THE EFFECT OF FOOD AND WEIGHT-RELATED CUES ON PHYSIOLOGICAL STRESS MEASURES IN PREMENOPAUSAL WOMEN WITH HIGH VERSUS LOW LEVELS OF COGNITIVE DIETARY RESTRAINT

by

Mandeep Sanghera

BA, Queen's University, 2006
BScH, Queen's University, 2007

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

in

The Faculty of Graduate Studies
(Human Nutrition)

THE UNIVERSITY OF BRITISH COLUMBIA
(Vancouver)

May 2010

ABSTRACT

Cognitive dietary restraint (CDR) reflects a perception of constantly monitoring or attempting to restrict food intake as a means to control body weight, rather than eating in response to physiological hunger cues. Higher salivary and urinary cortisol levels have been observed in women with high versus low CDR. This study assessed whether food and weight-related cues differentially activate the physiological stress response in 70 healthy women aged 19-35 with low (0-5; n = 35) or high (13-21; n = 35) scores on the Three Factor Eating Questionnaire Restraint subscale. Participants completed questionnaires on eating attitudes, stress, anxiety, depression and physical activity in the presence of food temptations. Concurrently, blood pressure, heart rate and salivary cortisol measures were obtained every 15 minutes over a 90 minute period. Results showed significant between-group differences in eating attitudes while anthropometric, general perceived stress, anxiety, depression and physical activity variables were similar. Although women with high CDR perceived the protocol as more stressful, physiological measures did not differ by CDR level. Participants also provided 4 saliva samples collected within 1 hour of awakening to assess the awakening cortisol response (ACR). ACR disturbances may be indicative of disrupted hypothalamic-pituitary-adrenal axis functioning, which may be responsible for the higher cortisol levels observed in high restraint women. Morning sampling procedures showed no between-group differences in the ACR. In conclusion, women with high and low CDR had similar physiological stress responses after cue exposure; however, this may have been the result of a weak stressor.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

A thesis haiku
To say thanks for the support,
Guidance, and the smiles.

Firstly, Susan Barr
Thanks for giving me a chance
Your support, patience,

Feedback, expertise
Have helped me gain confidence
As a researcher.

I am so thankful
For the opportunity
To have worked with you.

I have learned so much
A mentor like no other,
Truly inspiring.

Jen Bedford, thank you
For the initial pilot
That brought me to Van.

More for the support,
Answering my silly Qs,
And being a friend.

Next, my committee
Tim Green and Wolfgang Linden
Thanks for making time

To help with design,
Offer a new perspective,
‘Til the very end.

Of course, my family
Mom, Dad, Kino and Sukhveer
For endless support

Even when I moved
Quite far, travelled on a whim,
And forgot to call.

You've shaped who I am,
Supported my decisions
And that means the world.

Thanks for being there
And for learning not to ask
"What's taking so long?"

Massi, Mamaji
For the check-ins, reminders
That I'm not alone.

My amazing friends
I'm grateful that some moment
Brought us together.

Nights out / in, skype dates,
Concerts, e-mails, study dates.
You added balance

Whether just one night
Or endless talks, it all made
Such a difference.

Through the good, bad, and
Tragically hilarious
Thanks for all the smiles.

And last, but not least
Baristas of Vancouver
Thank you for caffeine.

CHAPTER 1: INTRODUCTION

The increasing rate of obesity over the past several decades has led to increased pressure to lose weight and conform to societal ideals of a thin figure. Every day, individuals report having over 200 food-related thoughts and decisions[1] and for some people, constant environmental food cues lead to difficulties in losing or maintaining body weight. Cognitive dietary restraint (CDR) is a term describing the thought process in which one continually monitors or attempts to restrict food intake as a means of weight control. However, despite these perceptual differences, the relative weights of healthy individuals with high versus low levels of CDR are generally similar. Most literature on CDR has focused on women, and among other findings, reports that those with higher levels of CDR have increased salivary and urinary levels of the stress hormone cortisol. Food and weight-related cues are hypothesized sources of perceived stress; however, it has yet to be determined whether cues cause direct activation of the stress response and if it can be captured in an experimental setting. The purpose of this study was to assess whether women with high versus low levels of dietary restraint differed in their blood pressure, heart rate and salivary cortisol levels after exposure to various food cues and diet-related questionnaires. Furthermore, the awakening cortisol response (ACR) was examined since an altered ACR is believed to be suggestive of disturbances in the hypothalamic-pituitary-adrenal axis.

Chapter 2 is a review of the literature. This chapter discusses the definition of CDR, the hypothesized relationship between CDR and the stress response and the potential effects of food cue exposure on individuals with high CDR. Chapter 2 concludes with the research objectives and three hypotheses of interest in this study. Chapter 3 discusses the research methodology and statistical approaches associated with each hypothesis. Chapter 4 presents

the research results. Lastly, Chapter 5 discusses the findings, study strengths and limitations and provides suggestions for future work.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In the following literature review, several topics related to cognitive dietary restraint (CDR) are discussed including (1) the definition and key features of high CDR, (2) methodology used to characterize levels of dietary restraint, (3) the association between CDR and the physiological stress response, (4) mechanism of action and role of cortisol in the body, (5) potential health concerns associated with high CDR, (6) the awakening cortisol response and (7) the effects of cue exposure on individuals exhibiting dietary restraint.

2.2 What is cognitive dietary restraint?

Influences in media and popular culture have led many to value a thin and lean female figure. As a result, many women feel negatively about their body image, are conscious of their eating habits and struggle to lose or maintain weight. High levels of *cognitive dietary restraint* reflect a perception in which one is constantly monitoring or attempting to restrict food intake as a means to control body weight, rather than eating in response to physiological hunger cues[2]. This pattern of thinking is believed to be a relatively stable characteristic that persists throughout the lifespan. A past study on postmenopausal women found that those with high CDR reported similar patterns of dietary restraint throughout the majority of their adolescent and adult years[3]. The concept of dietary restraint applies to both men and women but literature tends to focus on female eating behaviours due to the increased societal pressures and higher reported rates of dieting and dietary restraint[4].

The “cognitive” nature of dietary restraint emphasizes the difference between restrained eating and dieting. Women with high levels of restraint do not always self-report

as being on a diet[5]. Furthermore, despite a heightened awareness of food intake, the diet of high restraint women does not appear to differ significantly from that of low restraint women in terms of caloric intake, macronutrient or micronutrient content[6]. Levels of restraint are not usually correlated with body mass index (BMI) values, thus providing further support for a similar caloric intake among the two restraint groups over an extended period of time[7,8].

2.3 Assessment of CDR

A number of assessment methods can be used to categorize an individual's level of dietary restraint. Among the commonly used tools are the Three-Factor Eating Questionnaire Restraint subscale (TFEQ-R)[9] and the Restraint Scale (RS)[10]. The assessment methods differ because the RS measures restrained eating and the effects of unsuccessful restraint, including disinhibition and weight fluctuation, while the TFEQ-R focuses exclusively on dietary restraint. Since dietary restraint is not recognized as a clinical condition, neither questionnaire serves to "diagnose" a high level of CDR and investigators must choose how they wish to define high restraint. When the TFEQ-R is used, total scores range from 0 to 21. Levels of restraint are categorized using either a continuous scale[11,12], median split[6,8,13,14], tertiles[15] or quartiles of scores such that the first quartile is defined as "low restraint", second and third as "medium restraint" and fourth as "high restraint"[7,16-18].

The lack of strict diagnostic criteria makes it difficult to determine an exact prevalence of high CDR. The subtle nature of this type of disordered eating also leads to difficulties in estimating true prevalence rates. However, dietary restraint is thought to be a common concern among women and past studies observe that many women report some features of CDR. In one recent study, all women over the age of 18 recruited from various

undergraduate classes were asked to complete a questionnaire package on eating attitudes, perceived stress and self-esteem[7]. The TFEQ-R scale was used to categorize levels of restraint. A total of 596 women completed the questionnaires and 32% of the sample was classified with low restraint (scores 0-5), 44% with medium restraint (scores 6-12) and 24% with high restraint (scores 13-21). Further characteristics of women with high levels of CDR compared to those with low CDR in this sample included higher exercise scores, increased desire to lose weight, a greater likelihood of reporting a history of eating disorders, higher perceived stress levels and lower self-esteem. The three restraint groups were similar in their age, height, weight and BMI. Thus, there appears to be a continuum in the level of restraint among female women, which is unrelated to one's age or weight.

2.4 CDR and stress

Although this is a fairly new and growing area of research, several studies suggest that a potential relationship may exist between CDR and the physiological stress response such that CDR may act as a subtle, yet chronic stressor.

Times of stress lead to an increased release of the hormone cortisol[19]. Higher 24 hour urinary levels of this stress hormone have been observed in samples of both premenopausal[17] and postmenopausal women[3] with high CDR. An alternative approach to measuring urinary cortisol levels is to examine salivary cortisol release. Two studies have reported higher levels of salivary cortisol among premenopausal women scoring high in CDR[11,12]. In one study, 85 female university students provided a single saliva sample in the morning hours for subsequent cortisol analysis[11]. All participants completed the TFEQ-R and were categorized as restrained or non-restrained eaters based on a median split of scores. Restrained eaters had

a significantly higher level of salivary cortisol than unrestrained eaters (0.32 ± 0.50 μg/dl versus 0.15 ± 0.12 μg/dl, $p = 0.04$).

Putterman and Linden replicated these findings in an additional study[12]. A total of 170 female participants provided one saliva sample 30 minutes after awakening to examine morning cortisol levels and another 6-8 hours later. The afternoon sample aimed to provide information on cortisol levels after exposure to daily food and weight-related cues. The TFRQ-R Rigid and Flexible Control subscales assessed restraint along with questions investigating women's appearance beliefs, perceived stress and body dissatisfaction. Cortisol change scores from morning to afternoon levels showed a significant positive relationship between scores on the Flexible Control subscale ($r = 0.17$, $p = 0.03$), Rigid Control subscale ($r = 0.16$, $p = 0.04$) and Beliefs About Appearance scale ($r = 0.19$, $p < 0.05$).

Although two studies have reported no association between CDR and cortisol measures, this may be explained by a smaller sample size (n = 31)[6] or differences in research design[20]. Pirke and colleagues' study, which failed to find a relationship between CDR and cortisol, involved a collection of overnight blood samples from a small sample of high (n = 9) and low restraint individuals (n = 13)[20]. If CDR is truly associated with the stress response, food cues and eating decisions throughout the day may be required to observe increases in cortisol and would not likely be captured in an overnight sampling procedure. In support of this hypothesis, Putterman and Linden found significant positive relationships between afternoon salivary cortisol and restraint scores ($r = 0.15$, $p < 0.05$), whereas morning samples were not correlated to scores on the TFEQ-R Flexible ($r = 0.02$, $p > 0.05$) or Rigid Control ($r = 0.04$, $p > 0.05$) subscale. They proposed that daytime cues might be necessary for differences in cortisol secretion to be evident since afternoon samples were collected after

usual daily cue exposure while morning samples were not[12]. Nickols-Richardson and colleagues also reported no significant correlations between the salivary cortisol levels and restraint scores in premenopausal women who provided a saliva sample within 1.5 hours of awakening ($r = 0.04$, $p > 0.05$, n = 63)[21]. These women were in fasted state and thus would not have experienced typical cues associated with breakfast. Overall, past research supports a positive relationship between levels of dietary restraint and cortisol release after exposure to daytime cues. These findings are of potential significance due to the role of cortisol as a stress hormone in the human body.

2.5 Cortisol and stress

Cortisol is a glucocorticoid that has received significant research attention due to its association with the stress response. Both physical and psychological stressors activate the hypothalamic-pituitary-adrenal (HPA) axis, which consists of the hypothalamus, pituitary and adrenal glands. The origin of the HPA axis is the synthesis of corticotropin-releasing hormone (CRH) in the paraventricular nucleus of the hypothalamus. Stressors stimulate the release of CRH into the hypophyseal portal veins to act on the anterior pituitary glands[22]. Adrenocorticotropic hormone (ACTH) is subsequently released into the bloodstream from the anterior pituitary. This hormone targets the adrenal glands and stimulates the synthesis and release of cortisol and other glucocorticoids[19]. Cortisol is the end point of the HPA axis and also regulates the pathway through a negative feedback loop in which high levels of cortisol prevent the further release of CRH and ACTH[23].

Cortisol release is typically an adaptive response to stressful situations; however, an abnormally high level of cortisol is linked to many negative health conditions. Cushing's

syndrome is characterized by excess cortisol release and illustrates the cardiovascular and metabolic consequences that result from elevated levels of cortisol. Some of the symptoms associated with this condition are insulin resistance, dyslipidemia, hypertension, hyperglycemia and central obesity[24]. A further implication of stress-induced cortisol release of particular relevance to this study is the role cortisol appears to have in menstrual irregularity and decreased bone mineral content.

Cortisol directly and indirectly influences bone and menstrual health. Glucocorticoids alter osteoclast and osteoblast activity as well as calcium metabolism[25]. Furthermore, excess cortisol indirectly affects bone health due to the relationship between the HPA axis and the hypothalamic-pituitary-gonadal (HPG) axis. Activation of the HPA axis inhibits the HPG axis, resulting in decreased secretion of sex hormones and impaired reproductive function[19]. Reproductive hormones are essential for reaching peak bone mass and maintaining bone density in women[26]. The decrease in sex hormones consequently contributes to stress-induced losses in bone density. Thus, if a subtle but sustained activation of the HPA axis due to high CDR sufficiently increases cortisol levels, women's reproductive and bone health may be compromised.

2.6 Health concerns associated with high CDR

Several studies have attempted to discover whether elevated cortisol levels observed in those with high CDR are associated with women's health concerns. Women rating high on the TFEQ-R have had measurable menstrual disturbances in comparison to low restraint women. One study comparing a group of low (n =13) and high CDR (n = 9) women first discovered that high restraint women were more likely to have decreased progesterone

concentrations and a shorter luteal phase of their ovarian cycle[27]. Findings of shorter luteal cycles have been replicated in subsequent studies collecting physiological data on menstrual cycles in healthy young women[28,29]. Furthermore, a large questionnaire-based study of premenopausal women found twice the rate of self-reported menstrual irregularity among females with high CDR (n = 145) compared to those with low (n = 189) or medium (n = 262) levels of restraint[7]. This finding is not universal as Waugh and colleagues could not detect an association between CDR and subclinical ovulatory disturbances in a group of 225 healthy premenopausal women[15]. However, methodological differences may have affected the research outcome. As in studies using temperature methods or self-report, a short luteal phase was defined as less than 10 days. Differences occurred because ovulatory assessment was conducted based on urine luteinizing hormone (LH) levels. Since the LH peak occurs prior to ovulation, whereas temperature changes occur afterwards, the definition of a short luteal phase should likely have been extended to 11-12 days. The stringent criteria could have underestimated the prevalence of ovulatory disturbances among women with high CDR.

