotional eaters did not differ from non-emotional eaters with respect to food choice or intake after *performing* a self-evaluative public speaking task (the TSST; Chapter 3), although we have found that they did report comparatively higher food cravings than non-emotional eaters (i.e., high fat foods, carbohydrates, sweets, and fast food), irrespective of the stressor condition (Appendix F). In this regard, these women completed mood and food craving measures immediately following the task, but were only presented with food approximately 20 minutes after they completed their task. Although speculative, this raises the possibility that food cravings were initially increased, but women's negative affect might have diminished by the time they received their food choice, perhaps affecting food intake. In contrast to these findings, when *anticipating* the same public speaking task (vs. control) (Chapter 4), emotional eaters ate more of the miniature brownies than non-emotional eaters during the anticipation period, irrespective of the task being anticipated. It will be recalled that the emotional eating subscale of the DEBQ also assessed a desire to eat in response to emotions such as boredom, and it is possible that this emotion might have been experienced by women *in the control condition* (Chapter 4; stressor anticipation), as they had been engaged in a relatively mindless task (i.e., reading neutral magazines over an extended period of time). In Chapter 3, women were asked to *perform* a control task (i.e., listening to a book on

tape as if it were part of a lecture). Although these women were informed that they would not be tested on the audiotape material, they might have been more engaged in the listening task than women merely *anticipating* a benign event (i.e., looking through neutral content magazines), and would not have been as bored. As such, it is possible that emotional eaters *anticipating* both the stressor and control tasks (Chapter 4) were eating in response to negative emotional states, although the nature of these states differed (i.e., boredom vs. anxiety and anger).

Although the reason for the absence of stressor effects on the relation between emotional eating and food intake is not entirely certain, emotional eaters also demonstrated hormonal responses irrespective of stressor condition. As will be discussed shortly, emotional eating status was tied to the maintenance of ghrelin levels during food presentation periods, and these effects were apparent regardless of the nature of the task being performed or anticipated. It is possible that the lack of relation between emotional eating and stressor-induced eating might be related to the altered patterns of the eating initiation hormone, ghrelin, that were observed. Nevertheless, these results highlight the many factors that need to be taken into consideration when assessing stressor-induced eating, such as stressor type, food selections, and timing of food presentation.

As mentioned earlier, it is possible that increased eating results from changes of stress- and eating-related hormones (e.g., cortisol, ghrelin). There is evidence suggesting that binge-eaters might be particularly sensitive to stressors compared to non-binge eaters, as they report a greater number of stressful events, and rate these events as having a greater impact (Wolff et al., 2000). The present investigation supported the view that emotional eating, a potentially sub-clinical version of binge-eating, might also

be related to stressor sensitivity, but that this effect might be dependent on the nature of the stressor. Indeed, when asked to perform a social-evaluative public speaking task, emotional eaters appraised the event as more stressful than non-emotional eaters, and also demonstrated a tendency towards enhanced cortisol reactivity in response to the stressor. However, when merely anticipating this same task, such differences were not observed. As suggested earlier, it is unlikely that, compared to having to perform a public speech, the mere anticipation of this same task was sufficient to elicit strong emotional and cortisol responses. Indeed, the mood responses and change of cortisol levels following the anticipation task were much lower than those attained by having women perform the task. These findings are in agreement with a recent meta-analysis assessing cortisol reactivity across a variety of naturalistic stressors, which highlighted the importance of considering stressor chronicity, type, and controllability when examining cortisol responses (Michaud et al., 2008), as well as the emotional responses (particularly shame) associated with these situations (Dickerson and Kemeny, 2004; Gruenewald et al., 2004; Matheson and Anisman, 2009; Moons et al., 2010).

Although cortisol levels increased in response to performing the TSST, and to a marginal degree when anticipating the TSST, in the present investigation associations were not evident between cortisol reactivity and food preference or food intake, as others have reported (Epel et al., 2001; Newman et al., 2007). In fact, elevated cortisol levels present after *performing* the public speaking task were associated with decreased food intake. It will be recalled that the decrease in food intake might be biologically adaptive, in that it would be counterproductive for an organism to stop to eat in the minutes following a stressor event. Furthermore, during the *anticipation* of a stressor, cortisol

responses were not related to food intake, either positively or negatively, quite possibly due to the limited change of cortisol levels evoked by the stressor. Again, these findings underscore the importance of taking the nature of the stressor into consideration when assessing the effects of stress and cortisol reactivity on food choice and intake.

In addition to cortisol, several eating regulatory peptides might be relevant when examining stressor-induced eating. In this regard, ghrelin, which is involved in eating initiation opposed to cessation, is affected by stressful events (Asakawa et al., 2001; Kristensson et al., 2006; Rouach et al., 2007). Thus, stressor-evoked changes of ghrelin might be fundamental in initiating increased eating. However, as previously reported with respect to the effects of ghrelin on the urge to eat (Rouach et al., 2007), ghrelin levels in the current investigation were not associated with the initiation of food intake in response to either performing or anticipating a psychosocial stressor, although only anticipation of the social stressor elicited a significant increase of ghrelin levels. Given the strong evidence base associating ghrelin with eating initiation and caloric consumption (Cummings et al., 2004b; Cummings et al., 2001; Cummings et al., 2002b), this was unexpected. However, in many studies assessing the relation between eating and ghrelin, individuals were typically examined over extended periods time, whereas in the current studies women were presented with food for only 10 or 15 minutes. Thus, it is possible that women's limited exposure to the food might have precluded detection of eating changes. More importantly, behaviors were assessed in a laboratory context rather than in a natural setting that might have been more aligned with the eating responses participants might have ordinarily engaged in response to stressful events.

Of particular interest was the altered ghrelin pattern observed among emotional eaters, compared to non-emotional eaters. Emotional eaters demonstrated lower basal ghrelin levels, as well as the maintenance of ghrelin levels after food intake, as opposed to the expected decline of ghrelin, which was observed among non-emotional eaters. It seemed that the maintenance of ghrelin levels observed among emotional eaters was not due to food choice (i.e., low vs. high fat carbohydrate). Moreover, this effect was specific to food presentation and intake as emotional and non-emotional eaters demonstrated similar ghrelin patterns when no food was present. The ghrelin profile demonstrated by emotional eaters in the current investigation were similar to those exhibited by obese individuals (English et al., 2002; Yildiz et al., 2004) and binge eaters (Geliebter et al., 2005b; Geliebter et al., 2004), perhaps reflecting a potential risk factor for one of these states.

Interestingly, ghrelin has been implicated as being involved in reward processes. Specifically when released by natural stimuli or when exogenously administered in the ventral tegmental area (VTA), it promotes dopamine release in the NAcc (Abizaid et al., 2006; Jerlhag, 2008) and instigates food intake (Abizaid et al., 2006; Naleid et al., 2005). Rodent studies suggest that peripherally derived ghrelin might also affect central reward centres (Abizaid, 2009; Jerlhag, 2008). Thus, although speculative, the maintenance of ghrelin levels among emotional eaters during food presentation and intake, might suggest that the reward value of food among this group is increased or prolonged, potentially having impacts on protracted engagement in consummatory behavior. It will be recalled that emotional eaters demonstrated increased activity in appraisal and reward areas, but only when food was presented, and when negative affect was induced (Bohon et al.,

2009). Binge eaters demonstrated similar increased dopamine activity in reward areas (Wang et al., 2011), whereas obese individuals seem to exhibit decreased dopamine activity, perhaps due to fewer dopamine receptors (Stice et al., 2008), although inconsistent data were reported in this regard (Davis et al., 2008). Nevertheless, the sustained ghrelin levels among emotional eaters observed in the current studies indicate that these women are receiving a prolonged ‘start to eat’ signal, and it is possible that this influenced reward processes.

Conclusion

As indicated in each of the chapters, there are limitations to the current investigations. Ultimately, it will be necessary to evaluate hormone changes and measures of reward among emotional eaters more directly, or concurrently, in order to draw strong conclusions regarding relations between these factors. Indeed, as mentioned above, evidence is beginning to surface regarding altered food reward processes among clinical populations, however efforts should also be focused on elucidating these relations among those who might be at risk for, but who have not yet reached, pathological states (e.g., emotional eaters) in order to prevent these adverse potential outcomes.

In summary, the current program of research raises some important questions about the stress-eating paradox. First, both psychological and neuroendocrine studies underline the importance of considering the nature of the stressor, its intensity, the timing of food presentation, and types of food offered when attempting to understand stress-eating behaviors. Furthermore, it seems that individual difference factors, such as emotional eating, might be particularly important when examining differences in stressor-induced eating behaviors. Indeed, it seems that emotional eating behaviors might be

strongly rooted in affect regulation, either through self-medication or reward processes. Additionally, emotional eaters demonstrated maintained ghrelin levels, a hormone involved with reward processes, during food presentation instead of showing the decline typically observed under those conditions. Thus, both psychological and neuroendocrine perspectives point to the possibility of an association between emotional-eating behaviors and reward processes. Nonetheless, as ghrelin levels are similarly altered among obese individuals and binge eaters, it is possible that these results suggest a future vulnerability among emotional eaters for one, or both of these conditions.

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Appendix A

Study 1 Information

Recruitment Notice:

Study Title: Factors influencing student perceptions of written scenarios

Abstract: Earn 1% for letting us know your perceptions and responses to a few written scenarios!

Description: Many factors influence perceptions and appraisals of different situations and the potential stress and coping strategies associated with these situations. These factors may include the type or intensity of the event (e.g., do you perceive it to be stressful?), the resources (social or physical) we feel we have to deal with the situation, and other individual difference factors (e.g., mood, gender, sociocultural pressures, eating behaviour patterns). In this study, we're interested in how students perceive and would respond to different situations. You will be asked to answer a series of questionnaires asking about general coping styles, factors that may influence coping (e.g., social support), and individual difference factors (mood, physical appearance and health, eating behaviour patterns). You will then be asked to read a series of short vignettes, and be asked about how you would appraise and cope with those situations. Finally, since we are interested in how perceptions of our own physical appearance affect stressor appraisals and coping, the researcher will take height and weight measurements (measurements will be taken individually, in private). This will take approximately 50-60mins to complete. This study has received clearance by the Carleton University Psychology Research Ethics Board (10-157).