As previously discussed, a relationship between CDR and reproductive health may affect bone due to the altered secretion of reproductive hormones. Furthermore, elevated cortisol release directly causes negative effects on bone[25]. Past research examining CDR and its relationship to bone health has led to conflicting results. Vescovi's research team compared premenopausal exercising women with high CDR (TFEQ-R score ≥ 9, n = 38) and low CDR (TFEQ-R score < 9, n = 46). They observed that the high CDR group had lower total body (1.140 ± 0.011 versus 1.179 ± 0.010 g/cm^2; $p = 0.015$) and lumbar spine (1.114 ± 0.019 versus 1.223 ± 0.022 g/cm^2, $p = 0.001$) bone mineral density (BMD)[18]. Menstrual status was assessed through self-reported regularity and it was noted that there was an

increased frequency of oligomenorrhea in the high CDR group over those with lower restraint scores ($\chi^2 = 5.110$, $p = 0.024$).

In another study, lower bone mineral content (BMC; $p = 0.033$) was reported among 96 premenopausal women characterized with high CDR (TFEQ-R score ≥ 9) compared to 89 with low CDR[13]. The relationship was specific to BMC since no differences were observed between the BMD of high and low restraint women. Menstrual regularity was not examined so the relationship between bone and menstrual health is unknown for women in this study.

Inconclusive findings were also reported by McLean and colleagues in a study of 62 healthy, regularly menstruating women[30]. In this sample, 29 women were categorized with low restraint (TFEQ-R between 0-5) and 33 with high restraint (TFEQ-R between 13-21). Total BMC was observed to be significantly lower in the high CDR group when weekly exercise hours, height and weight were considered as covariates ($p = 0.041$). Differences in spinal BMD, spinal BMC and total body BMD were non-significant but values tended to be lower in the high restraint group.

Although these three studies found moderate negative relationships between level of restraint and bone health, two other studies failed to detect an association[15,21]. A 2 year prospective study involving 189 healthy premenopausal women observed no relationship between high CDR, menstrual regularity and bone health[15]. CDR categorization was based on tertiles of scores on the TFEQ-R subscale. There were no significant associations between CDR and the average initial value or change in lumbar spine BMD. Furthermore, no significant differences existed in the number of subclinical ovulatory disturbances between restraint groups. The contrasting findings may be related to differences in the study

population since women had a higher mean age, greater variation in BMI and as described earlier, the criterion for subclinical ovulatory disturbances was likely overly stringent.

Nickols-Richardson and colleagues also reported null findings in their group of 65 healthy, normal weight premenopausal young women[21]. No significant relationships existed between CDR scores, total body, hip, forearm or lumbar spine BMD or BMC. However, CDR scores were inversely related to serum osteocalcin ($r = -0.32$, $p < 0.01$, n = 63) and urinary n-telopeptide concentrations ($r = -0.25$, $p < 0.05$, n = 63), which are markers of bone turnover. Reduced bone turnover may compromise bone health in high restraint women but further investigation is necessary before conclusions can be drawn.

In summary, conflicting data describe the relationships among CDR, subclinical ovulatory disturbances and bone health. Research on the topic of CDR suggests that the potential implications for women's health may be widespread and serious in nature due to the importance of menstrual regularity for reproductive function and bone mass for osteoporosis related risk. Due to the mixed findings of previous studies, the relationship between high levels of dietary restraint and cortisol release clearly needs further exploration.

2.7 Awakening cortisol response and CDR

An additional method of examining cortisol release involves the study of the awakening cortisol response (ACR). There is a diurnal and circadian pattern of cortisol release following CRH and ACTH secretion. CRH and ACTH undergo pulsatile release with pulses of greater amplitude in the morning hours, which decrease in magnitude over the course of the day[31]. Accordingly, cortisol follows the same pattern where levels elevate after awakening and decrease until they are at their lowest in the evening[22,32]. The ACR is a

distinct part of the cortisol secretion profile. It describes the period of time roughly within the first thirty minutes of awakening when cortisol levels reach their daily maximum.

The primary importance of the ACR is the stability of this response. Pruessner and colleagues were first to report that the increase in morning cortisol is consistent[32] and subsequent studies have shown fairly high intraindividual stability over time ($r = 0.63$ for area under the curve measures over two days)[33]. This contrasts with the large intraindividual variation observed when taking single samples based on clock time, rather than awakening time[34]. Furthermore, the ACR is consistently shown in both sexes, can distinguish between subsets of healthy participants and is unaffected by factors including age, weight, smoking, sleep duration or quality, the time of awakening and alcohol consumption[32].

The precise role of the ACR is still unknown[35]; however, its reliable nature compared to other aspects of the cortisol secretion profile has led to exploration into the significance of this response. There appears to be an association between the ACR and dysregulation of the HPA axis[36]. Various psychosocial conditions believed to involve HPA dysregulation have become a target for ACR-related research including posttraumatic stress syndrome, burnout, general life stress and depression[37]. Of particular interest to the topic of dietary restraint is the association of the ACR with chronic stress and anxiety scores. Studies examining the relationship between chronic stress and the ACR have found that participants with higher reported stress levels have significantly higher increases in peak morning cortisol levels than nonstressed individuals[38,39].

A common hypothesis surrounding the role of the ACR is that it may function in activating memory representations that help prepare an individual for upcoming demands[40,41]. Support for this hypothesis rests in the observation that the cortisol response is

larger on weekdays over weekends, consistent with the increased workday demands placed on most individuals[42,43]. Increased cortisol release among those experiencing chronic stress and worrying also supports the idea that an increased ACR is likely for those with greater perceived daily demands[39,42].

Few studies have directly examined ACR as a marker for HPA axis dysregulation in restrained eaters. In a sample of 170 female undergraduates, the ACR was investigated with a single saliva sample collected thirty minutes after awakening[12]. There was no association between any of the restraint-related measures and morning peak cortisol levels, which led to the suggestion that food or weight-related cues may be necessary to activate the stress response. There are limitations to using a single cortisol measure because it does not capture the full ACR profile and may be subject to increased sampling error.

A recent study conducted by Therrien and colleagues looked at the relationships between ACR and anxiety, depression, eating behaviours and body esteem[44]. Analysis on 78 men and women illustrated gender-dependent results where men were observed to have a negative correlation between ACR and the flexible control and strategic dieting behaviour measures of the restraint scale. On the other hand, women were observed to have negative associations between ACR and trait anxiety, disinhibition, hunger, binge eating, body esteem related to appearance, drive for thinness, body dissatisfaction, interoceptive awareness and the rigid control subscale of restraint.

One additional study examined the relationship between HPA dysregulation and dietary restraint using methodology comparable to the ACR[14]. This study examined HPA axis functioning in 38 men and 38 women with use of the dexamethasone suppression test. This test is commonly used in studies looking for elevated levels of cortisol among

participants. No relationship was observed between cortisol levels and dietary restraint in men; however, increased cortisol concentrations were reported in women categorized with high CDR based on a median split of scores on the TFEQ-R.

Overall, research on variables associated with HPA axis dysregulation and CDR are limited and inconsistent in nature, illustrating the need for further research on this topic.

2.8 Effects of cue exposure

A key purpose of our study was to investigate whether differences exist between women with high and low CDR after exposure to various food and weight-related cues. Cephalic phase responses (CPRs) are commonly used to measure an individual's response to food-related stimuli. CPRs occur following the sight, smell, taste or thought of eating[45]. The body reacts to food exposures with a variety of autonomic and endocrine responses such as changes in salivation and cardiac output. Physiological changes are believed to have a primary role in preparing the body for efficient utilization of incoming food[46].

Cephalic phase salivation is a measure of appetite that has received significant research attention. An increased salivary flow rate has been observed among individuals with high dietary restraint following food exposure than among unrestrained eaters; however, this finding is not universal[47]. Increased salivation in restrained individuals is hypothesized to occur as a result of an increased sensitivity to food cues in their surroundings[48]. Other measures of physiological arousal following food exposure have also been examined. In a study conducted by Vögele and colleagues, food exposure led to increased physiological arousal in both binge and nonbinge eaters including increased heart rate, blood pressure, electrodermal activity and respiratory rate. Furthermore, over the 20 minute exposure period,

the two groups differed among certain measures of physiological arousal; for example, binge eaters maintained an elevated systolic blood pressure throughout the trial and had altered electrodermal activity when compared to nonbinge eaters[49].

Similar findings were observed in a group of healthy female participants when CPRs following food exposure were examined[45]. In this study, significant changes were observed in salivation, temperature, heart rate, blood pressure and skin conductance following food exposure in all subjects, suggestive of the role of CPRs in preparation for incoming food. Of particular interest is the observation that systolic and diastolic blood pressure correlated significantly with restraint scores classified using the Restraint Scale ($r = 0.66$, $p < 0.05$ and $r = 0.64$, $p < 0.05$, respectively).

These findings are not universal, as illustrated in a study conducted by Rutledge and Linden[50]. They recruited 77 healthy young women and categorized dietary restraint based on a median split of scores on the Restraint Scale. Heart rate, systolic and diastolic blood pressure were monitored while participants completed various cognitive tasks in the presence of sweet and salty food temptations. Comparisons between the high and low restraint group did not detect any significant difference in blood pressure or heart rate variables during the task completion or recovery phases.

Likewise, differences were not observed in a smaller study comparing the physiological responses of skin conductance, heart rate, startle reflex and facial electromyography in a group of 11 restrained and 13 unrestrained eaters classified using the Restraint Scale[51]. In this study, women were asked to look at pictures of neutral foods, foods self-selected as preferred and “binge-provoking”, and pictures of their own body. This study did not report significant differences in cue reactivity although it was hypothesized that

restrained eaters would experience a greater physiological response to food and weight-related cues.

It is important to note that several difficulties arise when comparing across studies. The classification of restrained versus unrestrained eating varies with each study, a range of physiological measures have been examined and studies differ in the presentation of cues through the use of images, standardized food or only the individual's favourite food. Studies also differ in how directly participants were asked to attend to the cues used. The strength of cue exposure may have a key role in subsequent physiological responses. Direct changes in salivary cortisol levels following food exposure have not been examined and present an alternative measure of physiological arousal. Furthermore, previous studies have exclusively used the Restraint Scale while the TFEQ-R can act as a different measure of dietary restraint.

2.9 Research objectives

In previous studies, CDR and physiological stress were investigated through comparisons of the level of salivary or urinary cortisol in women with high CDR to the levels in women with low CDR. If CDR is a true physiological stressor, it may cause activation of the stress response after exposure to food or weight-related cues. Since past studies have not examined whether these types of stimuli can act as stressors that cause an immediate observable response, this study was designed to assess salivary cortisol, blood pressure and heart rate as indices of physiological stress experienced in an experimental setting. Both food and weight-related cues were presented to women to observe whether differing physiological responses are present between high and low CDR groups. The ACR was also

examined as it acts as an additional assessment measure of disturbances in the HPA axis and thus the stress response.

2.10 Study hypotheses

We hypothesize that high levels of CDR act as a source of physiological stress among healthy premenopausal women such that:

(1) A lab simulation involving exposure to everyday food and weight-related cues will lead to signs of physiological arousal, evident through changes in blood pressure, heart rate and salivary cortisol.

(2) High levels of CDR will cause increased activation of the physiological stress response and greater elevations in blood pressure, heart rate and afternoon salivary cortisol than those observed in women with lower levels of restraint.

(3) The awakening cortisol response will differ between women with high and low levels of CDR, providing evidence of HPA axis dysregulation.

CHAPTER 3: METHODS

3.1 Research participants

Female participants were recruited from the University of British Columbia Vancouver campus using poster advertisements (Appendix A) and announcements in various undergraduate classes. Individuals interested in the study were asked to e-mail us and were directed to an online screening questionnaire (Appendix B and C).

Blood pressure (BP) data was used to estimate the required sample size for our study. Based on previous research observing a significant increase of roughly 13.3 mmHg in systolic and 10.3 mmHg in diastolic BP among healthy premenopausal women who completed laboratory stress tests[52], a significant difference between groups with 80% power and a two-sided 0.05 significance level required 21 participants per group. Our stressor was weaker in nature and comparable research studies examining differences among individuals scoring high and low in dietary restraint have recruited 60-80 individuals in total[44,49]. As a result, we had a total of 70 participants complete the study protocol, with equal numbers of high and low restraint women.

3.2 Inclusion criteria

Eligibility was assessed through the use of an online screening questionnaire hosted on SurveyMonkey (Appendix C). Women eligible for full study participation met the following criteria:

- Non-smoker between the age of 19 and 35 years, inclusive.

- Reported a BMI that was neither underweight (less than 18.5 kg/m^2) nor obese (greater than 30 kg/m^2) on the screening questionnaire. Height and weight measurements were confirmed during the lab visit.
- Fell within the upper or lower range of restraint scores characterized by the TFEQ Restraint subscale. A low level of CDR was defined as a score of 0-5 whereas a score of 13-21 classified participants with high CDR.
- Fluent in English to allow for proper completion of the questionnaire package and communication with the research team.

3.3 Exclusion criteria

Women were ineligible for participation if they had TFEQ-R scores between 6 and 12, inclusive. Women were also ineligible if they self-reported use of corticosteroids, antihistamines or blood pressure medications. These medications affect cortisol or blood pressure and could have altered our research findings. Lastly, women were excluded if they self-reported previous diagnosis or treatment for an eating disorder, such as anorexia or bulimia, or were currently pregnant or lactating.

3.4 Research design

This study involved four components that are described in detail below:

(1) Eligibility assessment for all interested women.

(2) Lab visit at UBC's Human Nutrition facilities for completion of the questionnaire package and collection of anthropometric data, afternoon salivary cortisol, blood pressure and heart rate readings.

(3) Morning saliva collection for investigation of the ACR.

(4) Debriefing session following return of the morning samples.

3.4.1 Eligibility assessment

Recruitment materials provided interested individuals with an e-mail address to contact the student investigator. Those interested were informed via e-mail (Appendix B) that the study involved a two hour lab visit during which they would complete a questionnaire, provide saliva samples and have their blood pressure monitored. We also specified that they would be asked to provide four saliva samples within the first hour of awakening the morning following their lab visit. Individuals were directed to the online screening questionnaire (Appendix C) and asked to provide brief personal information. Volunteers were also asked to complete the TFEQ-R (described below). Responses to this 21 item questionnaire were coded, scored and those with either low (score of 0-5) or high (score of 13-21) levels of restraint were contacted via phone or e-mail to schedule a lab visit. Individuals who were ineligible due to any of the previously described criteria were contacted by e-mail (Appendix D) to thank them for their interest and to let them know that they did not meet the eligibility criteria.

Eligible women were informed that the study purpose was to assess their physiological response to questionnaires on eating attitudes and body image. Participants were told that saliva samples would be collected during the lab visit to measure the hormone cortisol. They were also informed that they would be provided materials for the morning sampling procedure at the end of the visit and that a $20 gift certificate in recognition of their involvement would be provided after all morning cortisol samples were received.

Since cortisol release undergoes a diurnal variation[32], all visits were scheduled between 1pm and 5pm. Visits were also scheduled during the follicular phase of the menstrual cycle (days 2-10) because the menstrual cycle can affect cortisol release patterns[53]. To ensure proper scheduling, each participant was asked to estimate when she would be within days 2-10 of her cycle to tentatively book her lab visit. All participants were e-mailed a study reminder (Appendix E) two days prior to the scheduled visit and asked to confirm day 1 of her menstrual cycle. Lab visits were rescheduled if the participant's cycle began significantly earlier or later than expected to ensure that all visits fell within the correct time frame. All lab visits and morning saliva collections were completed on weekdays. This is believed to help minimize ACR differences between weekdays and weekends since there have been some reports of a greater cortisol response on weekdays mornings[42,43].

In the reminder e-mail, we also asked if participants were currently experiencing a significant degree of personal stress due to school or other reasons. One participant's lab visit was rescheduled because it fell on the same day as an exam that was causing increased stress levels. Participants were asked to refrain from eating two hours prior to the lab visit such that they arrived neither very hungry nor overly full. This helped to minimize salivary cortisol elevations due to a recent meal since meal-induced elevations in salivary cortisol have been observed in previous studies[54,55]. Lastly, participants were asked to refrain from physical activity they perceived as "strenuous exercise" the morning of the lab visit. Strenuous exercise gradually increases cortisol levels over a prolonged period of time[56] so this instruction minimized exercise-related effects on our outcome variable.

3.4.2 Afternoon procedure

At their scheduled visit at the UBC Human Nutrition lab, participants met with the student investigator. The procedure was explained in detail while discussing the letter of consent (Appendix F), with the exception that women were not told that the snack foods placed in the room were a component of the study design. After reviewing the procedure, each participant was asked to provide written informed consent. The participant was then instructed on how to use the Salivette (the sampling protocol is discussed in detail below) and the first saliva sample was collected after the participant fully rinsed her mouth with water. We demonstrated how to set a timer for 15 minute intervals as a reminder of the appropriate sampling time. The 15 minute sampling interval was chosen in an attempt to capture responses at different rates specific to each individual since cortisol responses are not immediate and take a variable number of minutes to be observed among different people[57].

The ambulatory blood pressure (BP) monitor (described below) was fitted on the participant's non-dominant arm. Baseline BP monitoring began at this point and readings were programmed to occur every 15 minutes while the participant was seated and completing the questionnaire package (Appendix G and H). Two saliva samples and BP measures were completed before providing the first part of the questionnaire package to the participant.

Prior to leaving the room to allow the participant to complete the questionnaire package, the student investigator informed the participant that the basket of packaged snacks on the table were leftovers from a study that finished earlier that day. The snack options of rice chips, raisins, fruit bars, potato chips, almonds, chocolate chip cookies and chocolate covered granola bars were categorized as low-fat/low-sugar, low-fat/high-sugar, high-fat/low-sugar or high-fat/high-sugar foods as shown in Table 1 below. The participant was

told that she was welcome to take as many snacks as she would like but she must refrain from eating until the end of the procedure since consumption would contaminate the saliva samples. The participant was also informed that the student investigator would return in 30-35 minutes to provide part two of the questionnaire package. Participants were provided with women's health and fitness magazines (Women's Health, Shape, Fitness and Nutrition) and told that they could look through these magazines if questionnaires were completed prior to the student investigator's return.

Table 1: Food options

Snack category	Food item
Low-fat, low-sugar	Rice chips
Low-fat, high-sugar	Fruit bars, raisins
High-fat, low-sugar	Potato chips, almonds
High-fat, high-sugar	Chocolate chip cookies, chocolate granola bars

After roughly 30 minutes, the BP monitor was checked to make sure it was still properly attached. The participant was provided with the opportunity to ask any questions regarding part one of the questionnaire package. The volunteer was then given the second half of the questionnaire package and told that the student investigator would return in another 30-35 minutes.

Once the participant completed the questionnaire package, the blood pressure equipment was removed and anthropometric data were collected (explained in detail below). Written instructions for morning saliva sampling were provided and verbally explained to the participant (Appendix I). After explaining the procedure and answering any questions, the

student investigator told the participant that she forgot the Salivettes in her office down the hall. The participant was asked to meet the student investigator in her office but to first read over the instruction sheet in case she had any questions. She was reminded once more that she was free to take snacks with her prior to leaving the lab. The student investigator then left the participant alone in the room so that she was free to take food without any feelings of self-consciousness. After leaving the lab, the participant was provided with Salivettes to use for morning cortisol collection, thanked for her assistance and reminded to return the sampling kit the following afternoon to receive compensation for participation. Lastly, the remaining food items were counted to determine the amount and type of food taken by the participant.

3.4.3 Morning sampling

The ACR was examined using salivary cortisol collected on a weekday morning following the lab visit. Although most participants provided samples the next weekday after their lab visit, some sampling was completed within a few days to ensure that the sampling occurred on a usual morning. For example, sampling was not done on a morning where the participant had to wake up unusually early or went to bed unusually late. Participants were instructed to take the first saliva sample immediately after waking up (time 0) and 15, 30 and 45 minutes afterwards. Participants were instructed not to brush their teeth or consume breakfast prior to completing the sampling procedure, as this could cause sample contamination. A 45 minute sampling period aimed to capture the awakening cortisol response since it has been observed that the ACR profile of women tends to have a delayed peak in comparison to men with increases in salivary cortisol apparent past thirty minutes

after awakening[32]. A minimum of three saliva samples allowed accurate estimation of total cortisol secretory activity using area under the curve calculations[58].

The student investigator emphasized the importance of accurate sampling because the ACR is a time-sensitive response and noncompliant participants can significantly alter research results[59]. Compliance was strengthened by providing programmable timers in the morning sampling kit. The participant was asked to program the timer for 15 minute intervals after taking the first sample so that there would be a clear reminder of when to sample. The participant was also instructed to record the time of each sample on the sampling log that was later checked for accuracy. Lastly, participants were provided with the student investigator's cell phone number and told that if a delay did occur, they should not hesitate to call and reschedule the morning procedure. It was emphasized that rescheduling the sampling procedure was highly preferred over inaccurate sampling.

3.4.4 Debriefing session

All participants returned morning Salivettes on the same day as sampling. At that time, two questions were asked to gauge whether deception (related to provision of snack foods) was successful: (1) the participant was asked to describe the study in her own words and (2) she was asked if she felt there was anything unusual about the study procedures. Only 2 of the 70 participants guessed the true reasons behind the presence of snack foods. Finally, participants were debriefed (Appendix J), provided compensation in the form of a gift certificate and thanked for their participation.

3.5 Measurement

3.5.1 Questionnaire package (Appendix G and H)

The questionnaire was completed in two parts with each portion balanced in terms of time needed for completion and content material. Participants were first asked to provide general information including their age, occupation, program of study, ethnicity, dietary habits and medication use. The following validated self-report questionnaires were included in the study package:

Three-Factor Eating Questionnaire (TFEQ)[9]: The TFEQ is a 51 item questionnaire that examines three different aspects of restrained eating: dietary restraint, disinhibition and feelings of perceived hunger. There is a strong internal consistency in this scale with Cronbach's alpha scores of 0.92 for the restraint subscale, 0.91 for disinhibition and 0.85 for perceived hunger[9].

Past studies examining dietary restraint have typically used the Restraint Scale (RS[10]) or the TFEQ Restraint subscale (TFEQ-R). The TFEQ-R was chosen for this study because stronger correlations have been observed between high scores on the TFEQ-R and elevated salivary cortisol levels than with the RS[11]. The 21 item subscale looks at controlling behaviours focused on weight loss or weight maintenance with questions such as "while on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it" and "I do not eat some foods because they make me fat." The TFEQ-R was incorporated into the screening questionnaire with answers to each question coded as either 0 or 1 and summed to calculate a final score. We categorized scores ≤ 5 as "low restraint" and ≥ 13 as "high restraint."

The TFEQ Cognitive Restraint Rigid and Flexible Control subscales were included in part one of the questionnaire package[60]. The 16 item Rigid Control and 12 item Flexible Control subscales were created based on the observation that individuals display dietary restraint in different ways. Those high in Rigid Control are believed to have an "all-or-none" approach to eating where certain foods are completely avoided and treated as "forbidden foods". If consumed, the individual does not attempt to adjust their intake to compensate for the given food. On the other hand, Flexible Control describes an eating pattern in which the individual allows for sweets in their usual diet without feelings of guilt[61]. Internal consistency for the Rigid Control subscale is reflected by a Cronbach's alpha coefficient of 0.79, while the Flexible Control subscale has an alpha of 0.77.

Body Shape Questionnaire (BSQ)[62]: The BSQ is a 34 item questionnaire that explores the concern one has over their body shape and feelings of fatness. Shortened forms of this questionnaire have been developed since the detailed nature of the 34 item tool is deemed unnecessary for studies where body dissatisfaction is not the primary concern[63]. The 8-item shortened version (BSQ-8C) was included in our questionnaire package[63]. A recent study examining differences between the 8-item, 14-item and 16-item versions found that the BSQ-8C has a high internal consistency with Cronbach's alpha of 0.91 and is the shortened version with a sensitivity to change that most closely resembles that of the full-length BSQ[64]. The shortened version provided a good assessment of the participant's dissatisfaction due to body shape while ensuring the questionnaire was completed in a reasonable amount of time.

Beliefs About Appearance Scale (BAAS)[65]: The 20 items on this questionnaire assess the importance one believes appearance can have on relationships, achievement, self-view and emotions. A 5 point Likert scale is used to indicate how strongly one agrees with different statements ranging from 0 ("not at all") to 4 ("extremely"). The BAAS exhibits high internal consistency with alpha scores ranging from 0.94 to 0.96[65].

Eating Disorder Examination Questionnaire (EDE-Q)[66]: The EDE-Q is a self-report questionnaire based directly from the Eating Disorders Examination (EDE)[67]. The EDE is conducted in an interview format and is highly preferred for the assessment of eating disorders and disordered eating symptoms. However, the nature of the interview is that it is lengthy, intrusive and difficult to administer. The questionnaire version provides necessary information for a research setting and is well correlated with most aspects of the EDE, including measures of dietary restraint[66]. With a total of 28 items evaluating the frequency of various eating behaviours and attitudes over the past four weeks, the EDE-Q examines key behavioural aspects of eating disorders. Questions are categorized into the subscales of Restraint, Shape Concern, Weight Concern and Eating Concern. The Global subscale creates a final score based on the average of the 4 subscales. Strong test-retest reliability and internal consistency for the EDE-Q have been documented with a Cronbach's alpha coefficient of 0.93 for the Global subscale[68,69].

Baecke Questionnaire of Habitual Physical Activity[70]: This 16 item tool gathers information on an individual's physical activity during work, sport and non-sport leisure activity. It is a short and user-friendly questionnaire that is frequently used by epidemiological studies

exploring various aspects of habitual physical activity. This tool has been validated with physical activity levels measured using doubly labelled water[71]. Intense physical activity is observed to induce cortisol secretion such that cortisol levels rise in a pattern related to the degree of physical stress[56]. Although participants were instructed to avoid strenuous physical activity the morning of the lab visit, this questionnaire was included to assess the participant's usual physical activity.

Daily Stress Inventory (DSI)[72]: The DSI consists of 58 items that allow an individual to self-report minor stressors that occurred within the previous 24 hours. The participant must read a list of events and indicate whether or not a given event occurred. For those events that did occur, a subsequent Likert scale is used to indicate the amount of stress associated with each event. The Likert scale ranges from a score of 1 ("occurred but was not stressful") to 7 ("caused me to panic"). The DSI provides three scores for each participant: the total number of stressful events within the last 24 hours (Frequency), total impact rating of the events combined (Sum) and average stress rating of the events (Average Impact Rating). Convergent validity for the DSI as a tool assessing minor daily stresses has been illustrated through comparisons with biochemical measures of stress including daily urinary cortisol and vanillylmandelic acid, a metabolite of epinephrine and norepinephrine[73]. The role of the DSI in the questionnaire package was to assess the participant's stress level in the time period preceding the laboratory visit. It has been shown that individuals with high levels of stress prior to an experiment participation show lower cortisol levels in the experimental setting[57,74].

Depression Anxiety Stress Scales (DASS)[75]: The DASS consists of three 14 item subscales measuring depression, anxiety and stress. Overall, the 42 symptoms listed relate to negative emotions and ask the participant to rate the frequency with which they experienced a symptom in the last week from 0 ("did not apply to me at all") to 3 ("applied to me very much, or most of the time"). The internal consistencies for each subscale are high with an alpha score of 0.91 for Depression, 0.84 for Anxiety and 0.90 for Stress[76]. Along with support for internal consistency, convergent and discriminant validity in nonclinical samples[76,77], reliability and validity in clinical samples with conditions such as major depressive disorder, obsessive compulsive disorder and social phobia have also been demonstrated[78,79]. This questionnaire was included because depressed and control individuals differ in cortisol secretion following stress exposure[80] and in their ACR[81,82]. The DASS was chosen over other depression and anxiety scales since it was developed largely from a pool of healthy, non-clinical participants[76], which is representative of the participants in our study.

Perceived Stress Scale (PSS)[83]: This 14 item tool examines the degree to which events within the last month were deemed stressful by the individual. The scale provides a measure of stress that considers both chronic and minor stresses. It has been used in past CDR research, which will allow for comparisons between findings[7,12]. Internal consistency for the PSS ranges from a Cronbach's alpha of 0.84 to 0.86[83].