Eligibility: In order to be eligible for this study you must be an undergraduate student at Carleton University, who can receive experimental credits for participation.

Informed Consent:

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study title: Factors influencing student perceptions of written scenarios

Study personnel: Kate Raspopow (Researcher, 613-520-2600 ext. 4199)
Sara Javadi (Researcher, 613-520-2600 ext. 4199)
Kevin Hamdullahpur (Researcher, 613-520-2600 ext. 4199)
Dr. Hymie Anisman (Faculty Investigator, 613-520-2699)
Dr. Alfonso Abizaid (Faculty Investigator, 613-520-2600 ext. 1544)

If you have any concerns about how this study was run please contact:

For ethical concerns: Monique Sénéchal, Chair of Carleton University Ethics Committee for Psychological Research, 613-520-2600 ext. 1155

For other concerns: Dr. J. Mantler, Chair of Dept. of Psychology, 613-520-2600 ext. 4173.

Purpose and Task Requirements: Many factors influence perceptions and appraisals of different situations and the potential stress and coping strategies associated with these situations. These factors may include the type or intensity of the event (e.g., do you perceive it to be stressful?), the resources (social or physical) we feel we have to deal with the situation, and other individual difference factors (e.g., mood, gender, sociocultural pressures). In this study, we're interested in how students perceive and would respond to different situations. You will be asked to answer a series of questionnaires asking about general coping styles, factors that may influence coping (e.g., social support), and individual difference factors (mood, physical appearance and health). You will then be asked to read a series of short vignettes, and be asked about how you would appraise and cope with those situations. Finally, since we are interested in how perceptions of our own physical appearance affect stressor appraisals and coping, the researcher will take height and weight measurements (measurements will be taken individually, in private). The study will take place in the testing room, and the total time for this session should be approximately 50-60mins. You will receive 1% course credit for your participation.

Potential Risk and Discomfort: There are no physical risks in this the study. There may be some emotional discomfort when thinking about mood, or the stressors or support you experience in daily life.

Anonymity/Confidentiality: The data collected in this study will be kept confidential. Your informed consent form will be kept in a separate and secured file, apart from your questionnaire, by the research investigators. The data will also be stored in a secured data file that is only accessible by the researcher and research assistants. All information provided will be kept anonymous. The questionnaire booklet will be associated with a randomly assigned code, and only this code will identify your questionnaires.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to not complete certain questions or to withdraw entirely without penalty.

I have read the above description of the study concerning student perceptions of written scenarios. The data collected will be used in research publications and/or for teaching purposes. My signature indicates that I agree to participate in the study, and this in no way constitutes a waiver of my rights.

Full Name (please print): _____

Participant Signature: _____ Date: _____

Researcher Signature: _____ Date: _____

This study has received clearance by the Carleton University Psychology Research Ethics Board (10-157).

Debriefing:

People are confronted daily with stressful events, both ambiguous and blatant. When these potentially stressful situations come up, people first make appraisals of the situation in terms of how threatening, challenging, controllable, and distressing it is to them. They then appraise the resources they think they have available to deal with the event (e.g., social support, tangible or informational resources). These appraisals affect how people, in turn, choose to cope with the situation. These coping mechanisms can help get rid of the problem, or help the individual deal with the emotions they're experiencing in response to the stressor. One coping resource, seeking social support, is typically associated with more effecting coping strategies, and better mental and physical health. But even if people seek out this help from their friends, they're not guaranteed to get positive or helpful responses. Both the positive and negative support responses people receive can play a role in buffering against (or making worse) the bad effects of stressors, as well as influencing how individuals will cope with a situation.

Importantly, the type of stressful situation, individual differences (e.g., gender, mood disorders, emotional eating behaviours, physical appearance and the belief in societal physical norms and body image, general coping styles, etc.) can influence a person's perceptions of these events, and how they choose to deal with them. For example, men often find academic stressors particularly stressful compared to women, whereas women are particularly sensitive to stressful social situations. In this study, we will be looking to see whether this difference holds, and we also want to see if men and women are affected differently by other types stressors, such as money and time worries. Also, it seems that emotional eaters may be more sensitive to some stressors (e.g., a social stressor); therefore it might be possible that emotional eaters cope with stressful situations in ways that help them get rid of these negative emotions, for instance, through eating. This is one of the main questions we are hoping to answer in this study. However, we are also interested in finding out which people are more likely to use physical activity in order to deal with stressful events, and whether the support and advice we receive from our friends and family influence our coping.

Finally, many stressors that we encounter in daily life are social in nature (e.g., conflict with friends, presentations in front of a group of peers), and it is these types of scenarios that we are particularly interested in. It might be suspected that a person's appearance (e.g., being overweight), and how they believe others are judging their physical appearance in social situations (e.g., stigma and stereotypes associated with being overweight), may impact their appraisals of the stressor (e.g., as threatening or stressful). Therefore, we were also interested in taking body composition measurements in this study, to determine whether being overweight, in combination with the endorsement of the societal 'thin ideal', is related to more negative appraisals of social stressor situations. Thank you for your help in completing our study. We hope that you have learned something about research in health psychology, particularly some of the factors that can influence how people choose to deal with the stressors in their lives.

This study has received clearance by the Carleton University Psychology Research Ethics Board (10-157).

Contact Information:

The following people are involved in this research project and may be contacted at any time if you have any further questions about this project, what it means, or concerns about how it was conducted:

Sara Javadi, Researcher , Department of Psychology

Phone: (613) 520-2600 ext. 4199

Kevin Hamdullahpur Department of Psychology

Phone: (613) 520-2600 ext. 4199

Kate Raspopow, Researcher, Department of Psychology

Phone: (613) 520-2600 ext. 4199

Dr. Hymie Anisman, Faculty Member, Department of Psychology

Phone: (613) 520-2699

Dr. Alfonso Abizaid, Faculty Member, Department of Psychology

Phone: (613) 520-2600 ext. 1544

If you have any concerns about how this study was conducted, please contact either of the following:

For ethical concerns:

Dr. Monique Sénéchal, Chair, Carleton University Ethics Committee for Psychological Research

Phone: (613) 520-2600 ext 1155

For other concerns:

Dr. Janet Mantler, Chair, Department of Psychology,

Phone: (613) 520-2600 ext 4173

If you have any worries or concerns about your personal well-being, or student skills, you can contact the following services:

Carleton University Health and Counselling Services, (613) 520-6674

Student Life Services, (613) 520-6600

Hopewell Eating Disorder Support Centre, (613) 241-3428

Appendix B

Study 2 Information

Recruitment Notice

Study Title: Student Perceptions of Written Scenarios

Abstract: Earn 1% for letting us know your perceptions of some short written scenarios!

Description: Many factors influence perceptions and appraisals of situations and the potential stress associated with these situations. These factors may include the type or intensity of the event, the resources (social or physical) we feel we have to deal with the situation, and other individual difference factors (e.g., mood). In this study, we're interested in how students perceive and would respond to different situations. You will be asked to answer a series of questionnaires asking about general coping styles, factors that may influence coping (e.g., social support), and individual difference factors (mood, physical appearance and physical health). You will then be asked to read a series of short vignettes, and be asked about how you would appraise and cope with those situations.

Eligibility: In order to be eligible for this study you must be an undergraduate student at Carleton University, who can receive experimental credits for participation.

Informed Consent:

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study title: Student Perceptions of Written Scenarios

Study personnel: Kate Raspopow (Researcher, 613-520-2600 ext. 4199)
Sawsan Ismaiel (Researcher, 613-520-2600 ext. 4199)
Dr. Hymie Anisman (Faculty Investigator, 613-520-2600 ext. 2699)
Dr. Kim Matheson (Faculty Investigator, 613-520-2600 ext 2684)

If you have any ethical concerns about how this study was run please contact:
Monique Sénéchal, Chair of Carleton University Ethics Committee for Psychological Research, 613-520-2600 ext. 1155 or Dr. J. Mantler, Chair of Dept. of Psychology, 613-520-2600 ext. 4173.

Purpose and Task Requirements: Many factors influence perceptions and appraisals of situations and the potential stress associated with these situations. These factors may include the type or intensity of the event, the resources (social or physical) we feel we have to deal with the situation, and other individual difference factors (e.g., mood). In this study, we're interested in how students perceive and would respond to different situations. You will be asked to answer a series of questionnaires asking about general coping styles, factors that may influence coping (e.g., social support), and individual difference factors (mood, physical appearance and physical health). You will then be asked to read a series of short vignettes, and be asked about how you would appraise and cope with those situations.

Potential Risk and Discomfort: There are no physical risks in this the study. There may be some emotional discomfort when thinking about the stressors or support you experience in daily life.

Anonymity/Confidentiality: The data collected in this study will be kept confidential. Your informed consent form will be separated from your questionnaire and kept in a separate and secured file by one of the research investigators who will keep this information confidential. It will be associated with a code, and only this code will identify your questionnaire. The data will also be stored in a secured data file that is only accessible by the researcher and research assistants.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to not complete certain questions or to withdraw entirely without penalty.

I have read the above description of the study concerning student perceptions of written scenarios. The data collected will be used in research publications and/or for teaching purposes. My signature indicates that I agree to participate in the study, and this in no way constitutes a waiver of my rights.

Full Name (please print): _____
Participant Signature: _____ Date: _____
Researcher Signature: _____ Date: _____

Debriefing:

People are confronted daily with stressful events, both ambiguous and blatant. When these potentially stressful situations do come up, people first make appraisals of the situation in terms of how threatening, challenging, controllable, and distressing it is to them. They then appraise the resources they think they have available to deal with the event (e.g., social support, tangible or informational resources). These appraisals affect how people, in turn, choose to cope with the situation. These coping mechanisms can help get rid of the problem, or they can help the individual deal with the emotions they're experience in response to the stressor. One coping resource, seeking social support, is typically associated with more effecting coping strategies, and better mental health. But even if people seek out this support, they're not guaranteed to get a positive response from the people they go to. Both the positive and negative support an individual receives can play a role in both buffering against the adverse effects of stressors, as well as influencing how individuals will cope with a situation.