100 mm Visual Analogue Scale (VAS) for Stress: The questionnaire package included a 100 mm VAS asking participants to rate the level of stress they felt due to participation in

this study ranging from 0 ("not stressful at all") to 100 ("extremely stressful). This question was asked at the end of part 1 and part 2 of the package and examined whether participants differed in their rating of stress associated with the lab procedure. The VAS acts as a quick assessment tool that has been used in past research[53].

100 mm Visual Analogue Scale (VAS) for Appetite Sensations[84]: Since participants were allowed to take snacks with them following the completion of the questionnaire package, appetite sensations were considered as potential confounding variables for any differences in the quantity of food taken. Appetite sensations were examined through questions regarding one's hunger, fullness and desire to eat. The VAS provided by Flint and colleagues[84] consists of 8 questions such as "how hungry do you feel?" and "how much do you think you can eat?" The participant was asked to indicate their response by marking a point on a line anchored with the most positive and most negative rating. Although it is difficult to establish validity for appetite sensations due to their subjective nature, VAS scales for appetite sensations are commonly used tools with acceptable within-subject reliability and validity[85].

In addition to these validated questionnaires, participants answered two open-ended questions in each part of the questionnaire package (Appendix G and H). We asked participants to read mock magazine articles describing women's diet and fitness routines and discuss their thoughts and feelings. The open-ended questions served to provide additional food and weight-related cues in the form of visual images and anecdotes from health-conscious women. Furthermore, we included these questions in an attempt to avoid

questionnaire fatigue and give the participants a break from the multiple choice style answers in the remainder of the questionnaire package.

3.5.2 Saliva collections

Salivary cortisol has become a commonly used measure of stress due to the ease and non-invasive nature of collection compared to blood samples[86]. There are strong correlations between salivary and serum cortisol values, $r = 0.71\text{-}0.96$[23]. Furthermore, saliva samples can be stored at room temperature and easily returned to the lab following the morning collection. In this study, the Salivette was used for saliva collection. The Salivette is a cotton roll held within a centrifugation tube. Women were asked to chew on the cotton roll for one minute and then place it within the tube. Participants were also instructed to rinse their mouth with water prior to the first sample collected during the lab visit and morning procedure. All samples were frozen until shipped to the University of Dresden in Germany where subsequent centrifugation and immunoassays were used to determine salivary cortisol levels[87].

3.5.3 Blood pressure readings

Stressors activate the HPA axis and sympathetic nervous system[88], thus blood pressure (BP) and heart rate acted as additional measures of perceived stress to increase the strength of experimental findings. Ambulatory BP and heart rate were recorded in 15 minute intervals throughout the lab visit, including a baseline period prior to completion of the questionnaire package. The Spacelabs Burdick ambulatory blood pressure monitor (model #90207-80) was used. Validation studies have illustrated consistent performance for at least

a six year period with this model[89,90]. The monitor was fitted on the participant's non-dominant arm so that readings could be taken while the participant was seated and completing the questionnaire package.

3.5.4 Anthropometric measurements

To determine each participant's body mass index in kg/m^2, height and weight information was collected at the end of the lab visit. With shoes taken off, height was measured to the nearest 0.1 cm. Weight was also recorded with shoes taken off and to the nearest 0.1 kg on a standard electronic scale. Two measurements were recorded for both height and weight to ensure minimal differences in measurement. If differences did occur, a third measure was taken and the average of the closest measures was recorded. Waist and hip circumferences were also measured to the nearest 0.1 cm in the same manner.

3.6 Statistical analysis

Data from the screening questionnaire, lab protocol and morning sampling procedure were entered into SPSS Version 17.0 for analysis. Descriptive statistics, Student's *t*-test and chi-square tests were used to describe the characteristics of the study population. When necessary, the Yates continuity correction was used for chi-square tests, Greenhouse-Geisser correction for analysis of variance (ANOVA) tests and Bonferroni adjustments for post-hoc tests. The following statistical approaches were used to examine our three research hypotheses:

Hypothesis #1: Exposure to food and weight-related cues will lead to signs of physiological arousal among participants.

- To assess whether a physiological response was activated and captured in the laboratory setting, a one-way ANOVA for repeated measures was used to identify changes in blood pressure, heart rate and afternoon salivary cortisol.

Hypothesis #2: High levels of CDR will lead to a greater activation of the physiological stress response and cause higher elevations in BP, heart rate and afternoon salivary cortisol than those observed in women with lower levels of restraint.

- A mixed between-within subjects ANOVA (restraint X time) was used to analyze each variable of interest and examine whether differences existed between women with high and low levels of restraint. Restraint was expressed as a categorical variable (high or low).

Hypothesis #3: CDR is a subtle and chronic stressor that causes disturbances of the HPA axis and leads to measurable differences in the ACR of women who vary in their levels of dietary restraint.

- A mixed between-within subjects ANOVA was used to confirm that the ACR response occurred and investigated whether differences were apparent between restraint groups. Furthermore, 3 common methods used to investigate the ACR in past studies were used to explore differences between the two restraint groups[37,91,92]:
    1. Mean increase (MnInc) calculates the mean rise in cortisol levels from awakening to 45 minutes post-awakening.
        - $\text{MnInc} = (\text{Awakening cortisol}_{15\text{min}} + \text{AC}_{30\text{min}} + \text{AC}_{45\text{min}})/3 - \text{AC}_{0\text{min}}$
    2. Area under the response curve (AURC) indicates the dynamic of the ACR by looking at the area under the curve with respect to the first sample collected.

- AURC = $AC_{15min} + AC_{30min} - (2 \times AC_{0min}) + ((AC_{45min} - AC_{15min})/2)$

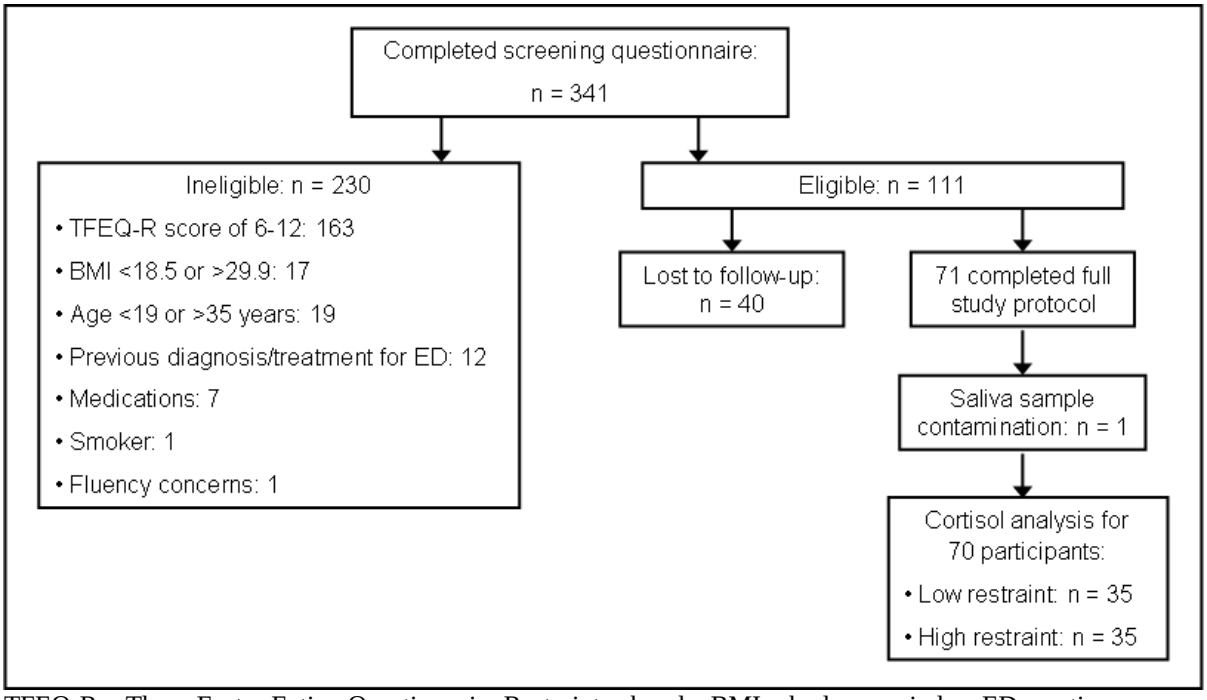
3. Area under the curve (AUC) examines the cortisol response with reference to zero to calculate the overall amount of cortisol produced in the first 45 minutes post-awakening.
    - AUC = $AC_{0min} + AC_{15min} + AC_{30min} + ((AC_{45min} - AC_{0min})/2)$

CHAPTER 4: RESULTS

4.1 Participant characteristics

A total of 341 women completed the online screening questionnaire for eligibility assessment. Figure 1 illustrates the screening process that led to the exclusion of 230 of these women. The remaining 111 women were eligible for study participation; however, 40 women did not reply to subsequent e-mails or were no longer interested in study participation ("lost to follow-up"). As a result, the full study protocol was completed by 71 participants. One participant's results were excluded due to saliva sample contamination leaving an equal number of low restraint (LR) and high restraint (HR) women as desired.

Figure 1: Recruitment process



TFEQ-R = Three-Factor Eating Questionnaire Restraint subscale, BMI = body mass index, ED = eating disorder.

Oral contraceptives were used by 13 LR and 8 HR women and as discussed earlier, this is not believed to have an effect on physiological data. Questionnaire packages were

completed in their entirety and the few missing answers were replaced with the most common answer among other participants. As summarized in Table 2, the mean age of all participants was roughly 22 years, with no significant difference in age between the LR and HR group. Anthropometric measures also did not significantly differ between groups. Participants had a mean BMI of 22.0 and mean waist-to-hip ratio of 0.78.

Table 2: Mean age, body mass index (BMI) and waist-to-hip ratio

	Overall mean (n = 70)	LR group mean (n = 35)	HR group mean (n = 35)	*t*-test	*p* value
Age (years)	22.2 ± 3.4	22.8 ± 3.2	21.9 ± 3.6	0.531	0.597
BMI (kg/m^2)	22.0 ± 2.3	22.2 ± 2.5	21.8 ± 2.1	0.777	0.440
Waist-to-hip ratio	0.78 ± 0.05	0.78 ± 0.05	0.78 ± 0.05	-0.409	0.684

Data are presented as mean ± SD, LR = low restraint, HR = high restraint, BMI = body mass index.

The participants' occupation and ethnicity information is provided in Table 3. The majority of women were students, primarily at the undergraduate level. Program majors differed among the student group since we made a conscious effort to avoid recruitment from a particular discipline. The remaining participants were employed in research, administration or had recently graduated.

To gather ethnicity data, the questionnaire asked participants to check off any of the following groups they felt described their background: Caucasian, Chinese, South Asian, Black, Arab/West Asian, Filipino, Southeast Asian, Latin American, Japanese, Korean or Other (asked to specify). We grouped the ethnicity results into two categories for simplicity: (1) *Caucasian*, which described individuals who self-identified as Caucasian or Latin American and (2) *Asian*, which included all other ethnic groups. Overall, a larger number of

participants were Asian than Caucasian. Of the 35 women in the LR group, 16 were Caucasian (45.7%) and 19 were Asian (54.3%). This was in contrast to the 9 Caucasian women (25.7%) and 26 Asian women (74.3%) in the HR group. However, a chi-square test for independence with Yates Continuity Correction showed no significant association between level of CDR and ethnicity, $\chi^2(1, n = 70) = 2.24, p = 0.13$.

Table 3: Occupation and ethnicity

	n	%
Occupation		
Undergraduate student	51	72.9%
Graduate student	10	14.3%
Unclassified student	2	2.9%
Recently graduated or employed	7	10.0%
Ethnicity		
Caucasian	25	35.7%
Asian	45	64.3%

Table 4 presents data on participants' weight loss efforts, weight perceptions and usual diet. Among the group as a whole, almost a third reported that they were currently trying to lose weight, with a majority of these women belonging to the HR group. Almost two-thirds of participants felt their current weight was "about right", about one-third felt "slightly overweight" and very few reported feeling "very overweight" or "slightly underweight". Weight perceptions differed between restraint groups, with HR women more likely to perceive themselves as "slightly overweight". Lastly, when asked to describe their typical diet, the majority of LR and HR women reported consuming a mixed diet of meat, dairy products, eggs, fruits, vegetables and grains. Some participants reported dietary

restrictions such as excluding red meat, dairy or all animal products but this response did not differ between restraint groups.

Table 4: Participants' thoughts regarding diet and weight status

	Overall n, (%)	LR group n, (%)	HR group n, (%)	χ^2 test	*p* value
Are you currently trying to lose weight?					
No	47 (67.1%)	33 (94.3%)	14 (40%)	20.981*	< 0.001
Yes	23 (32.9%)	2 (5.7%)	21 (60%)		
How do you feel about your current weight?					
Very or slightly overweight	25 (35.7%)	5 (14.3%)	20 (57.1%)	12.196*	< 0.001
About right or slightly underweight	45 (64.3%)	30 (85.7%)	15 (42.9%)		
How would you describe your usual diet?					
Mixed	59 (84.3%)	30 (85.7%)	29 (82.9%)	0.000*	1.000
Other (lacto-ovo, pesco-pollo, vegan or specific food intolerances)	11 (15.7%)	5 (14.3%)	6 (17.1%)		

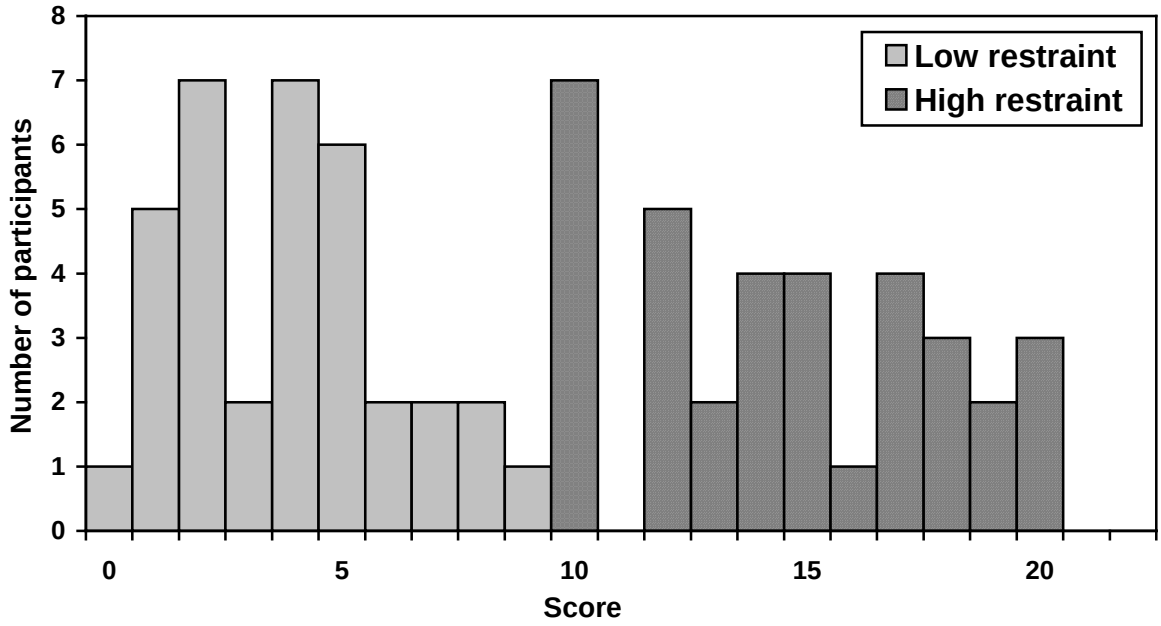
LR = low restraint, HR = high restraint.
*Yates continuity correction applied.