Importantly, individual difference factors (e.g., mood disorders, physical appearance, general coping styles) can influence a person's perceptions of these events, and the coping strategies they choose to adopt. With respect to emotional eaters, a previous study in our laboratory indicated that emotional eating behaviour was related to increased perceptions of stress and threat in a laboratory stressor. Therefore, it is possible that emotional eaters have a different appraisal process, and that this may be related to altered endorsements of coping strategies. This is one of the main questions we are hoping to answer in this study.

Finally, many stressors that we encounter in daily life are social in nature (e.g., conflict with friends, presentations in front of a group of peers), and it is these types of scenarios that we are particularly interested in. It might be suspected that a person's appearance (e.g., being overweight), and how they believe others are judging their physical appearance in social situations (e.g., stigma and stereotypes associated with being overweight), may impact their appraisals of the stressor (e.g., as threatening or stressful). Therefore, we were also interested in taking body composition measurements in this study, to determine whether being overweight is related to appraisals of social stressor situations.

Contact Information

The following people are involved in this research project and may be contacted at any time if you have any further questions about this project, what it means, or concerns about how it was conducted:

Kate Raspopow, Researcher, Department of Psychology

Phone: (613) 520-2600 ext. 4199

Dr. Hymie Anisman, Faculty Member, Department of Psychology

Phone: (613) 520-2699

Dr. Kimberly Matheson, Faculty Member, Department of Psychology

Phone: (613) 520-2600 ext. 2684

If you have any ethical concerns about how this study was conducted, please contact either of the following:

Dr. Monique Sénéchal, Chair, Carleton University Ethics Committee for
Psychological Research

Phone: (613) 520-2600 ext 1155

Dr. Janet Mantler, Chair, Department of Psychology,

Phone: (613) 520-2600 ext 4173

If you have any worries or concerns about your personal well-being, or student skills, you can contact the following services:

Carleton University Health and Counselling Services, 520-6674

Student Life Services 520-6600

Appendix C

Study 3 and 5 Information

Recruitment Notice

Study Title: Student responses to daily life events

Abstract: Earn up to 4% in experimental credit AND \$15!

Description: Student life isn't always as easy as people claim it to be! Students are faced with a variety of situations every day, some good, and some that can be rather stressful. Whether you're trying to study for exams, win the intramural league, or work a part-time job, we're interested in how you deal with it! We're particularly interested in how students' eating habits may change during these times. In this study you'll be asked to fill out initial questionnaires in an introductory session, complete a daily online diary entry for one week, and take part in a final laboratory session involving completing a second set of questionnaires, performing a short task, and providing a voluntary blood sample (\$15). From this information we're interested in determining the psychological and physiological motivations behind the coping mechanisms you use to deal with events in your life.

Eligibility: In order to be eligible for participation in this study you must be a female psychology 1001A/1002B student at Carleton University. Based on preliminary results, some participants may not be eligible to provide a blood sample.

Informed Consent Forms

Introductory Session (Study 3 and 5)

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study title: Student Reactions to Daily Life Events

Study personnel: Kate Raspopow (Researcher, 613-520-2600 ext. 4199)
Dr. Hymie Anisman (Faculty Investigator, 613-520-2600 ext. 2699)
Dr. Kim Matheson (Faculty Investigator, 613-520-2600 ext. 2864)
Dr. Alfonso Abizaid (Faculty Investigator, 613-520-2600 ext. 1544)

If you have any ethical concerns about how this study was run please contact: Dr. J. Mantler, Chair of Carleton University Ethics Committee for Psychological Research, 613-520-2600 ext. 4173 or Dr. M. Gick, Chair of Dept. of Psychology, 613-520-2600 ext. 2648.

Purpose and Task Requirements: Students experience a wide variety of events in their daily lives, ranging from the mundane, to the rather stressful. However, perceptions of what is stressful may vary between people as well as between situations. Also, individuals may choose to cope with stressors differently, and use different coping methods depending on the situation at hand. We are interested in the types of daily events that are stressful to students, as well as how they choose to deal with such events, with particular emphasis on eating as a coping mechanism. You will be asked to complete a series of questionnaires that will include some personal information about yourself. Following this introductory session you will be asked to keep an online daily diary for one week of the various stressful experiences in your daily life, as well as the methods you used to deal with them. Each daily entry should take approximately 15 minutes. You will receive 1% of experimental course credit for this introductory session, and another 2% if all entries have been completed (0.5 % for every 2 entries made). You will then be able to schedule a time for the final session of this study if eligible and desired, at which point further information will be provided, and additional consent requested. You will be debriefed about the full intent of this study and the researcher's expectations following this final session.

Potential Risk and Discomfort: There are no physical risks in this portion of the study. There may be some emotional discomfort when thinking about the emotions you experience in response to various stressors in your life.

Anonymity/Confidentiality: The data collected in this study will be kept confidential. Your informed consent form will be separated from your questionnaire and kept in a separate and secured file by one of the research investigators who will keep this information confidential. It will be associated with a code, and only this code will identify your questionnaire. We will need to have a code associated with your questionnaire, daily diary, and blood samples so that we are able to match up your responses at the end of the study. The data will also be stored in a secured data file that is only accessible by the researcher and research assistants.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to not complete certain questions or to withdraw entirely without penalty.

I have read the above description of the study concerning the daily experiences of students. The data collected will be used in research publications and/or for teaching purposes. My signature indicates that I agree to participate in the study, and this in no way constitutes a waiver of my rights.

Full Name (please print): _____
Participant Signature: _____ Date: _____
Researcher Signature: _____ Date: _____

Final Lab Session (Study 5)

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study title: Student reactions to daily events

Study personnel: Kate Raspopow (Researcher, 613-520-2600 ext. 4199)
Dr. Hymie Anisman (Faculty Investigator, 613-520-2600 ext. 2699)
Dr. Kim Matheson (Faculty Investigator, 613-520-2600 ext. 2864)
Dr. Alfonso Abizaid (Faculty Investigator, 613-520-2600 ext. 1544)

If you have any ethical concerns about how this study was run please contact: Dr. J. Mantler, Chair of Carleton University Ethics Committee for Psychological Research, 613-520-2600 ext. 4173 or Dr. M. Gick, Chair of Dept. of Psychology, 613-520-2600 ext. 2648.

Purpose and Task Requirements: Students experience a wide variety of events in their daily lives, ranging from the mundane, to the rather stressful. However, perceptions of what is stressful may vary between people as well as between situations. Also, individuals may choose to cope with stressors differently, and use different coping methods depending on the situation at hand. In this portion of the study we are interested in individual responses to a brief task (similar to one that may occur in daily student life). You will be asked to complete a series of questionnaires that will include some personal information about yourself. You will then be asked to perform a brief task, after which you will be asked to complete several remaining questionnaires. As we are also interested in physiological reactions to stress, we ask your consent to take a blood sample. This consists of having a registered nurse insert a catheter into your arm (just as they do when you give blood to the Red Cross) and over the course of the session, approximately 34.5mL of blood will be taken (this amounts to about 1/13th of the amount taken by the Red Cross). This portion of the study is entirely voluntary. There is a separate consent form for providing a blood sample. For participating in this final session you will receive 1.5% of experimental credit OR \$15, and an additional \$15 if you agree to provide a blood sample. At the end of this session you will be debriefed about this study in its entirety, and what the researchers are expecting to find.

Potential Risk and Discomfort: There may be some emotional discomfort when performing the assigned task and thinking about the emotions you experience in response to various stressors. The attached consent form describes the process related to giving a blood sample.

Anonymity/Confidentiality: The data collected in this study will be kept confidential. Your informed consent form will be separated from your questionnaire and kept in a separate and secured file by one of the research investigators who will keep this information confidential. It will be associated with a code, and only this code will identify your questionnaire. We will need to have a code associated with your questionnaire, daily diary, and blood samples so that we are able to match up your responses at the end of the study. The data will also be stored in a secured data file that is only accessible by the researcher and research assistants.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to not complete certain questions or to withdraw entirely without penalty.

I have read the above description of the study concerning the daily experiences of students. The data collected will be used in research publications and/or for teaching purposes. My signature indicates that I agree to participate in the study, and this in no way constitutes a waiver of my rights.

Full Name (please print): _____
Participant Signature: _____ Date: _____
Researcher Signature: _____ Date: _____

Final lab session blood sample (Study 5)

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study title: Student reactions to daily events

Study personnel:

Kate Raspopow (Researcher, 613-520-2600 ext. 4199)

Dr. Hymie Anisman (Faculty Investigator, 613-520-2600 ext. 2699)

Dr. Kim Matheson (Faculty Investigator, 613-520-2600 ext. 2864)

Dr. Alfonso Abizaid (Faculty Investigator, 613-520-2600 ext. 1544)

If you have any ethical concerns about how this study was run please contact: Dr. J. Mantler, Chair of Carleton University Ethics Committee for Psychological Research, 613-520-2600 ext. 4173 or Dr. M. Gick, Chair of Dept. of Psychology, 613-520-2600 ext. 2648.

Purpose and Task Requirements: Students experience a wide variety of events in their daily lives, ranging from the mundane, to the rather stressful. However, perceptions of what is stressful may vary between people as well as between situations. When situations are found to be stressful, our body reacts by producing various hormones and peptides to help us contend with this perceived threat. In order to evaluate these hormones and peptides, we would like to take a blood sample through a pump that slowly withdraws blood from your arm. This consists of having a registered nurse insert a catheter into your arm (from the same area of your arm from which blood samples are normal are drawn, just as they do when you give blood to the Red Cross) and over the course of the session approximately 34.5mL of blood will be taken (this amounts to about 1/13th of the amount taken by the Red Cross). All instruments used for blood withdrawal will be sterile and one-time use only. The blood samples will be analyzed for levels of stress related hormones (ACTH, cortisol, norepinephrine, epinephrine, prolactin and oxytocin), and peptides involved with eating initiation and satiety mechanisms (ghrelin, leptin, insulin, neuropeptide Y, neuromedin B), glucose, and cytokines (markers of immune function). Once these markers have been analyzed, any remaining blood will be disposed of and will not be used for any other purposes. The total procedure will span 50 mins, and for agreeing to provide a blood sample you will receive \$15. Your signature below indicates that you have given consent to have a blood sample taken for the purposes of this study. At the end of this session you will be debriefed about this study in its entirety, and what the researchers are expecting to find.

Potential Risk and Discomfort: Inserting the needle usually gives a small pin-prick (as it does when you give blood for testing or to the Red Cross). In this case, however, the needle is taped down and left in place for 50 mins while you will be engaged in the study. Most people don't notice the needle in their arm after a short adjustment period. However, if at any time you wish to stop the experiment, please let us know and the nurse will take out the needle.

Anonymity/Confidentiality: The sample you provide will be kept confidential. Your informed consent form will be separated from your questionnaire and kept in a separate and secured file by one of the research investigators who will keep this information confidential. The questionnaire and blood samples will be assigned the same code, and only this code will identify your samples. The blood samples will be stored in a secured storage area that is only accessible by the researcher and research assistants. Once these markers have been analyzed, any remaining blood will be disposed of and will not be used for any other purposes.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to withdraw entirely without penalty.

I have read the above description of the blood sample purpose and procedure. The data collected will be used in research publications and/or for teaching purposes. My signature indicates that I agree to provide a blood sample, and this in no way constitutes a waiver of my rights.

Full Name (please print): _____

Participant Signature: _____ Date: _____

Researcher Signature: _____ Date: _____

Debriefing (Study 3 and 5)

Students face a number of different experiences throughout the year. There are exams to study for, papers to write, tuition that has to be paid for, social tensions, new relationships, and family responsibilities that may come in to play. However, the way that we deal with these events may differ based on the negative and long-term implications of the event, our perceptions of control over the cause and end results of the event, and the resources we think are available to us.

One type of resource in particular, social support, has proven to be especially beneficial when dealing with a stressful situation. However, we're also interested in what effect negative social interactions with our friends and family may have on the coping strategies we adopt. Coping strategies may often be beneficial, and can help alleviate the source of our distress. However, this may not always be the case, and some forms of coping, such as increased eating when distressed, may be considered maladaptive. If we use eating in response to many of our daily stressors, there may be long-term health repercussions, especially when the foods we choose to eat in these situations are high in carbohydrates and fats. This being said, although eating in response to stress may be common for many people, it is not the case for all. Therefore, we want to know who eats when feeling distressed, why they do this, is it specific to certain types of stressors, and what do they crave and eat. In order to do this, we took many measures of the daily stressors in your life, your perceptions of these stressors, your general and daily eating patterns, and a physiological measure of your stress hormones and eating-related peptides.

In this study we had students either perform a moderately stressful task (give a speech), or participate in a non-stressful task (listening to a book on tape). We are looking to see if food craving and eating increases when distressed compared to not, what types of foods are craved most, and to see who may follow through with these cravings and eat. Although we suspect that the specific food cravings may be more physiologically based (due to the release of various hormones and peptides), it may be individual differences are responsible for the variation in who gives in to such cravings. Such differences may include your level of eating restraint, tendency to eat when experiencing negative emotions, and the support (or "unsupport") from your social network. Although we provided you with food after giving a blood sample, part of our reason for providing you specifically with chocolate and mini-donuts to eat during the last segment of the study (two foods characteristic of those chosen during stress-related eating) was that we could measure how much you ate, and whether this was associated with your perceptions of the task you were assigned (e.g., how stressful it was to you), and your stress-hormone and eating-related peptide levels.

In addition to questionnaires, and measuring the food eaten, we also took a blood sample. We are interested to see whether a peptide that is involved with eating initiation, ghrelin, may increase with the perceived stressfulness of the situation. Furthermore, we are interested in whether increased ghrelin levels in response to stress, or continued elevated levels of this hormone following a stressful encounter, may be associated with increased cravings for specific foods, and in turn, increased eating.

We hope this study has provided you with information regarding coping mechanisms in response to stressful events, and particularly eating in response to a stressor. Thank you for participation in our study!

Contact Information (Study 3 and 5)

The following people are involved in this research project and may be contacted at any time if you have any further questions about this project, what it means, or concerns about how it was conducted:

Kate Raspopow, Researcher, Department of Psychology

Phone: (613) 512-2600 ext. 4199

Dr. Hymie Anisman, Faculty Member, Department of Psychology

Phone: (613) 520-2699

Dr. Kim Matheson, Faculty Member, Department of Psychology

Phone: (613) 520-2684

Dr. Alfonso Abizaid, Faculty Member, Department of Psychology

Phone: (613) 520-2600 ext. 1544

If you have any ethical concerns about how this study was conducted, please contact either of the following:

Dr. J. Mantler, Chair of the Carleton University Research Ethics Committee for Psychological Research, (613) 520-2600 ext. 4173

Dr. M. Gick, Chair, Dept. of Psychology, Carleton University, (613) 520-2648

If you have any worries or concerns about your personal well-being, or student skills, you can contact the following services:

Carleton University Health and Counselling Services, 520-6674

Student Life Services 520-6600

Appendix D

Study 4 and 6 Information

Recruitment Notice

Study Title: Student responses to an employment task

Abstract: Earn 2.5% in experimental credit AND \$15!!

Description: People experience similar events (e.g., getting a job to help pay for the extra costs of school), but responses to these events often differ between people, and between situations. Responses include perceptions and appraisals of the event, coping responses, changes in daily patterns (e.g., eating, sleeping, exercising), and hormonal changes. In this study we are interested in student responses to an employment task. In this study you'll be asked to come into the lab twice. The first session is an introduction session to fill out general questionnaires, and will take approximately one hour. If willing and eligible, during the second session you will be asked to fill out a questionnaire booklet, to perform a short task related to employment, and to provide a blood sample (taken continuously over 40 minutes), for a total time of approximately 1hr and 10mins. From this information we're interested in examining differences in behavioral and physiological responses to the task.

Eligibility: In order to be eligible for participation in this study you must be a female undergraduate student at Carleton University. Based on preliminary analyses some participants may not be eligible to participate in the final session.

Informed Consent Forms

Introduction session (Study 4 and 6)

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study title: Student responses to an employment task

Study personnel: Kate Raspopow (Researcher, 613-520-2600 ext. 4199)
Dr. Hymie Anisman (Faculty Investigator, 613-520-2600 ext. 2699)
Dr. Alfonso Abizaid (Faculty Investigator, 613-520-2600 ext. 1544)

If you have any ethical concerns about how this study was run please contact: Avi Parush, Chair of Carleton University Ethics Committee for Psychological Research, 613-520-2600 ext. 6026 or Dr. J. Mantler, Chair of Dept. of Psychology, 613-520-2600 ext. 4173.

Purpose and Task Requirements: Students experience a wide variety of events in their daily lives, and perceptions of what is stressful may vary between people as well as between situations. One such situation for undergraduate students is applying for jobs. In this study we're interested in student responses (e.g., appraisals, coping, hormones) to an employment task. During today's session, which should take approximately one hour, you will be asked to complete a series of questionnaires that will include general daily events, coping strategies, factors that may influence coping, and some personal information about yourself. During the second session you will be asked to perform a brief 10-minute task, after which you will be asked to complete several remaining questionnaires. As we are also interest in physiological reactions, we will also have a registered nurse take a continuous blood sample over 40 minutes. The total amount of blood taken will be approximately 25mL. Signing this informed consent gives consent for participation in today's session only. Further consent will be requested for the final session and blood sample. You will be fully debriefed about this study and what the researchers are expecting to find at the end of the final session. You will be awarded 1% for participation in today's session.

Potential Risk and Discomfort: There are no physical risks in this portion of the study. There may be some emotional discomfort when thinking about the stressors you experience in daily life.

Anonymity/Confidentiality: The data collected in this study will be kept confidential. Your informed consent form will be separated from your questionnaire and kept in a separate and secured file by one of the research investigators who will keep this information confidential. It will be associated with a code, and only this code will identify your questionnaire. We will need to have a code associated with your questionnaire, daily diary, and blood samples so that we are able to match up your responses at the end of the study. The data will also be stored in a secured data file that is only accessible by the researcher and research assistants.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to not complete certain questions or to withdraw entirely without penalty.

I have read the above description of the study concerning the daily experiences of students. The data collected will be used in research publications and/or for teaching purposes. My signature indicates that I agree to participate in the study, and this in no way constitutes a waiver of my rights.

Full Name (please print): _____
Participant Signature: _____ Date: _____
Researcher Signature: _____ Date: _____

Final Session (Study 6)

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study title: Student responses to an employment task

Study personnel: Kate Raspopow (Researcher, 613-520-2600 ext. 4199)
Dr. Hymie Anisman (Faculty Investigator, 613-520-2600 ext. 2699)
Dr. Alfonso Abizaid (Faculty Investigator, 613-520-2600 ext. 1544)

If you have any ethical concerns about how this study was run please contact Avi Parush, Chair of Carleton University Ethics Committee for Psychological Research, 613-520-2600 ext. 6026 or Dr. J. Mantler, Chair of Dept. of Psychology, 613-520-2600 ext. 4173.

Purpose and Task Requirements:

Students experience a wide variety of events in their daily lives, and perceptions of what is stressful may vary between people as well as between situations. One such situation for undergraduate students is applying for jobs. In this study we're interested in student responses to an employment task. During today's session, which should take approximately 1 hour and 10 minutes, you will be asked to perform a brief 10-minute task, after which you will be asked to complete several remaining questionnaires. As we are also interested in physiological reactions to stress, we ask your consent to take a blood sample. This consists of having a registered nurse insert a catheter into your arm (just as they do when you give blood to the Red Cross), and over the course of the session approximately 25mL of blood will be taken (this amounts to about 1/18th of the amount taken by the Red Cross). This portion of the study is entirely voluntary. There is a separate consent form for providing a blood sample. For participating in this final session you will receive 1.5% of experimental credit OR \$15, and an additional \$15 if you agree to provide a blood sample. At the end of this session you will be debriefed about this study in its entirety, and what the researchers are expecting to find.

Potential Risk and Discomfort: There may be some emotional discomfort when performing the assigned task and thinking about the emotions you experience in response to various stressors. The attached consent form describes the process related to giving a blood sample.

Anonymity/Confidentiality: The data collected in this study will be kept confidential. Your informed consent form will be separated from your questionnaire and kept in a separate and secured file by one of the research investigators who will keep this information confidential. It will be associated with a code, and only this code will identify your questionnaire. We will need to have a code associated with your questionnaire, daily diary, and blood samples so that we are able to match up your responses at the end of the study. The data will also be stored in a secured data file that is only accessible by the researcher and research assistants.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to not complete certain questions or to withdraw entirely without penalty.