4.2 Eating attitudes

For inclusion in the full study protocol, participants had scores ranging from 0-5 or 13-21 on the TFEQ-R component of the screening questionnaire. Upon visiting the lab, participants were asked to complete the full TFEQ so the TFEQ-R was completed again, as part of the questionnaire package. Although some participants' scores on the TFEQ-R changed between visits and subsequently fell in the mid-range of scores (6-12), no participant changed restraint group category based on the second score. As expected, final TFEQ-R

scores were significantly different between groups. Figure 2 illustrates the distribution of final TFEQ-R scores.

Figure 2: Distribution of final scores on the Three-Factor Eating Questionnaire Restraint subscale



Additional measures examining eating attitudes included the Disinhibition, Hunger, Rigid and Flexible Control subscales of the TFEQ, the shortened version of the Body Shape Questionnaire (BSQ-8C), the Beliefs About Appearance Scale (BAAS) and the Eating Disorders Examination Questionnaire (EDE-Q). Table 5 summarizes overall and group means on the different scales with scores on BSQ-8C multiplied by 4 to allow for easy comparison to the full 32 item BSQ[63]. With the exception of the hunger subscale of the TFEQ, the LR and HR group means were significantly different across all assessment tools.

Table 5: Mean scores on eating attitude assessment tools

Questionnaire subscale	Possible range of scores	Overall mean (n = 70)	LR group mean (n = 35)	HR group mean (n = 35)	*t*-test	*p* value
TFEQ						
Restraint	0 – 21	9.2 ± 6.1	3.8 ± 2.3	14.5 ± 3.3	-15.665	< 0.001
Disinhibition	0 – 14	6.9 ± 3.4	5.9 ± 3.3	7.8 ± 3.4	-2.334	0.023
Hunger	0 – 16	6.1 ± 2.8	6.4 ± 2.7	5.8 ± 2.9	0.847	0.400
Rigid control	0 – 16	5.5 ± 3.9	2.3 ± 1.8	8.7 ± 2.6	-11.936	< 0.001
Flexible control	0 – 12	5.6 ± 3.0	3.2 ± 1.6	7.9 ± 2.2	-10.326	< 0.001
BSQ	34 - 204	88.1 ± 28.4	69.5 ± 20.7	106.6 ± 22.3	-7.127	< 0.001
BAAS*	0 – 76	25.4 ± 15.3	20.2 ± 15.1	30.5 ± 13.9	-2.990	0.004
EDE-Q						
Restraint	0 – 6	1.1 ± 1.2	0.3 ± 0.6	1.9 ± 1.2	-7.130	< 0.001
Shape concern	0 – 6	1.9 ± 1.2	1.3 ± 1.0	2.6 ± 1.0	-5.640	< 0.001
Weight concern	0 – 6	1.4 ± 1.2	0.6 ± 0.6	2.2 ± 1.1	-7.408	< 0.001
Eating concern	0 – 6	0.7 ± 0.8	0.3 ± 0.4	1.2 ± 0.8	-5.965	< 0.001
Global score	0 – 6	1.3 ± 1.0	0.6 ± 0.6	2.0 ± 0.9	-7.577	< 0.001

Data are presented as mean ± SD, LR = low restraint, HR = high restraint, TFEQ = Three Factor Eating Questionnaire, BSQ = Body Shape Questionnaire, BAAS = Beliefs About Appearance Scale, EDE-Q = Eating Disorders Examination Questionnaire.
*One question from the 20-item BAAS was omitted in our questionnaire package, resulting in a maximum score of 76 rather than 80.

4.3 Physical activity, depression, anxiety and stress

Participants completed the following questionnaires related to usual physical activity, depression, anxiety and stress: Baecke Questionnaire of Habitual Physical Activity, Daily Stress Inventory (DSI), Depression Anxiety Stress Scales (DASS) and the Perceived Stress Scale (PSS). Student's *t*-tests were conducted to analyze differences in group means between the LR and HR groups. As summarized in Table 6, no significant between group differences were found among any of the subscales.

Participants were also asked to rate how stressful they found study participation using a 100 mm visual analogue scale. This question was asked at the end of each part of the questionnaire package with results shown in Table 7. Women in the HR group reported significantly higher levels of stress than the LR group after completing each part of the questionnaire package.

Table 6: Mean scores on physical activity, depression, anxiety and stress scales

Questionnaire subscale	Possible range of scores	Overall mean (n = 70)	LR group mean (n = 35)	HR group mean (n = 35)	*t*-test	*p* value
Baecke						
Work index	1 – 5	2.3 ± 0.6	2.3 ± 0.6	2.2 ± 0.7	0.942	0.349
Sport index	1 – 5	2.6 ± 1.1	2.4 ± 1.0	2.7 ± 1.1	-1.242	0.218
Leisure index	1 – 5	3.0 ± 0.7	3.0 ± 0.7	3.0 ± 0.6	0.045	0.964
DSI						
Frequency	0 – 58	15.5 ± 7.5	14.5 ± 6.9	16.6 ± 8.0	-1.150	0.254
Sum	0 – 406	51.3 ± 34.7	46.3 ± 33.5	56.3 ± 35.5	-1.211	0.230
Average impact rating	0 – 7	3.2 ± 0.9	3.0 ± 0.9	3.3 ± 0.9	-1.111	0.270
DASS						
Depression	0 – 42	7.7 ± 8.2	6.6 ± 8.3	8.8 ± 8.1	-1.139	0.259
Anxiety	0 – 42	6.5 ± 5.9	5.3 ± 4.2	7.8 ± 7.1	-1.800	0.076
Stress	0 – 42	12.9 ± 8.8	11.2 ± 9.0	14.6 ± 8.5	-1.644	0.105
PSS	0 – 56	24.7 ± 7.0	24.1 ± 7.9	25.3 ± 6.2	-0.712	0.479

Data are presented as mean ± SD, LR = low restraint, HR = high restraint, Baecke = Baecke Questionnaire of Habitual Physical Activity, DSI = Daily Stress Inventory, DASS = Depression Anxiety Stress Scales, PSS = Perceived Stress Scale.

Table 7: Mean visual analogue scale scores for stress due to study participation*

	Overall (n = 70)	LR group (n = 35)	HR group (n = 35)	*t*-test	*p* value
Stress rating after part 1	13.9 ± 17.5	8.5 ± 8.1	19.3 ± 22.2	-2.722	0.009
Stress rating after part 2	17.0 ± 18.8	10.5 ± 10.0	23.4 ± 23.1	-3.040	0.004

*A 100 mm visual analog scale was used, with anchors of "not at all stressful" (0) and "extremely stressful" (100). Data are presented as mean (mm) ± SD, LR = low restraint, HR = high restraint.

4.4 Appetite sensations and food choices

Since this study had food items present as a form of cue exposure, we examined whether differences in hunger between restraint groups acted as a confounding variable. Hunger and food preferences were assessed using 100 mm visual analogue scales for appetite sensations at the start of the study. Differences in the number and type of food items taken by LR and HR individuals were later examined.

Results are presented in Table 8. Of key importance is that no significant differences existed between the feelings of hunger, satisfaction or fullness among LR and HR women at the start of the study. LR women had a significantly higher preference for salty, savoury or fatty foods than HR women but groups did not actually differ in the overall number of food items taken. HR women were observed to take more low-fat, low-sugar items on average but preference for all other food types did not significantly differ between the two groups.

Table 8: Mean scores for appetite sensations and food choices

	Overall (n = 70)	LR group (n = 35)	HR group (n = 35)	*t*-test	*p* value
Appetite scores*					
Hunger	32.4 ± 24.3	37.7 ± 25.1	27.0 ± 22.5	1.876	0.065
Satisfaction	47.7 ± 19.0	44.8 ± 17.1	50.8 ± 20.8	-1.308	0.195
Fullness	40.1 ± 24.3	35.1 ± 23.3	45.1 ± 24.6	-1.750	0.085
Prospective food consumption	54.5 ± 24.7	59.3 ± 24.8	49.7 ± 24.0	1.645	0.105
Desire for specific food type*					
Sweet	49.8 ± 29.8	56.2 ± 28.3	43.9 ± 30.4	1.825	0.072
Salty	47.2 ± 28.8	56.5 ± 26.9	37.9 ± 27.9	2.849	0.006
Savoury	55.1 ± 27.2	63.8 ± 24.4	46.5 ± 27.4	2.798	0.007
Fatty	31.1 ± 24.0	38.1 ± 25.0	24.1 ± 21.1	2.534	0.014
Food choices**					
Total items taken	4.9 ± 4.1	4.5 ± 3.8	5.4 ± 4.4	-0.875	0.385
Low-fat, low-sugar	0.6 ± 0.8	0.3 ± 0.5	0.9 ± 1.0	-3.539	0.001
Low-fat, high-sugar	1.5 ± 2.1	1.4 ± 2.2	1.6 ± 2.1	-0.280	0.780
High-fat, low-sugar	1.3 ± 1.6	1.2 ± 1.4	1.4 ± 1.8	-0.602	0.549
High-fat, high-sugar	1.5 ± 1.7	1.6 ± 1.7	1.5 ± 1.7	0.419	0.676

*A 100 mm visual analog scale was used, with anchors of two opposing statements such as "I am not hungry at all" (0) and "I have never been more hungry" (100) for the Hunger score. Data are presented as mean (mm) ± SD, LR = low restraint, HR = high restraint.
**Food choices reflects the mean number of food items taken, with total items ranging from a minimum of 0 to a maximum of 55 items.

4.5 Physiological measures

4.5.1 Cue exposure and physiological arousal

The first research hypothesis proposed that food and weight-related cues present in the lab setting would lead to signs of physiological arousal. Changes were predicted for the measures of systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate and afternoon salivary cortisol.

For each physiological variable, a one-way repeated measures ANOVA was used with Greenhouse-Geisser corrections applied if necessary. Post hoc tests with Bonferroni

adjustments were completed after obtaining significant results. For SBP, DBP and heart rate, a complete set of 6 measures was recorded for all participants except 1 LR female. Mean values for the resulting sample size of 69 are provided in Table 9.

The results indicate that SBP measures significantly changed over the 6 time points, $F(5, 340) = 25.83$, $p < 0.001$. Post hoc tests reveal that baseline measures were significantly higher from all other time points. Likewise, there was a significant change in DBP over the duration of the study protocol, $F(5, 340) = 2.85$, $p < 0.05$.

Mauchly's test indicated that assumption of sphericity had been violated for the effect of time on heart rate measures, $\chi^2(14) = 217.21$, $p < 0.001$. Therefore, the Greenhouse-Geisser correction was applied, $\varepsilon = 0.36$. There was a significant change in heart rate measures over time, $F(1.80, 122.60) = 16.24$, $p < 0.001$. Pairwise comparisons shown in Table 9 illustrate that measures collected in the first and second half of the study significantly differed from each other.

Lastly, mean values of afternoon salivary cortisol levels are provided in Table 9. Missing samples from 2 LR participants reduced the sample size to 68 women. Participants were asked to record the time each sample was collected in the lab setting to verify accuracy of sampling. Most samples were collected within a 15-16 minute interval. Out of 408 samples, only 1 was collected after 17 minutes and this represents the largest deviation from the requested 15 minute sampling interval.

The Greenhouse-Geisser correction was applied ($\varepsilon = 0.67$) due to a violation of the assumption of sphericity for cortisol data, $\chi^2(14) = 370.84$, $p < 0.001$. Similar to other variables, afternoon cortisol levels significantly changed over time, $F(1.51, 101.32) = 24.18$, $p < 0.001$. Pairwise comparisons with Bonferroni corrections are provided in Table 9.

Table 9: Overall mean values for systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate and afternoon salivary cortisol measures in the lab setting

	Minutes elapsed					
Variable	0 minutes	15 minutes	30 minutes	45 minutes	60 minutes	75 minutes
SBP (mmHg, n = 69)	110.2 ± 10.2^{a}	107.9 ± 10.0^{a}	105.5 ± 9.2^{bc}	105.3 ± 9.0^{bc}	104.1 ± 9.4^{bc}	104.6 ± 10.1^{bc}
DBP (mmHg, n = 69)	67.4 ± 7.9^{df}	66.3 ± 7.9	65.3 ± 9.5^{b}	66.0 ± 8.6	65.1 ± 9.4^{b}	65.8 ± 9.1
Heart rate (bpm, n = 69)	73.3 ± 11.3^{efg}	71.7 ± 9.8^{efg}	70.5 ± 9.1^{efg}	67.8 ± 7.8^{bcd}	68.5 ± 8.2^{bcd}	66.8 ± 8.4^{bcd}
Salivary cortisol (nmol/L, n = 68)	7.0 ± 5.3^{fg}	7.5 ± 4.7^{defg}	6.6 ± 3.8^{cefg}	5.8 ± 3.1^{cdfg}	5.2 ± 2.7^{a}	4.8 ± 2.5^{a}

Data are presented as mean ± SD, SBP = systolic blood pressure, DBP = diastolic blood pressure.
a = significantly different from all other time points ($p < 0.05$), b = significantly different from time point 1 ($p < 0.05$), c = significantly different from time point 2 ($p < 0.05$), d = significantly different from time point 3 ($p < 0.05$), e = significantly different from time point 4 ($p < 0.05$), f = significantly different from time point 5 ($p < 0.05$), g = significantly different from time point 6 ($p < 0.05$).