I have read the above description of the study concerning the daily experiences of students. The data collected will be used in research publications and/or for teaching purposes. My signature indicates that I agree to participate in the study, and this in no way constitutes a waiver of my rights.

Full Name (please print): _____
Participant Signature: _____ Date: _____
Researcher Signature: _____ Date: _____

Final Session Blood Sample (Study 6)

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study title: Student responses to an employment task

Study personnel: Kate Raspopow (Researcher, 613-520-2600 ext. 4199)
Dr. Hymie Anisman (Faculty Investigator, 613-520-2600 ext. 2699)
Dr. Alfonso Abizaid (Faculty Investigator, 613-520-2600 ext. 1544)

If you have any ethical concerns about how this study was run please contact: Avi Parush, Chair of Carleton University Ethics Committee for Psychological Research, 613-520-2600 ext. 6026 or Dr. J. Mantler, Chair of Dept. of Psychology, 613-520-2600 ext. 4173.

Purpose and Task Requirements: Students experience a wide variety of events in their daily lives, ranging from the mundane, to the rather stressful. However, perceptions of what is stressful may vary between people as well as between situations. When situations are found to be stressful, our body reacts by producing various hormones and peptides to help us contend with this perceived threat. In order to evaluate these hormones and peptides, we would like to take a blood sample through a pump that slowly withdraws blood from your arm. This consists of having a registered nurse insert a catheter into your arm (from the same area of your arm from which blood samples are normal are drawn, just as they do when you give blood to the Red Cross) and over the course of the session approximately 25mL of blood will be taken (this amounts to about 1/18th of the amount taken by the Red Cross). All instruments used for blood withdrawal will be sterile and one-time use only. The blood samples will be analyzed for levels of stress related hormones (ACTH, cortisol, norepinephrine, epinephrine, prolactin and oxytocin), and peptides involved with eating initiation and satiety mechanisms (ghrelin, leptin, insulin, neuropeptide Y, neuromedin B), as well as glucose and cytokines. Once these markers have been analyzed, any remaining blood will be disposed of and will not be used for any other purposes. The total procedure will span 40 mins, and for agreeing to provide a blood sample you will receive \$15. Your signature below indicates that you have given consent to have a blood sample taken for the purposes of this study. At the end of this session you will be debriefed about this study in its entirety, and what the researchers are expecting to find.

Potential Risk and Discomfort: Inserting the needle usually gives a small pin-prick (as it does when you give blood for testing or to the Red Cross). In this case, however, the needle is taped down, covered, and left in place for 40 mins while you will be engaged in the study. Most people don't notice the needle in their arm after a short adjustment period. However, if at any time you wish to stop the experiment, please let us know and the nurse will take out the needle.

Anonymity/Confidentiality: The sample you provide will be kept confidential. Your informed consent form will be separated from your questionnaire and kept in a separate and secured file by one of the research investigators who will keep this information confidential. The questionnaire and blood samples will be assigned the same code, and only this code will identify your samples. The blood samples will be stored in a secured storage area that is only accessible by the researcher and research assistants. Once these markers have been analyzed, any remaining blood will be disposed of and will not be used for any other purposes.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to withdraw entirely without penalty.

I have read the above description of the blood sample purpose and procedure. The data collected will be used in research publications and/or for teaching purposes. My signature indicates that I agree to provide a blood sample, and this in no way constitutes a waiver of my rights.

Full Name (please print): _____
Participant Signature: _____ Date: _____
Researcher Signature: _____ Date: _____

Debriefing (Study 4 and 6)

Students face many stressful experiences, in and outside of school, including looking and applying for jobs, and public speaking. Although many people may encounter similar events in daily life, the way they perceive and respond to these events may differ. These differences may be based on the degree of control we feel we have over the event, the long-term consequences it may have for us, the resources we think are available to us, and individual difference factors.

Social support is a coping resource many people engage in times of distress. Having positive support from people in our social networks can effectively buffer against negative emotional and physiological responses to stressors. However, sometimes when we approach people for support their reactions may be negative (e.g., blaming, minimizing, distancing), which may exacerbate our distress. In addition to associations with poor well-being and depression, unsupportive social interactions may influence the development of eating disturbances such as binge eating and emotional eating. Other forms of coping we choose, such as eating to make ourselves feel better, may also have poor long-term health consequences, especially when we choose to eat foods that are high in carbohydrates and fats. This being said, although some individuals use eating to deal the negative emotions following stressful situations, this isn't the case for everyone and all situations. Therefore, we are interested in determining who eats when distressed, what the motivations may be behind this, and what kinds of foods they may crave and eat. In order to do this, we took measures of general perceived stress, coping, and eating behaviours.

Although psychological factors play an important role in stress-eating, it's likely that stress hormones and eating regulatory peptides are also important players. In this study we told students they would either perform a moderately stressful task (give a speech to an evaluating audience about their employability), or participate in a non-stressful task (fill out a questionnaire about the employment interests of Carleton University students). We also provided half of the participants with food during their anticipation period. Although participants did not have to perform the task, anticipation of an evaluative speech has proven to act as a stressor in itself. We are looking to see if the amount of food eaten and hormone responses during anticipation (for those given food) is associated with individual differences, and whether the two may be associated. Some of these differences may include level of eating restraint, emotional eating, or the general support (or unsupport) from your social network. In particular, we will be examining whether those individuals who are emotional eaters are more likely to eat (and to eat more) during the stressful anticipation period, and whether they have ghrelin (an eating initiation hormone) levels that show a blunted decrease following eating, perhaps explaining why they may continue eating even when not hungry.

We hope this study has provided you with information regarding coping mechanisms in response to stressful events, and particularly eating in response to a stressor. Thank you for participation in our study!

Contact Information (Study 4 and 6)

The following people are involved in this research project and may be contacted at any time if you have any further questions about this project, what it means, or concerns about how it was conducted:

Kate Raspopow, Researcher, Department of Psychology

Phone: (613) 520-2600 ext. 4199

Dr. Hymie Anisman, Faculty Member, Department of Psychology

Phone: (613) 520-2699

Dr. Alfonso Abizaid, Faculty Member, Department of Psychology

Phone: (613) 520-2600 ext. 1544

If you have any ethical concerns about how this study was conducted, please contact either of the following:

Dr. Avi Parush, Chair, Carleton University Ethics Committee for Psychological Research

Phone: (613) 520-2600 ext 6026

Dr. Janet Mantler, Chair, Department of Psychology,

Phone: (613) 520-2600 ext 4173

If you have any worries or concerns about your personal well-being, or student skills, you can contact the following services:

Carleton University Health and Counselling Services, 520-6674

Student Life Services 520-6600

Appendix E

General Measures

Background Information (Study 1 and 2)

Age: _____

Year of study: _____ 1st year _____ 2nd year _____ 3rd year _____ 4th year

What is your citizenship status?

_____ Canadian citizen

_____ Landed immigrant Since what year? _____ Country of origin: _____

_____ Student visa Since what year? _____ Country of origin: _____

What is your first language? _____

If your first language is not English, how long have you been fluent in reading, writing and comprehension of the English language? _____

What is your ethnic/racial background? _____

What is your religion, if any? _____

What is your current relationship status (please check ONE that best applies to you)?

_____ Single, and not seeing anyone

_____ Am going out with someone

_____ Am living with or married to an intimate other

_____ Have recently broken up

Is your current (or most recent) partner: Male _____ OR Female _____?

If you are currently in a relationship:

How long have you been in this relationship? _____

Is this **relationship** a source of support to you?

-3	-2	-1	+1	+2	+3
Extremely	Moderately	Slightly	Slightly	Moderately	Extremely
Unsupportive		unsupportive	supportive		supportive

Is your **family** a source of support to you?

-3	-2	-1	+1	+2	+3
Extremely	Moderately	Slightly	Slightly	Moderately	Extremely
Unsupportive		unsupportive	supportive		supportive

Are your **friends** a source of support for you?

-3	-2	-1	+1	+2	+3
Extremely	Moderately	Slightly	Slightly	Moderately	Extremely
Unsupportive		unsupportive	supportive		supportive
Current height:	_____		Current weight:	_____	

Are you currently on a diet? No _____ Yes _____

If yes, for how long have you been dieting? _____

Approximately how much weight have you lost in this time? _____

Background Information (Studies 3, 4, 5, and 6)

Age: _____

Year of study: _____ 1st year _____ 2nd year _____ 3rd year _____ 4th
year

What is your citizenship status?

_____ Canadian citizen
_____ Landed immigrant Since what year? _____ Country of origin: _____
_____ Student visa Since what year? _____ Country of origin: _____

What is your first language? _____

If your first language is not English, how long have you been fluent in reading, writing and comprehension of the English language? _____

What is your ethnic/racial background? _____

What is your religion, if any? _____

What is your current relationship status (please check ONE that best applies to you)?

_____ Single, and not seeing anyone
_____ Am going out with someone
_____ Am living with or married to an intimate other
_____ Have recently broken up

If you are currently in a relationship:

How long have you been in this relationship? _____

Is this relationship a source of support to you? No ___ Yes ___

Is your current (or most recent) partner: Male _____ OR Female _____?

Current Health, Medication and Treatments - Introduction session (Studies 5 and 6)

Current height: _____ Current weight: _____

Are you currently on a diet? No _____ Yes _____

If yes, which type(s)?

_____ General calorie reduction

_____ Glycemic Index

_____ High Protein

_____ Low Carb

_____ South Beach

_____ Other: _____

If yes, for how long have you been dieting? _____

Approximately how much weight have you lost in this time? _____

Have you been on a diet in the past year? No _____ Yes _____

If yes, how long ago? _____

For how long were you dieting? _____

How much weight did you lose? _____

Do you currently smoke? No _____ Yes _____

If yes, on average, how many cigarettes/day? _____

Are you taking any form of hormonal based contraception (birth control)?

No _____ Yes _____

If yes, which one?

_____ Standard birth control pill

_____ Evra Patch

_____ NuvaRing

_____ Depo-Provera Shot

_____ Mini (progestin-only) birth control pill

_____ Other: _____

When did your last period begin? _____ And end? _____

Are you suffering from a medical illness (e.g., type 2 diabetes, hyperthyroidism, etc.)?