4.5.2 Cue exposure, physiological arousal and CDR

A mixed between-within subjects ANOVA (restraint X time) was used to examine whether levels of restraint had an impact on physiological responses in the lab setting. Mean values across time points for each restraint group are presented in Table 10 and are illustrated in Figures 3-6.

Changes in SBP and DBP over time are illustrated in Figures 3 and 4, respectively. There was no significant interaction between restraint and SBP or DBP values over time, $F(5, 335) = 1.54$, $p = 0.18$ and $F(5, 335) = 0.77$, $p = 0.57$, respectively. There was a significant main effect of time with both groups showing a decrease in SBP ($F(5, 335) = 26.15$, $p < 0.001$) and DBP ($F(5, 335) = 2.87$, $p = 0.02$) over time. In contrast to hypothesis two, the main effect for restraint was not significant. Levels of restraint did not appear to have an effect on SBP ($F(1, 67) = 2.82$, $p = 0.10$) or DBP measures ($F(1, 67) = 2.47$, $p = 0.12$) after cue exposure.

Changes in heart rate are illustrated in Figure 5. Mauchly's test indicated that the assumption of sphericity was violated with $\chi^2(14) = 215.93$, $p < 0.001$. The Greenhouse-Geisser correction was applied to adjust degrees of freedom, $\varepsilon = 0.36$. There was no significant interaction between heart rate measures over time and restraint, $F(1.79, 119.97) = 0.29$, $p = 0.72$. A significant main effect of time was observed since both groups appeared to have a decrease in heart rate over time, $F(1.79, 119.97) = 16.10$, $p < 0.001$. However, restraint groups were not significantly different in their heart rate response over time, $F(1, 67) = 1.23$, $p = 0.27$.

Lastly, Figure 6 illustrates changes in afternoon salivary cortisol levels. Mauchly's test showed that the assumption of sphericity was violated for salivary cortisol measures,

$\chi^2(14) = 366.84$, $p < 0.001$ and the Greenhouse-Geisser correction was applied, $\varepsilon = 0.30$. There was no significant interaction between cortisol measures over time and levels of restraint, $F(1.51, 99.67) = 0.82$, $p = 0.41$. Both groups were observed to have a significant decrease in salivary cortisol over time, $F(1.51, 99.67) = 23.90$, $p < 0.001$. However, consistent with other findings in this study, high and low restraint women did not significantly differ in their cortisol response over time, $F(1, 66) = 0.30$, $p = 0.59$.

In summary, the physiological response of high and low restraint women did not appear to differ from each other in the measures of SBP, DBP, heart rate and afternoon salivary cortisol.

Table 10: Group means for systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate and afternoon salivary cortisol measures in the lab setting

		Minutes elapsed					
Variable	Restraint group	0 minutes	15 minutes	30 minutes	45 minutes	60 minutes	75 minutes
SBP (mmHg)	Low (n = 34)	113.1 ± 11.5	109.2 ± 11.2	107.1 ± 10.0	107.2 ± 10.7	105.8 ± 10.9	106.0 ± 11.6
	High (n = 35)	107.4 ± 8.0	106.6 ± 8.6	103.9 ± 8.1	103.3 ± 6.6	102.5 ± 7.4	103.2 ± 8.3
DBP (mmHg)	Low (n = 34)	69.6 ± 9.7	67.8 ± 9.6	67.0 ± 11.6	67.2 ± 9.9	66.5 ± 11.5	66.8 ± 10.9
	High (n = 35)	65.2 ± 4.7	64.8 ± 5.6	63.6 ± 6.8	64.8 ± 7.0	63.7 ± 6.6	64.9 ± 6.9
Heart rate (bpm)	Low (n = 34)	75.9 ± 11.6	73.4 ± 9.7	71.2 ± 9.2	68.8 ± 7.5	69.8 ± 8.0	67.4 ± 8.0
	High (n = 35)	73.3 ± 18.5	69.9 ± 9.7	69.6 ± 9.0	66.8 ± 8.1	67.2 ± 8.2	66.1 ± 8.7
Salivary cortisol (nmol/L)	Low (n = 33)	6.9 ± 5.0	7.8 ± 4.9	6.8 ± 4.1	6.0 ± 3.5	5.6 ± 3.2	5.2 ± 2.8
	High (n = 33)	7.1 ± 5.7	7.3 ± 4.5	6.5 ± 3.5	5.6 ± 2.8	4.7 ± 2.2	4.4 ± 2.0

Data are presented as mean ± SD, SBP = systolic blood pressure, DBP = diastolic blood pressure.

Figure 3: Mean values of systolic blood pressure (SBP) in the lab setting for women with low and high restraint scores

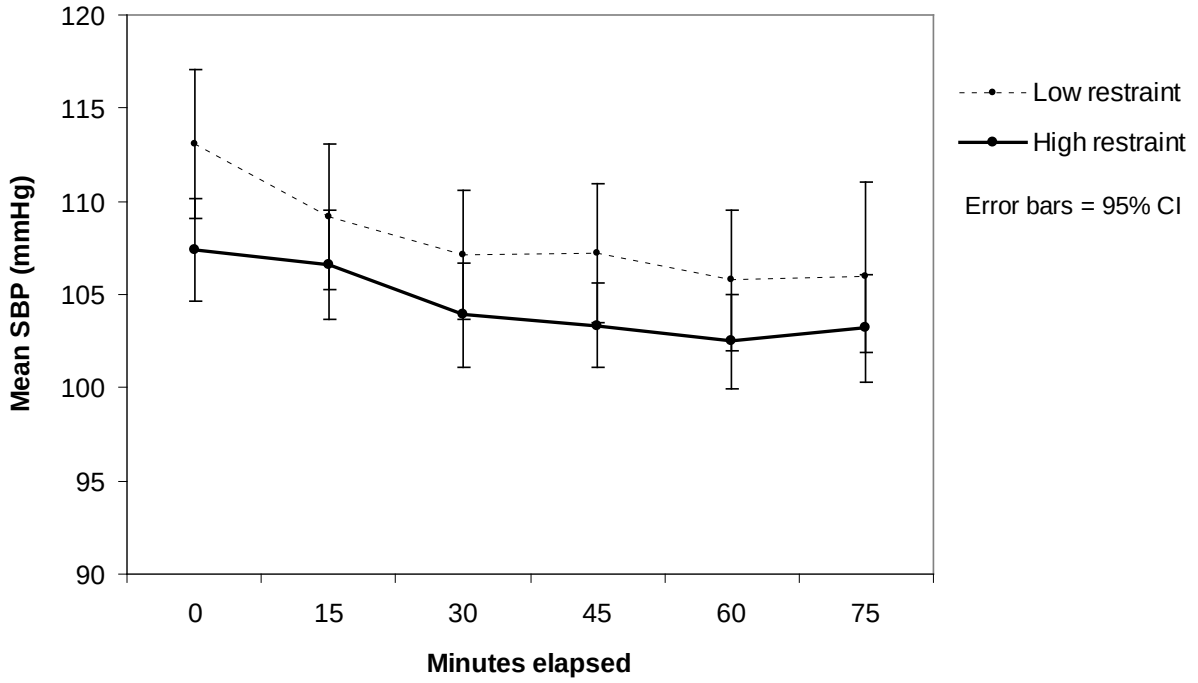


Figure 4: Mean values of diastolic blood pressure (DBP) in the lab setting for women with low and high restraint scores

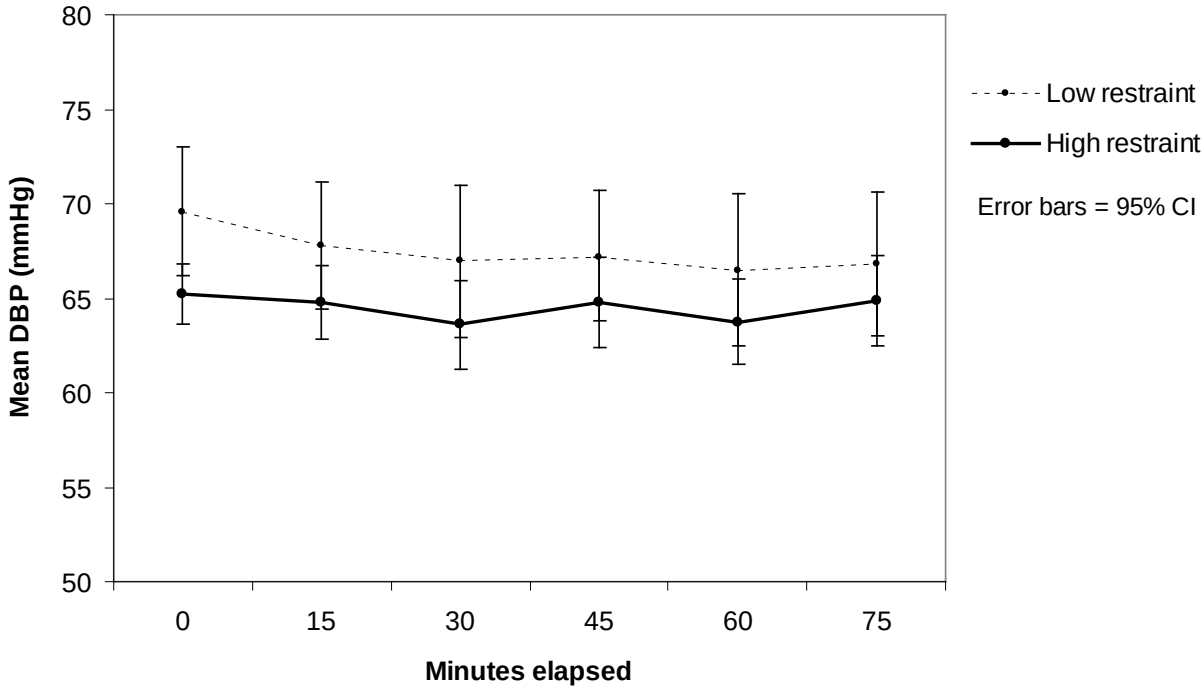


Figure 5: Mean values of heart rate in the lab setting for women with low and high restraint scores

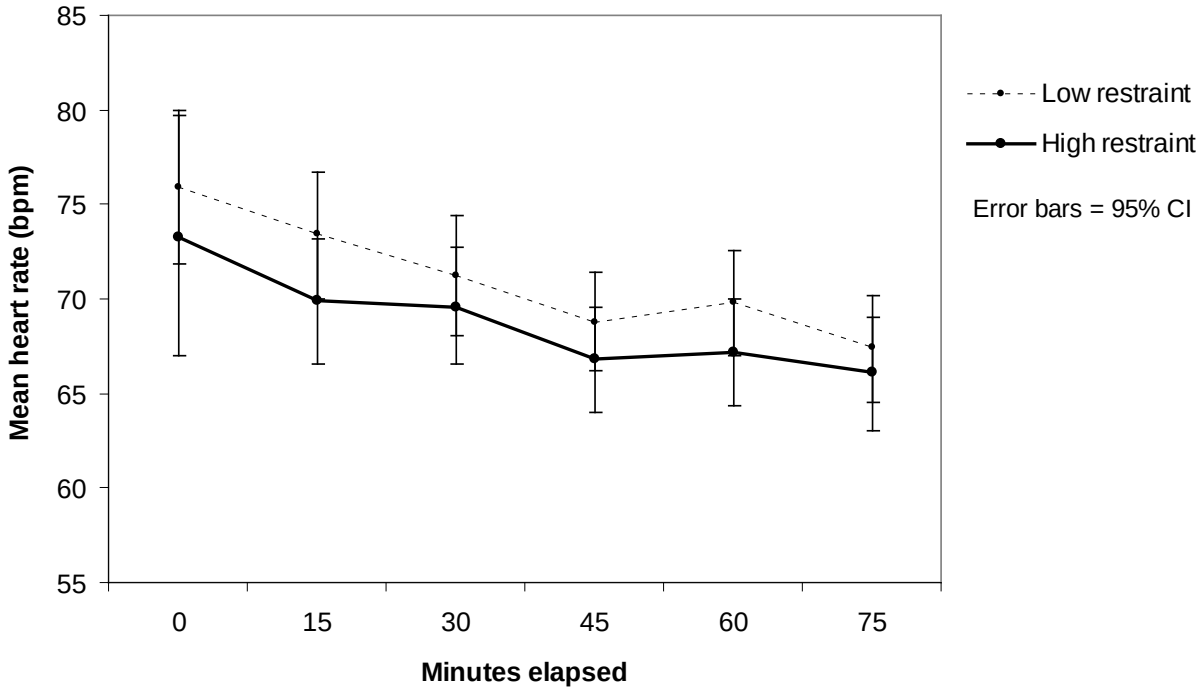
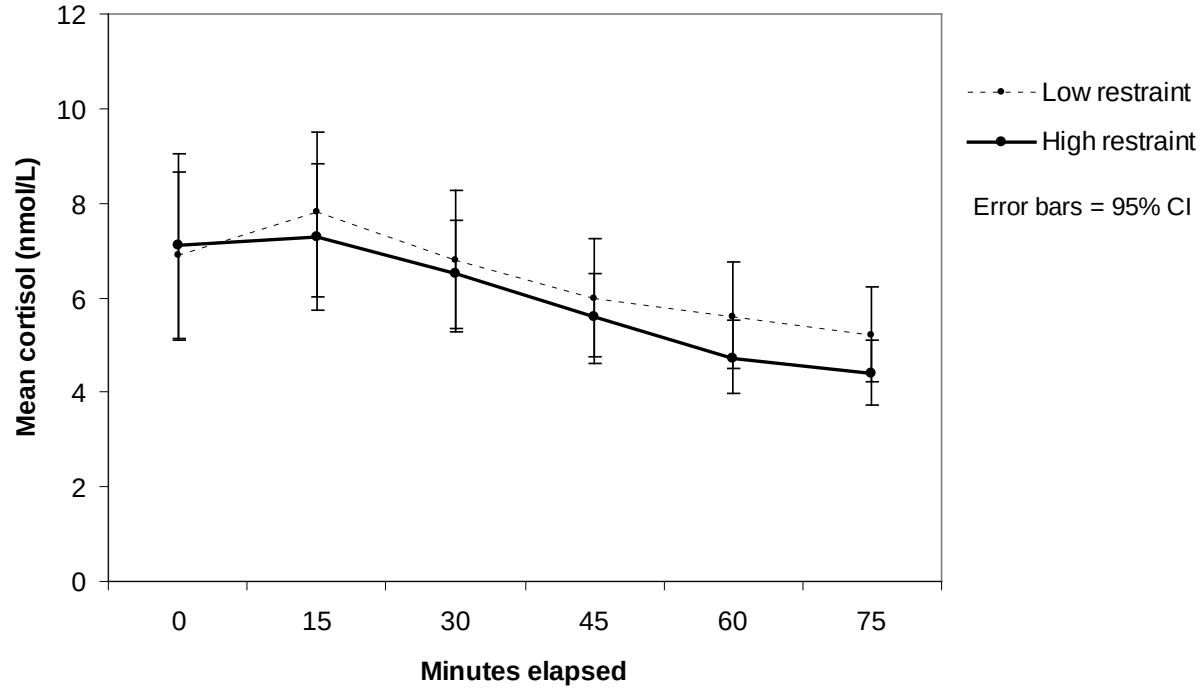


Figure 6: Mean values of afternoon salivary cortisol levels for women with low and high restraint scores



4.6 Awakening cortisol response

The ACR was examined using 3 approaches common to most studies[37]: mean increase (MnInc), area under the curve with reference to sample one (AURC) and area under the curve with reference to zero (AUC). Please refer to Section 3.6 for the formulas used.