No _____ Yes _____

If yes, please specify: _____

Are you on any of the following medications (please check all that apply)?

_____ Anti-inflammatories (please specify) _____

_____ Anti-depressants (please specify) _____

_____ Anti-anxieties (please specify) _____

_____ Allergy medication (please specify) _____

_____ Other prescription drugs (please specify) _____

Dutch Eating Behavior Questionnaire (all studies)

Please read the following items and circle the correct response below.

	Never	Seldom	Sometimes	Often	Very Often
1. When you have put on weight, do you eat less than you usually do?	0	1	2	3	4
2. Do you try to eat less at mealtimes than you would like to eat?	0	1	2	3	4
3. How often do you refuse food or drink offered because you are concerned about your weight?	0	1	2	3	4
4. Do you watch exactly what you eat?	0	1	2	3	4
5. Do you deliberately eat foods that are slimming?	0	1	2	3	4
6. When you have eaten too much, do you eat less than usual the following day?	0	1	2	3	4
7. Do you deliberately eat less in order not to become heavier?	0	1	2	3	4
8. How often do you try not to eat between meals because you are watching your weight?	0	1	2	3	4
9. How often in the evenings do you try not to eat because you are watching your weight?	0	1	2	3	4
10. Do you take into account your weight with what you eat?	0	1	2	3	4
11. Do you have the desire to eat when you are irritated?	0	1	2	3	4
12. Do you have a desire to eat when you have nothing to do?	0	1	2	3	4
13. Do you have a desire to eat when you are depressed or discouraged?	0	1	2	3	4
14. Do you have a desire to eat when you are feeling lonely?	0	1	2	3	4
15. Do you have a desire to eat when somebody lets you down?	0	1	2	3	4

	Never	Seldom	Sometimes	Often	Very Often
16. Do you have a desire to eat when you are <i>cross</i> ?	0	1	2	3	4
17. Do you have a desire to eat when you are approaching something unpleasant to happen?	0	1	2	3	4
18. Do you get the desire to eat when you are anxious, worried or tense?	0	1	2	3	4
19. Do you have a desire to eat when things are going against you or when things have gone wrong?	0	1	2	3	4
20. Do you have a desire to eat when you are frightened?	0	1	2	3	4
21. Do you have a desire to eat when you are disappointed?	0	1	2	3	4
22. Do you have a desire to eat when you are emotionally upset?	0	1	2	3	4
23. Do you have a desire to eat when you are bored or restless?	0	1	2	3	4
24. If food tastes good to you, do you eat more than usual?	0	1	2	3	4
25. If food smells and looks good, do you eat more than usual?	0	1	2	3	4
26. If you see or smell something delicious, do you have a desire to eat it?	0	1	2	3	4
27. If you have something delicious to eat, do you eat it straight away?	0	1	2	3	4
28. If you walk past the baker do you have the desire to buy something delicious?	0	1	2	3	4
29. If you walk past a snack-bar or a café, do you have the desire to buy something delicious?	0	1	2	3	4
30. If you see others eating, do you also have the desire to eat?	0	1	2	3	4
31. Can you resist eating delicious foods?	0	1	2	3	4
32. Do you eat more than usual, when you see others eating?	0	1	2	3	4

33. When preparing a meal are you inclined to eat something 0 1 2 3 4

Note: Items 11-23 comprise the Emotional Eating subscale.

Perceived Stress Scale (Studies 1, 2, and 4)

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the response option that seems like a reasonable estimate.

Response options:	0	1	2	3	4
	Never	Almost Never	Sometimes	Fairly Often	Very Often
1. How often have you been upset because of something that happened unexpectedly?					_____
2. How often have you felt that you were unable to control the important things in your life?					_____
3. How often have you felt nervous and "stressed"?					_____
4. How often have you dealt successfully with irritating life hassles?					_____
5. How often have you felt that you were effectively coping with important changes that were occurring in your life?					_____
6. How often have you felt confident about your ability to handle your personal problems?					_____
7. How often have you felt that things were going your way?					_____
8. How often have you found that you could not cope with all of the things that you had to do?					_____
9. How often have you been able to control irritations in your life?					_____
10. How often have you felt that you were on top of things?					_____
11. How often have you been angered because of things that happened that were outside of your control?					_____
12. How often have you found yourself thinking about things that you have to accomplish?					_____
13. How often have you been able to control the way you spend your time?					_____
14. How often have you felt difficulties were piling up so high that you could not overcome them?					_____

Survey of Coping Profiles Endorsed (Studies 1, 2, 3, and 4)

The purpose of this questionnaire is to find out how people deal with their problems or the stresses in their lives. The following are activities that you may have done. After each activity, please indicate the extent to which you would use this as a way of dealing with problems or stresses in recent weeks.

<i>Ordinarily, in recent weeks have you</i>	<i>Never</i>	<i>Seldom</i>	<i>Sometimes</i>	<i>Often</i>	<i>Almost always</i>
1. accepted that there was nothing you could do to change your situation?	0	1	2	3	4
2. tried to just take whatever came your way?	0	1	2	3	4
3. talked with friends or relatives about your problems?	0	1	2	3	4
4. tried to do things which you typically enjoy?	0	1	2	3	4
5. sought out information that would help you resolve your problems?	0	1	2	3	4
6. blamed others for creating your problems or making them worse?	0	1	2	3	4
7. sought the advice of others to resolve your problems?	0	1	2	3	4
8. blamed yourself for your problems?	0	1	2	3	4
9. exercised?	0	1	2	3	4
10. fantasized or thought about unreal things (e.g., the perfect revenge, or winning a million dollars) to feel better?	0	1	2	3	4
11. been very emotional compared to your usual self?	0	1	2	3	4
12. gone over your problems in your mind over and over again?	0	1	2	3	4
13. asked others for help?	0	1	2	3	4
14. thought about your problems a lot?	0	1	2	3	4
15. became involved in recreation or pleasure activities?	0	1	2	3	4
16. worried about your problems a lot?	0	1	2	3	4
17. tried to keep your mind off things that are upsetting you?	0	1	2	3	4
18. tried to distract yourself from your troubles?	0	1	2	3	4
19. avoided thinking about your problems?	0	1	2	3	4

<i>Ordinarily, in recent weeks have you</i>	<i>Never</i>	<i>Seldom</i>	<i>Sometimes</i>	<i>Often</i>	<i>Almost always</i>
20. made plans to overcome your problems?	0	1	2	3	4
21. told jokes about your situation?	0	1	2	3	4
22. thought a lot about who is responsible for your problems (besides yourself)?	0	1	2	3	4
23. shared humorous stories etc. to cheer yourself and others up?	0	1	2	3	4
24. told yourself that other people have dealt with problems such as yours?	0	1	2	3	4
25. thought a lot about how you have brought your problems on yourself?	0	1	2	3	4
26. decided to wait and see how things turn out?	0	1	2	3	4
27. wished the situation would go away or be over with?	0	1	2	3	4
28. decided that your current problems are a result of your own past actions?	0	1	2	3	4
29. gone shopping?	0	1	2	3	4
30. asserted yourself and taken positive action on problems that are getting you down?	0	1	2	3	4
31. sought reassurance and moral support from others?	0	1	2	3	4
32. resigned yourself to your problems?	0	1	2	3	4
33. thought about how your problems have been caused by other people?	0	1	2	3	4
34. daydreamed about how things may turn out?	0	1	2	3	4
35. been very emotional in how you react, even to little things?	0	1	2	3	4
36. decided that you can grow and learn through your problems?	0	1	2	3	4
37. told yourself that other people have problems like your own?	0	1	2	3	4
38. wished I was a stronger person or better at dealing with problems?	0	1	2	3	4
39. looked for how you can learn something out of your bad situation?	0	1	2	3	4
40. asked for God's guidance?	0	1	2	3	4

<i>Ordinarily, in recent weeks have you</i>	<i>Never</i>	<i>Seldom</i>	<i>Sometimes</i>	<i>Often</i>	<i>Almost always</i>
41. kept your feelings bottled up inside?	0	1	2	3	4
42. found yourself crying more than usual?	0	1	2	3	4
43. tried to act as if you were not upset?	0	1	2	3	4
44. prayed for help?	0	1	2	3	4
45. gone out?	0	1	2	3	4
46. held in your feelings?	0	1	2	3	4
47. tried to act as if you weren't feeling bad?	0	1	2	3	4
48. taken steps to overcome your problems?	0	1	2	3	4
49. made humorous comments or wise cracks?	0	1	2	3	4
50. told others that you were depressed or emotionally upset?	0	1	2	3	4
51. distracted myself with food?	0	1	2	3	4
52. found comfort in my favourite foods?	0	1	2	3	4
53. spent time cooking a big meal?	0	1	2	3	4
54. gone out for food with friends?	0	1	2	3	4

Note: Items 51-54 appear only in Studies 1 and 2

Unsupportive Social Interactions Inventory (Studies 3 and 4)

Think about times you have talked with other people about events in your life during the past month. Please circle the appropriate answer in regards to how much of the following responses you have received from others.

	None				A lot
1. Would not seem to want to hear about it.	0	1	2	3	4
2. Would refuse to take me seriously.	0	1	2	3	4
3. Would change the subject before I wanted to.	0	1	2	3	4
4. Would refuse to provide the type of help or support I was asking for.	0	1	2	3	4
5. When I was talking about it, the person wouldn't give me enough time, or would make me feel like I should hurry.	0	1	2	3	4
6. Would discourage me from expressing feelings such as anger, hurt or sadness.	0	1	2	3	4
7. Would not seem to know what to say, or would seem afraid of saying or doing the "wrong" thing.	0	1	2	3	4
8. Would seem to be telling me what he or she thought I wanted to hear.	0	1	2	3	4
9. From voice tone, expression, or body language, I would get the feeling he or she was uncomfortable talking about it.	0	1	2	3	4
10. Would try to cheer me up when I was not ready to.	0	1	2	3	4
11. Would respond with uninvited physical touching (e.g., hugging).	0	1	2	3	4
12. Would do things for me that I would want to do and could do myself.	0	1	2	3	4
13. Would feel that I should stop worrying about the event and just forget about it.	0	1	2	3	4
14. Would tell me to be strong, to keep my chin up, or that I should not let it bother me.	0	1	2	3	4
15. Would feel that I should focus on the present or the future and that I should forget about what has happened and get on with my life.	0	1	2	3	4
16. Would feel that it could have been worse or was not as bad as I thought.	0	1	2	3	4
17. Would say that I should look on the bright side.	0	1	2	3	4

	None				A lot
18. Would feel that I was overreacting.	0	1	2	3	4
19. Would ask “why” questions about my role in the event.	0	1	2	3	4
20. Would make “Should or shouldn’t have” comments about my role in the event.	0	1	2	3	4
21. Would tell me that I had gotten myself into the situation in the first place, and now must deal with the consequences.	0	1	2	3	4
22. Would blame me, or try to make me feel responsible for the event.	0	1	2	3	4
23. Would make “I told you so” or similar comments.	0	1	2	3	4
24. Would seem to be disappointed in me.	0	1	2	3	4

Social Support Scale (Study 4)

In the past, how often **did you receive** these activities from other people in the past month? Please read each statement carefully and circle or underline the answer that best describes your experience.

1. Someone gave you some information to help you understand a situation

Not at all Once or twice About once a week Several times a week About every day

2. People who have helped you have checked back to see if you have followed their advice

Not at all Once or twice About once a week Several times a week About every day

3. Others gave you information on how to do something

Not at all Once or twice About once a week Several times a week About every day

4. Others gave you feedback on how you were doing without saying it was good or bad

Not at all Once or twice About once a week Several times a week About every day

5. Others told you that you were O.K. just the way you are

Not at all Once or twice About once a week Several times a week About every day

6. Others have expressed interest and concern in your well-being

Not at all Once or twice About once a week Several times a week About every day

7. Others listened to you talk about your private feelings

Not at all Once or twice About once a week Several times a week About every day

8. Other have joked and kidded to try to cheer you up

Not at all Once or twice About once a week Several times a week About every day

9. Others have provided you with transportation

Not at all Once or twice About once a week Several times a week About every day

10. Others have pitched in to help do something that needed to be done

Not at all Once or twice About once a week Several times a week About every day

11. Others have provided you with a place where you could get away for a while

Not at all Once or twice About once a week Several times a week About every day

12. Others have loaned or given you something (a physical object other than money) that you needed

Not at all Once or twice About once a week Several times a week About every day

Appendix F

Hypothetical Stressor Scenarios

Study 1

Situation 1: social

You're out for dinner with a friend, and you start talking about a fight you just had with your boy/girlfriend. After explaining your side of the story, your friend starts questioning you about what you did, and almost blaming you for what happened. After confronting them about their behaviour, they don't apologize for anything. After that conversation, you don't really have much to say to each other, so you ask for the checks to leave quickly. A week later, you still haven't been in touch.

Situation 2: academic

You've just gotten a midterm back that's worth 40% of your final mark. You studied a lot for this exam and felt confident that you did well when you left the exam room, but you ended up with a failing grade. The professor said that he won't change the grading scheme, so you'll have to do really well on the final exam to pass the course. The exam is in a month, but you also have all of your other finals to study for, and they're all within a five-day period.

Situation 3: time pressures

You are supposed to help your co-worker out with a big project, and you need to be at the work meeting in a few days ready to contribute; it will be a lot of long days at the office after that. However, you didn't realize that you'd also have additional work given to you, classes to attend and an assignment due, an intramural playoff game, a friend's birthday dinner to attend and getting a gift for it, as well as your regular household tasks (e.g.,

groceries, cooking, laundry, cleaning, etc.), all of which have to be finished before the meeting. You should be fine for the meeting and project, as long as you are able to accomplish all of your other tasks in time.

Situation 4: financial

It's the end of the fall semester and you have to pay your December rent. Normally you don't have any problems with rent money, but you've had a lot of unexpected expenses lately. You've just paid your winter tuition, monthly bills, bought a plane ticket for a trip with friends during Reading week in February, and had to get major car repairs. Your hours at your part-time job have been cut down, and your parents aren't able to help you out with money at this time. You're not sure where the money to cover rent and groceries for the month is going to come from.

Study 2

Supportive condition

Situation 1: social

You're out at the movies with a friend, and his/her bank cards aren't working for some reason. (S)he doesn't have any cash, so you lend them \$20. A week later you email him/her for the money since money's a bit tight for you at the moment. You've tried to get in touch with your friend a few times, but (s)he's not getting back to you. You call another friend to talk about it and ask his/her advice. After listening to you vent and explain the situation (s)he says that (s)he also can't believe you haven't heard back from your friend, and that you should have been paid back by now; \$20 is a lot of money.

Situation 2: academic

You've just gotten a midterm back that's worth 35% of your final mark. You studied a lot for this exam and felt confident that you did well when you left the exam room, but you ended up with a failing grade. The professor said that he won't change the grading scheme, so you'll have to do really well on the final exam to pass the course. You call your best friend, and (s)he meets with you that evening. After talking about your worries, (s)he helps you come up with a study plan that will work for you, and that you think will help you ace the final. (S)he also volunteers to help you around exam time with little quizzes and anything else that will help.

Unsupportive condition

Situation 1: social

You're out at the movies with a friend, and his/her bank cards aren't working for some reason. (S)he doesn't have any cash, so you lend them \$20. A week later you email him/her for the money since money's a bit tight for you at the moment. You've tried to get in touch with your friend a few times, but (s)he's not getting back to you. You call another friend to talk about it and ask his/her advice. (S)he says that you're making too big a deal out of it, and can't believe that you're bugging your friend to pay you back such a small amount of money. (S)he then tells you (s)he doesn't have time to listen to your little problems.

Situation 2: academic

You've just gotten a midterm back that's worth 35% of your final mark. You studied a lot for this exam and felt confident that you did well when you left the exam room, but you ended up with a failing grade. The professor said that he won't change the grading scheme, so you'll have to do really well on the final exam to pass the course. You run into a friend right after the class, and tell him/her about your grade, but all (s)he does is remind you about how you went out a few days before the test, and that maybe you should have spent that time studying instead.

No support condition:

Situation 1: social

You're out at the movies with a friend, and his/her bank cards aren't working for some reason. (S)he doesn't have any cash, so you lend them \$20. A week later you email him/her for the money since money's a bit tight for you at the moment. You've tried to get in touch with your friend a few times, but (s)he's not getting back to you.

Situation 2: academic

You've just gotten a midterm back that's worth 35% of your final mark. You studied a lot for this exam and felt confident that you did well when you left the exam room, but you ended up with a failing grade. The professor said that he won't change the grading scheme, so you'll have to do really well on the final exam to pass the course.

Responses to Hypothetical Scenarios (Study 1 and 2)

Stress Appraisal Measure (abbreviated)

Please answer each of the following questions about your thoughts about various aspects of the situation you just read. Circle the appropriate number corresponding to the following scale.

	1	2	3	4	5
	Not at all	Slightly	Moderately	Considerably	Extremely
1. Is the outcome of this situation uncontrollable by anyone?	1	2	3	4	5
2. How much would I be affected by the outcome of this situation?	1	2	3	4	5
3. To what extent could I become a stronger person because of this problem?	1	2	3	4	5
4. Do I have the ability to do well in this situation?	1	2	3	4	5
5. How threatening is this situation?	1	2	3	4	5
6. Would I be able to overcome the problem?	1	2	3	4	5
7. Is there anyone who could help me manage the problem?	1	2	3	4	5
8. To what extent do I perceive this situation as stressful?	1	2	3	4	5

Survey of Coping Profiles Endorsed (abbreviated)

*The following are activities that you might do in order to deal with the events in the scenario you just read. After each activity, please indicate the extent to which **you would use this strategy** as a way of dealing with the situation in the scenario.*

<i>In response to this situation, would you:</i>	<i>Not at all</i>		<i>Somewhat</i>		<i>Extremely</i>
					<i>so</i>
1. seek out information that would help you resolve your problems?	0	1	2	3	4
2. look for how you can learn something out of your bad situation?	0	1	2	3	4
3. try to do things which you typically enjoy?	0	1	2	3	4
4. try to keep your mind off things that are upsetting you?	0	1	2	3	4
5. go over your problems in your mind over and over again?	0	1	2	3	4
6. share humorous stories etc. to cheer yourself and others up?	0	1	2	3	4
7. seek the advice of others to resolve your problems?	0	1	2	3	4
8. seek reassurance and moral support from others?	0	1	2	3	4
9. tell others that you were depressed or emotionally upset?	0	1	2	3	4
10. think a lot about who is responsible for your problems (besides yourself)?	0	1	2	3	4
11. blame yourself for your problems?	0	1	2	3	4
12. try to act as if you were not upset?	0	1	2	3	4
13. accept that there was nothing you could do to change your situation?	0	1	2	3	4
14. pray for help?	0	1	2	3	4
15. wish the situation would go away or be over with?	0	1	2	3	4
16. find comfort in my favourite foods?	0	1	2	3	4

Appendix G

Final Session Questionnaires

Background Information (Studies 5 and 6)

Age: _____

Year of study: _____ 1st year _____ 2nd year _____ 3rd year _____ 4th year

The following questions are important for our analysis of stress hormones:

What time did you wake up this morning? _____

Are you currently being treated for any physical condition?

No _____ Yes _____ If yes, please specify _____

Are you taking any form of hormonal based contraception (birth control)?

No _____ Yes _____

If yes, which one?

_____ Standard birth control pill

_____ Evra Patch

_____ NuvaRing

_____ Depo-Provera Shot

_____ Mini (progestin-only) birth control pill

_____ Other: _____

When did your last period begin? _____ And end? _____

Are you on any of the following medications (please check all that apply)?

_____ Anti-inflammatories (please specify) _____

_____ Anti-depressants (please specify) _____

_____ Anti-anxieties (please specify) _____

_____ Allergy medication (please specify) _____

_____ Other prescription drugs (please specify) _____

Have you taken any of these medications in the past 24 hours?

If yes:

Which medications? _____

What time did you take it/them? _____

How much did you take? _____

When was the last time you ate today? _____

What did you eat? _____

How hungry are you *right now*?