Mean cortisol levels for samples collected 0, 15, 30 and 45 minutes after awakening are provided in Table 11. A complete set of 4 morning samples were provided by all participants; however, technical error led the loss of a 15 minute sample from a LR and HR female. Calculations for these participants were based on remaining values.

Table 11: Group means for morning salivary cortisol

	Cortisol levels (nmol/L)			
	Time after awakening			
Level of restraint	0 minutes	15 minutes	30 minutes	45 minutes
Low (n = 34)	13.8 ± 6.7	23.3 ± 8.9	31.4 ± 12.1	31.8 ± 13.5
High (n = 34)	14.2 ± 6.8	22.8 ± 9.6	28.1 ± 10.7	27.5 ± 12.9

Data are presented as mean ± SD.

All participants were asked to record the time of sampling to verify compliance to the requested 15 minute sampling interval. The majority of the 280 samples were provided within a 15-16 minute interval. Two samples were collected 5 minutes earlier than desired and 1 was collected after 17 minutes. These small differences in sampling time are believed to have negligible effects on overall results[59,93]. Participants were asked if they had any difficulties with the morning sampling procedure prior to the debriefing session and the consensus was that there were no problems. Those who experienced unexpected issues the morning of the procedure (such as falling back asleep rather than taking the initial sample)

had contacted the student investigator to reschedule data collection. As a result, it is believed that all participants completed the morning sampling procedure as requested.

4.6.1 ACR and dietary restraint

A mixed between-within subjects ANOVA (restraint X time) was used to confirm that morning cortisol levels increased as expected in the ACR response. Group means over the 4 time points are illustrated in Figure 7. Mauchly's test indicated that the assumption of sphericity was violated for ACR measures, $\chi^2(5) = 104.95$, $p < 0.001$ and the Greenhouse-Geisser correction was applied, $\varepsilon = 0.51$. There was no significant interaction between morning cortisol levels over time and restraint, $F(1.52, 100.23) = 1.98$, $p = 0.15$. There was a significant main effect of time with both groups showing the expected increase in cortisol levels after awakening, $F(1.52, 100.23) = 86.34$, $p < 0.001$. Furthermore, the responder rate was calculated to determine the number of participants who experienced a minimum 2.5 nmol/L increase in cortisol in comparison to baseline levels. This cut-off has been established as a strict method of identifying those who show a cortisol response upon awakening[33]. Cortisol levels increased by at least 2.5 nmol/L in 66 of 70 participants (94.3%). The ACR was thus observed in most participants but the main effect for restraint was not significant, $F(1, 66) = 0.85$, $p = 0.36$. This suggests that results were in contrast to hypothesis three such that there were no observed differences in the ACR profile of LR and HR women.

Mean MnInc, AURC and AUC values for each restraint group are shown in Table 12 and further illustrate that ACR profiles did not differ between restraint groups. The mean increase in morning cortisol was determined by averaging post-awakening cortisol levels and

calculating the change from the sample collected immediately upon awakening. There was no significant difference between the mean MnInc value calculated for the LR and HR group.

AURC reflects the increase in cortisol levels from baseline to 45 minutes post-awakening. Student's *t*-tests comparing mean AURC values between the LR and HR group showed that no significant between-group difference was found.

Lastly, mean AUC values were calculated to gain an understanding of the amount of cortisol secreted after awakening. No significant differences were observed between the AUC of the LR and HR group.

Figure 7: Mean salivary cortisol levels after awakening for women with low and high restraint scores

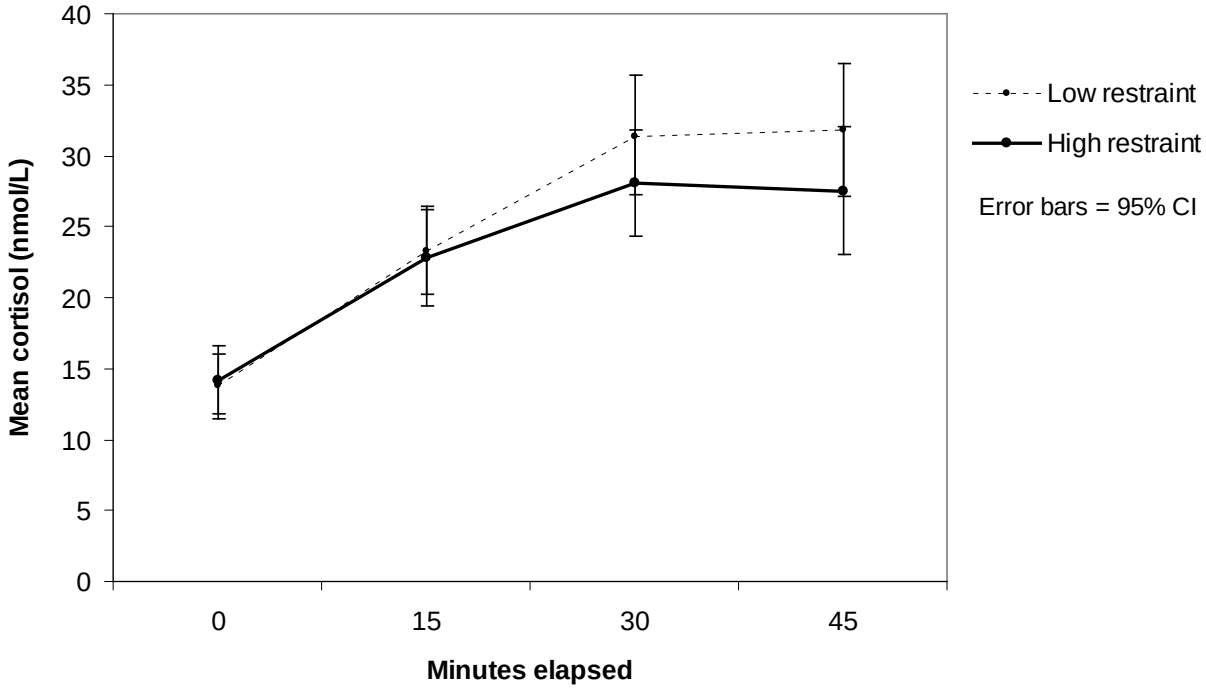


Table 12: Group means for mean increase (MnInc), area under the response curve (AURC) and area under the curve (AUC) values

	LR group mean (n = 35)	HR group mean (n = 35)	*t*-test	*p* value
MnInc (nmol/L)	15.8 ± 10.6	11.7 ± 8.6	1.782	0.079
AURC (nmol/L)	31.0 ± 20.5	23.9 ± 18.2	1.541	0.128
AUC (nmol/L)	78.2 ± 27.5	70.4 ± 27.1	1.198	0.235

Data are presented as mean ± SD, LR = low restraint, HR = high restraint, MnInc = mean increase, AURC = area under the response curve, AUC = area under the curve.

CHAPTER 5: DISCUSSION AND CONCLUSIONS

5.1 Introduction

The purpose of this study was to examine the relationship between CDR and physiological stress in healthy young women. It was previously unknown if the food and weight-related cues believed to be more stressful to those with high CDR would activate the stress response in such a way that measurable differences could be observed in an experimental setting. We proposed that (1) food and weight-related cues would lead to signs of physiological arousal, (2) HR women would experience higher degrees of physiological stress and (3) the LR and HR group would differ in their awakening cortisol response.

I will first discuss findings related to anthropometric and general participant characteristics. Differences in eating attitude measures will be explored, followed with a discussion of the physical activity, depression, anxiety and stress variables in the two groups. Next, there will be a discussion of the research results related to each of the three study hypotheses. Lastly, conclusions, study strengths and limitations and suggestions for future work will be presented.

5.2 Anthropometric findings

The eligibility criteria for this study required that participants had a BMI that was neither underweight nor obese. Initial height and weight information was collected by self-report on the screening questionnaire. Based on this information, less than 8% of potential participants were ineligible due to weight criteria. Anthropometric data were confirmed during the lab visit and the LR and HR group did not significantly differ in terms of BMI, with a mean of 22.0 ± 2.3 kg/m^2. Mean waist-to-hip ratios were identical between the two

groups. In contrast to these similarities, HR women were more likely to report that they were currently "slightly overweight" and were trying to lose weight. These findings confirm existing literature supporting the idea that CDR differences are not usually correlated with differences in anthropometric data and caloric intake, despite the variability in food and weight-related concerns[6,7,16].

5.3 Eating attitudes results

Eating attitudes were examined using the full Three Factor Eating Questionnaire (TFEQ), which includes the Restraint, Disinhibition, Hunger, Rigid Control and Flexible Control subscales; Body Shape Questionnaire (BSQ); Beliefs About Appearance Scale (BAAS) and the Eating Disorder Examination Questionnaire (EDE-Q) which consists of the Restraint, Shape Concern (SC), Weight Concern (WC), Eating Concern (EC) and Global subscales. Significant differences were observed between the two restraint groups for all scales and subscales, excluding the Hunger subscale of the TFEQ. This finding was expected since we selectively recruited participants on extreme ends of the TFEQ-R. Past research on LR and HR women has also observed significant between-group differences in the TFEQ Restraint and Disinhibition subscales while Hunger scores remained the same[30]. This study confirms that HR women are more likely to report disordered eating habits, controlling behaviours and concerns regarding their weight and body shape.

The BSQ focuses on body shape concerns and feelings of fatness in women[62]. In this study, the shortened BSQ-8C was used due to time limitations with mean scores multiplied by 4 for ease of comparison to the full scale. BSQ scores were significantly different between groups (LR mean = 69.5 ± 20.7, HR mean = 106.6 ± 22.3, t = -7.127, $p < 0.001$)

which indicates that HR women were more likely to report body dissatisfaction. A validation study of the BSQ reported that women who self-identified moderate or extreme weight concerns, shape concerns and fears of fatness had a mean BSQ score of 109.0 ± 21.2 compared to a score of 55.9 ± 14.4 among unconcerned women[62]. Since the HR group in our study had similar BSQ scores, they are believed to be at a higher risk of psychopathologies due to the widespread and stable nature of body dissatisfaction.

To supplement the role of the BSQ in examining the frequency of shape and weight concerns, the BAAS was included to gain an understanding of the potential implications of these beliefs. The BAAS functions to assess the importance of appearance to an individual and the effects they believe physical appearance has on relationships, work, achievement, self-view and emotions[65]. BAAS scores were significantly higher among HR women with a group mean of 30.5 ± 15.9 compared to 20.2 ± 15.1 in the LR group, $t = -2.990$, $p < 0.05$. Past studies using the BAAS in a university sample reported means ranging from 23.3 ± 14.9 to 30.6 ± 18.0[94], similar to scores in this study. Negative appearance beliefs have been shown to predict eating disorder risk factors such as dietary restraint and body dissatisfaction[94]. Thus, there are clear relationships between CDR, body dissatisfaction and appearance beliefs. The HR group was observed to have a high number of weight and body shape concerns that are likely being perceived as having negative effects on their work, relationships and self-esteem.

The EDE-Q was included as one final measure of eating attitudes. By gathering information on the subscales of Restraint, Eating Concern (EC), Weight Concern (WC) and Shape Concern (SC), this tool helped to identify further items of interest in our sample population. The LR and HR group significantly differed in all subscales, $p < 0.001$. Norms

for the EDE-Q have been established for a large group of American university-aged women (n = 723)[95]. Independent *t*-tests were used to compare overall mean EDE-Q scores in our study to Luce *et al.*'s sample population which had a mean Global score = 1.7 ± 1.3, mean Restraint = 1.6 ± 1.5, mean EC = 1.1 ± 1.1, mean SC = 2.3 ± 1.5 and mean WC = 2.0 ± 1.6. Our study population had significantly lower scores on the Global ($t = 2.813$, $p < 0.05$), Restraint ($t = 2.585$, $p < 0.05$), EC ($t = 2.796$, $p < 0.05$) and WC subscales ($t = 3.125$, $p < 0.05$), reflecting fewer diet and weight concerns on average than the American sample. Differences in our study compared to Luce *et al.*'s may be due to differences in ethnicity or age across the two groups. The study conducted by Luce and colleagues primarily recruited Caucasian participants (88% of total) who were of a significantly younger age than our study (mean age = 18.7 ± 1.2, $t = 18.346$, $p < 0.001$). Past studies using the EDE-Q in a sample of healthy Australian women aged 18-42 years observed that mean subscale scores decreased with age[96].

A further finding of interest from the EDE-Q is the proportion of women with extreme scores (≥ 4) on each of the subscales. Compared to Luce *et al.*'s finding of 19.4% of women with extreme scores in SC and 11.3% in WC[95], the current study had a lower proportion with 11.5% of all women scoring extremely high in SC and 4.2% in WC. Extreme scores varied between restraint groups. None were observed in the Restraint, WC, EC or Global subscale for the LR group whereas 8.6% of HR women scored ≥ 4 in Restraint, 8.7% in WC, 2.9% in EC and 2.9% in the Global subscale. Shape concerns were evident in both groups with 5.8% of LR women and 17.1% of HR women reporting extreme scores. This finding confirms the high scores reported on the BSQ and BAAS, indicating that body shape is a central issue among our participants, especially those with high CDR.