0	1	2	3	4	5	6	7	8	9	10
Extremely Full		Moderately Full			Content			Moderately Hungry		Extremely Hungry

Stress Appraisal Measure (Study 5)

This questionnaire is concerned with your thoughts about various aspects of the task you just performed. There are no right or wrong answers. Please respond according to how you view this situation right now, that is, at this moment. Please answer ALL questions. Answer each question by CIRCLING the appropriate number corresponding to the following scale.

	1 Not at all	2 Slightly	3 Moderately	4 Considerably	5 Extremely
1. Is this a totally hopeless situation?	1	2	3	4	5
2. Does this situation create tension in me?	1	2	3	4	5
3. Is the outcome of this situation uncontrollable by anyone?	1	2	3	4	5
4. Is there someone or some agency I can turn to for help if I need it?	1	2	3	4	5
5. Does this situation make me feel anxious?	1	2	3	4	5
6. Does this situation have important consequences for me?	1	2	3	4	5
7. Is this going to have a positive impact in me?	1	2	3	4	5
8. How eager am I to tackle this problem?	1	2	3	4	5
9. How much will I be affected by the outcome of this situation?	1	2	3	4	5
10. To what extent can I become a stronger person because of this problem?	1	2	3	4	5
11. Will the outcome of this situation be negative?	1	2	3	4	5
12. Do I have the ability to do well in this situation?	1	2	3	4	5
13. Does this situation have serious implications for me?	1	2	3	4	5
14. Do I have what it takes to do well in this situation?	1	2	3	4	5
15. Is there help available to me for dealing with this problem?	1	2	3	4	5
16. Does this situation tax or exceed my coping resources?	1	2	3	4	5
17. Are there sufficient resources available to help me in dealing?	1	2	3	4	5
18. Is this beyond anyone's power to do anything about this situation?	1	2	3	4	5
19. To what extent am I excited thinking about the outcome of this situation?	1	2	3	4	5

	1 Not at all	2 Slightly	3 Moderately	4 Considerably	5 Extremely
20. How threatening is this situation?	1	2	3	4	5
21. Is the problem unresolvable by anyone?	1	2	3	4	5
22. Will I be able to overcome the problem?	1	2	3	4	5
23. Is there anyone who can help me manage the problem?	1	2	3	4	5
24. To what extent do I perceive this situation as stressful?	1	2	3	4	5
25. Do I have the skills necessary to achieve a successful outcome to this situation?	1	2	3	4	5
26. To what extent does this event require coping efforts on my part?	1	2	3	4	5
27. Does this situation have long-term consequences for me?	1	2	3	4	5
28. Is this going to have a negative impact on me?	1	2	3	4	5

Positive and Negative Affect Schedule (Study 5 and 6)

Using the rating scale beside each item, please indicate how much each adjective describes **how you feel at the moment**. There are no right or wrong answers, we just want you to be as honest as possible in indicating how you're feeling **right now**.

Active.....	Not at all	0	1	2	3	4	5	6	Extremely
Afraid.....	Not at all	0	1	2	3	4	5	6	Extremely
Alert.....	Not at all	0	1	2	3	4	5	6	Extremely
Angry.....	Not at all	0	1	2	3	4	5	6	Extremely
Annoyed.....	Not at all	0	1	2	3	4	5	6	Extremely
Anxious.....	Not at all	0	1	2	3	4	5	6	Extremely
Ashamed.....	Not at all	0	1	2	3	4	5	6	Extremely
Attentive.....	Not at all	0	1	2	3	4	5	6	Extremely
Confused.....	Not at all	0	1	2	3	4	5	6	Extremely
Contempt.....	Not at all	0	1	2	3	4	5	6	Extremely
Depressed.....	Not at all	0	1	2	3	4	5	6	Extremely
Determined.....	Not at all	0	1	2	3	4	5	6	Extremely
Disdain.....	Not at all	0	1	2	3	4	5	6	Extremely
Disgust.....	Not at all	0	1	2	3	4	5	6	Extremely
Distressed.....	Not at all	0	1	2	3	4	5	6	Extremely
Embarrassed.....	Not at all	0	1	2	3	4	5	6	Extremely
Enraged.....	Not at all	0	1	2	3	4	5	6	Extremely
Enthusiastic.....	Not at all	0	1	2	3	4	5	6	Extremely
Excited.....	Not at all	0	1	2	3	4	5	6	Extremely
Frustrated.....	Not at all	0	1	2	3	4	5	6	Extremely
Guilty.....	Not at all	0	1	2	3	4	5	6	Extremely
Happy.....	Not at all	0	1	2	3	4	5	6	Extremely
Helpless.....	Not at all	0	1	2	3	4	5	6	Extremely
Hostile.....	Not at all	0	1	2	3	4	5	6	Extremely
Humiliated.....	Not at all	0	1	2	3	4	5	6	Extremely

Indifferent.....Not at all	0	1	2	3	4	5	6	Extremely
Infuriated.....Not at all	0	1	2	3	4	5	6	Extremely
Inspired.....Not at all	0	1	2	3	4	5	6	Extremely
Interested.....Not at all	0	1	2	3	4	5	6	Extremely
Irritable..... Not at all	0	1	2	3	4	5	6	Extremely
Jittery.....Not at all	0	1	2	3	4	5	6	Extremely
Nervous.....Not at all	0	1	2	3	4	5	6	Extremely
Proud.....Not at all	0	1	2	3	4	5	6	Extremely
Regretful..... Not at all	0	1	2	3	4	5	6	Extremely
Responsible.....Not at all	0	1	2	3	4	5	6	Extremely
Sad.....Not at all	0	1	2	3	4	5	6	Extremely
Scared.....Not at all	0	1	2	3	4	5	6	Extremely
Strong.....Not at all	0	1	2	3	4	5	6	Extremely
Unhappy.....Not at all	0	1	2	3	4	5	6	Extremely
Upset.....Not at all	0	1	2	3	4	5	6	Extremely
Worried.....Not at all	0	1	2	3	4	5	6	Extremely

Body Composition Measurements (Study 6)

Since some of the hormones we are interested vary with body composition we are interested in the following measurements:

Weight (lbs): _____

Height (inches): _____

Hip circumference (inches): _____

Waist circumference (inches): _____

Hip to waist ratio: _____

Percent body fat: _____

Food eaten (g): _____

Appendix H

Food cravings following an acute psychosocial stressor

A 2 (Stressor condition: control vs. stressor) x 2 (Emotional eating status: non-emotional eater vs. emotional eater) Multivariate Analysis of Variance of women's cravings for high fat, carbohydrate, sweet, and fast foods indicated that emotional eating status influenced women's post-stressor cravings, *Pillai's* = .195, $F(4,55) = 3.34$, $p < .05$. More specifically, as shown in Table 18, relative to non-emotional eaters, emotional eaters reported greater cravings for carbohydrate, $F(1,58) = 7.83$, $p < .01$, $\eta^2 = .119$, sweet, $F(1,58) = 5.11$, $p < .05$, $\eta^2 = .081$, and fast foods, $F(1,58) = 6.63$, $p < .05$, $\eta^2 = .103$. Additionally, stressor condition showed a borderline, but non-significant, effect on food cravings, *Pillai's* = .150, $F(4,55) = 2.42$, $p = .059$, wherein those in the stressor condition reported comparatively decreased cravings for high fat, $F(1,58) = 4.84$, $p < .05$, $\eta^2 = .077$, carbohydrate, $F(1,58) = 4.73$, $p < .05$, $\eta^2 = .075$, and sweet foods, $F(1,58) = 8.17$, $p < .01$, $\eta^2 = .123$ (Table ??).

Table 18. *Mean (SD) of Food Cravings Immediately Following an Acute Psychosocial Stressor as a function of Stressor Condition and Emotional Eating Status*

	Control	Stressor	Non-Emotional Eater	Emotional Eater
High Fat	1.53(.59)	1.24(.42)*	1.30(.46)	1.45(.59)
Carbohydrate	1.81(.76)	1.43(.61)*	1.38(.56)	1.83(.76)**
Sweet	2.05(.81)	1.44(.86)**	1.48(.70)	1.97(.98)*
Fast Food	2.04(1.20)	1.59(.87)	1.48(.78)	2.12(1.20)*

* $p < .05$, ** $p < .01$

Food-Craving Inventory – Final Laboratory Session (Study 5)

A craving is defined as an intense desire to consume a particular food (or food type) that is difficult to resist.

*How much are you craving the foods below **right now?***

	Not at all	Somewhat	Extremely		
1. Fried chicken	1	2	3	4	5
2. Sausage	1	2	3	4	5
3. Gravy	1	2	3	4	5
4. Fried fish	1	2	3	4	5
5. Bacon	1	2	3	4	5
6. Corn bread	1	2	3	4	5
7. Hot dog	1	2	3	4	5
8. Steak	1	2	3	4	5
9. Brownies	1	2	3	4	5
10. Cookies	1	2	3	4	5
11. Candy	1	2	3	4	5
12. Chocolate	1	2	3	4	5
13. Donuts	1	2	3	4	5
14. Cake	1	2	3	4	5
15. Cinnamon rolls	1	2	3	4	5
16. Ice cream	1	2	3	4	5
17. Rolls	1	2	3	4	5
18. Pancakes or waffles	1	2	3	4	5
19. Biscuits	1	2	3	4	5
20. Sandwich bread	1	2	3	4	5
21. Rice	1	2	3	4	5
22. Baked potato	1	2	3	4	5
23. Pasta	1	2	3	4	5
24. Cereal	1	2	3	4	5
25. Hamburger	1	2	3	4	5
26. French fries	1	2	3	4	5
27. Chips	1	2	3	4	5
28. Pizza	1	2	3	4	5

Appendix I

Statement of Permission

I, Kate Raspopow certify that all co-authors of the material presented in Chapter 3 of this dissertation (i.e., Alfonso Abizaid, Kimberly Matheson, Hymie Anisman) have read, and agreed to the following contribution statement:

“Kate Raspopow designed the study protocol and ran the study, developed the research questions and plan of analysis, analyzed the data, and wrote the manuscript. Hymie Anisman provided advice during data analysis, and contributed to the first draft of the manuscript. Hymie Anisman, Alfonso Abizaid, and Kimberly Matheson provided advice during the initial development of the study, and contributed to the interpretation of results, as well as manuscript revisions.”

All co-authors have granted permission for the use of the material in Chapter 3 in this dissertation.