5.4 Physical activity, depression, anxiety and stress findings

The Baecke Physical Activity questionnaire assessed usual physical activity levels in the study population. Participants did not differ in terms of activity levels at work, which was expected since the majority of participants in both restraint groups were students. The LR and HR group were also similar in terms of sport and leisure time activity. This finding has been observed in the past[28] but contrasts most studies examining the relationship between dietary restraint and exercise.

A study by Beiseigel and colleagues compared women scoring high in restraint (TFEQ-R score ≥ 12; n = 21) to those with low levels (TFEQ-R score ≤ 6; n = 20) and found that the HR group dedicated 1.5 times more hours of physical activity each week[6]. Two additional research groups used the same criteria for restraint as our study and also observed higher hours of physical activity among HR women. In the first study, weekly hours of exercise were significantly higher in the HR group with 3.4 ± 1.7 (n = 33) versus 2.2 ± 1.8 (n = 29) hours reported, $p < 0.01$[30]. A second questionnaire-based study observed that LR women reported fewer weekly hours of exercise with a mean of 3.2 ± 3.5 (n = 180) compared to 4.6 ± 5.3 (n = 145), $p < 0.05$[7].

Physical activity was not a key variable of interest in this study; however, it may have been helpful to have an additional question asking participants for their motivations behind exercise. This question could have been beneficial because although Baecke subscale scores did not significantly differ between groups, the motivations behind physical activity could provide further information. For instance, one might expect HR women to use physical activity for weight-related reasons rather than general health when compared to LR women. The self-report nature of the physical activity questionnaire also presents some difficulties

when comparing restraint groups. This method of estimating activity is subject to error since individuals can differ in how they rate exercise intensity and duration. HR women may be more likely to perceive an activity, such as walking, to be purposeful exercise due to their increased awareness of weight and fitness-related activities. Objective measures such as accelerometers may be useful to better understand whether physical activity levels differed by restraint.

Depression, anxiety and stress scores assessed by the Daily Stress Inventory (DSI), Depression Anxiety Stress Scales (DASS) and Perceived Stress Scale (PSS) were comparable between the LR and HR groups. The DASS was primarily used to assess depression and anxiety in our study population. The overall means on the three subscales were 7.7 ± 8.2 for depression, 6.5 ± 5.9 for anxiety and 12.9 ± 8.8 for stress. Scores on the DASS were compared to established norms created from a nonclinical sample of 717 male and female undergraduate students with a mean age of 21.0 years[76]. "Normal" scores fall between the range of 0-9 on the depression subscale, 0-7 on the anxiety subscale and 0-14 on the stress subscale[75]. Based on this categorization, the mean scores for all participants fell within the normal range and we can conclude that the participants in this study had a similar frequency of depressive, anxiety and stress symptoms as their general age group. Previous studies examining restraint among healthy premenopausal women have not commonly assessed depression and anxiety but based on our results, the level of restraint did not affect depression and anxiety assessed by the DASS.

On the other hand, perceived stress scores were regularly reported in past studies examining dietary restraint[7,12]. In a large questionnaire-based study, perceived stress scores were slightly (but significantly) higher among HR women than those categorized with low

levels of restraint[7]. It was hypothesized that higher levels of dietary restraint may heighten stress levels or alternatively, that higher levels of perceived stress may cause HR women to attend to negative food or weight-related thoughts more often. However, the findings of this study conflict with that hypothesis. Perceived stress scores also did not differ in a study of postmenopausal women with high and low levels of restraint, although urinary cortisol levels significantly differed between the two groups[3]. Since DSI scores also did not differ between restraint groups, it may be that stress experienced by HR women is primarily isolated to the domain of food and weight-related cognitions, which were not captured on stress scales.

5.5 Cue exposure, physiological arousal and CDR

One of my primary research questions was whether women at opposite ends of the CDR spectrum differ in their physiological response to cue exposure. Before this could be examined, it was important to determine whether participants as a whole showed physiological changes after exposure to food and weight-related stimuli. By using repeated measures ANOVAs, it was observed that SBP, DBP, heart rate and afternoon salivary cortisol levels significantly changed over time and mean scores decreased from baseline to final measures. However, this study did not detect any significant between-group differences.

The results are in accordance with the first hypothesis that a change in physiological measures would occur over the duration of the study. However, it was expected that cue exposure would lead to increases over time based on the belief that stimuli would activate the stress response similar to findings reported in past studies. In Vögele and colleagues' study on the effects of cue exposure on binge and nonbinge eaters, the main effect of time was

significant for measures of SBP, DBP and heart rate with significant increases from baseline for all participants[49]. There were key methodological differences in comparison to our study. Participants in Vögele *et al.*'s study had 20 minutes of intense cue exposure in which their individually selected favourite foods were placed on a rotating plate close to their face. Data were collected each minute and although binge eaters had a sustained increase in SBP over the 20 minute trial, nonbinge eaters experienced decreases in SBP after 10 minutes of food exposure, which was thought to represent habituation to the stressor.

Physiological arousal in response to cue exposure was also observed in a study involving 24 normal weight, non dieting women who were instructed to actively attend to their favourite foods by looking, smelling and licking food items[45]. Repeated measures ANOVAs involving 4 time points collected in 8 minute intervals showed significant increases in SBP, DBP and heart rate from the initial baseline measure. SBP and DBP remained significantly higher at the final measurement collected 24 minutes after the first, while heart rate decreased such that there was a nonsignificant change. A significant correlation was observed between restraint scores and SBP and DBP measures during cue exposure.

The contrast between our study's findings and past research may be due to differences in sampling and the nature of the stressor. Our sampling interval of 15 minutes was longer than both studies previously described. Physiological effects may not have been captured in our study since we collected samples over a longer duration, but with more time between samples. The stressors chosen for this study were also more subtle in nature. Food temptations and media images were selected to represent environmental cues commonly experienced by the general population. Care was taken to ensure the participant was aware

of food items next to her throughout the study; however, there were no instructions for direct visual attention as she completed the questionnaire package. Packaged foods were chosen due to budget and food safety reasons but the packaging may have decreased the impact of the visual stimulus. Packaging also prevented an olfactory stimulus from having an effect. Lastly, food items were chosen to represent a variety of food preferences from salty to sweet, unhealthy to healthy, but it is possible that the cues that would have provoked the most significant response for each participant were not selected.

Other studies using subtle cues have had a tendency to report null findings as well. In a study on restrained (n = 11) and unrestrained women (n = 13) categorized using the Restraint Scale, physiological responses including heart rate measures were assessed immediately after exposure to pictures of neutral items, body shapes or participants' favourite food items[51]. No significant between-group differences in cue reactivity were reported, nor were food slides shown to cause consistent physiological changes compared to neutral slides. Although the small sample size limits the power to detect minor differences, our study had a larger number of participants and confirms that subtle cues do not appear to differentially activate the stress response in HR versus LR women. An additional study observed no significant between-group differences in the stress reactivity of low (n = 38) and high restraint (n = 39) women assessed using Restraint Scale[50]. In this study, women completed stressful cognitive tests with food placed nearby on a table, with instructions that it could be eaten later. Participants had significant increases in SBP, DBP and heart rate from baseline to the end of the task period, which was expected due to the nature of the stressful cognitive tests.

A point of interest in our study is that HR women self-reported increased stress due to study participation in comparison to LR women, $p < 0.05$. CDR-related stress may not have been captured through afternoon salivary cortisol measures because cortisol levels could have decreased due to the natural circadian rhythms more than any stress-related increase over the 2 hour lab visit. Putterman and Linden reported similar findings when they collected afternoon saliva samples before and after questionnaire package completion in a subset of 48 of 170 women[12]. It was hypothesized that cortisol would be higher after completing restraint-related questionnaires but afternoon cortisol levels were actually lower in those who provided samples after completing the questionnaire (n = 48, $t(165) = -2.4$, $p < 0.05$). They proposed that the hour required to fill out the questionnaire may have had a sedating effect or that circadian rhythms were responsible for the decrease in cortisol. The seated period in our study was a half hour to a full hour longer than theirs so a potential sedating effect and the role of natural decreases due to circadian patterns could have had a larger effect.

A further point of importance regarding afternoon salivary cortisol is that our sample population differs from past studies because we observed no afternoon differences in mean values between LR and HR women. Much of previous literature reported higher levels of afternoon salivary cortisol[11,12] and 24 hour urinary cortisol[17] in HR women. It is unknown why our findings contrast previous studies. Ethnicity was one between-group difference that was taken into consideration in post-hoc analysis. Overall, more Asian women participated in this study than Caucasian students, which is reflective of the UBC student demographic. Ethnicity had the potential to act as a confounding variable since differing cultural beliefs and physiological responses could have affected our research outcome. However, ethnicity

did not appear to have a significant effect on cortisol levels during the cue exposure period or morning sampling when we controlled for this variable during statistical analysis. The number of ACR responders also was not affected by reported ethnicity. Participants' ethnic breakdown has often been described in past studies but usually not in relationship to restraint categories. Ethnicity also was not a primary research question in this study so a thorough investigation could not be accomplished.

In conclusion, the cues used in this study may not have been ideal since the saliency of food cues appears to have a key role in predicting whether physiological changes are captured in an experimental setting. Strong visual and olfactory cues consistently cause physiological arousal. Subtle cues, as used in this study, do not appear to elicit increases in blood pressure, heart rate or afternoon salivary cortisol that can be measured in an experimental setting.

5.6 ACR and dietary restraint

The awakening cortisol response was assessed the morning after the lab visit to investigate whether differences were apparent between LR and HR women. There were several strengths to this part of the procedure. It was emphasized that sampling should be completed in 15 minute intervals immediately upon awakening. This was completed correctly based on sampling logs. Furthermore, participants were instructed to call the student investigator if delays occurred, rather than sample inaccurately. A few participants did reschedule the procedure, which helped to minimize sampling error. Lastly, participants were asked if any problems arose when they returned the samples and no serious issues were reported.

A minimum 2.5 nmol/L increase in cortisol after awakening is required for a participant to be classified as a "responder" who shows an ACR[33]. In our study, 94.3% of participants met this criterion, providing confidence that the morning sampling procedure effectively captured the ACR. Although most women were observed to show an ACR, no between-group differences were observed between LR and HR women when analyzed using repeated measures ANOVA, change scores and area under the curve measures.

Null findings have also been reported in a previous study where premenopausal women provided a single morning sample roughly 30 minutes after awakening[12]. Although this procedure does not fully capture the profile of the ACR and is more likely to be affected by inaccurate timing, no significant differences were observed between LR and HR women.

The only study that has reported significant findings was completed by Therrien and colleagues[44]. The ACR of female participants was negatively correlated with certain eating attitude variables including disinhibition, hunger, drive for thinness, body dissatisfaction and interoceptive awareness. However, given the many variables that were assessed in this study, there is a possibility that the finding was due to chance. Alternatively, the conflicting findings may result from different participant characteristics in comparison to our study. Both studies involved premenopausal women; however, Therrien's study recruited women who were older (mean age of 37.0 ± 1.4 years) and included obese and reduced obese women (mean BMI of 28.8 ± 1.2).

Although CDR is believed to involve HPA axis dysregulation similarly to other psychosocial conditions correlated with ACR disturbances[37], the failure to detect an association between CDR and the ACR suggests that differences exist between conditions. As a result of these differences, CDR may not exert clinical effects like other stressors. CDR

has not been recognized as a clinical condition due to its subtle, yet chronic nature. HR participants in this study did not show increased depression, anxiety or general perceived stress and while these factors have been related to ACR disturbances, CDR does not appear to have a causative role.

5.7 Conclusions, study strengths, limitations and future directions

This study adds new findings to the field of literature on cognitive dietary restraint by examining the short-term effects of cue exposure and the awakening cortisol response in women experiencing very high or low levels of restraint. Overall, this study supports much of the past literature on CDR while presenting some conflicting findings. Women were chosen to be on opposite ends of the TFEQ-R scale and did not differ in age, occupation or anthropometric measures. Mean scores on eating attitude questionnaires were comparable to previous cohorts of young university aged women, with body shape being a central concern for HR women in our sample. As expected, the HR group had significantly higher scores on eating attitude subscales such as the BSQ, BAAS and EDE-Q. Depression, anxiety, stress and physical activity measures did not differ between groups, although self-reported stress due to study participation was significantly higher in the HR group. Despite this finding, the experimental setting did not lead to significant between-group differences in physiological arousal in the measures of blood pressure, heart rate or afternoon salivary cortisol. The stressor likely was not of sufficient magnitude to show large increases from baseline measures. Furthermore, the decrease in mean afternoon cortisol may have resulted from the natural fall in cortisol levels over time that was greater than any potential stress-related elevation. Lastly, the ACR did not differ between groups. While other psychosocial

conditions have caused ACR disturbances, CDR may not be a stressor of significant magnitude to show this type of physiological change.

There were several strengths to the study design. We minimized confounding variables among participant groups by excluding those who used medications affecting blood pressure or cortisol release. Furthermore, all participants visited the lab during the days 2-10 of their menstrual cycle to avoid hormonal effects and between 1-5pm to lessen the effects of circadian rhythms on cortisol release. We emphasized the importance of accurate sampling to prevent non-compliance in the morning sampling procedure. Participants were comfortable sampling in 15 minute intervals having done so in the lab the day before. Furthermore, we encouraged that they call us to reschedule if problems arose rather than sampling inaccurately. Compliance was discussed prior to the debriefing session and analysis of the sampling logs showed that deviations were minimal. Lastly, only 2 of 70 participants guessed the true purpose of the study so deception was successful.

Study limitations have been previously mentioned and are mostly focused on the nature of the stressor. Since our research question required a stressor that reflected everyday food and weight-related cues, a key component of the research design was choosing a stressor that would act as a cue, without being overly obvious to the participant. As a result, we did not tell the participant to directly attend to the experimental cues but this might have been necessary to evoke a strong physiological response. Cost and food safety concerns resulted in the use of packaged foods that the participant was encouraged to take with her; however, the packaging may have decreased the strength of the temptation item. There is also the possibility that the food items provided may not have reflected the participant's most stress-provoking food, although we did choose a variety of food items to minimize this

concern. Morning sampling is believed to be completed as requested but the possibility remains that participants may not have been as careful as desired, especially when providing the first sample immediately upon awakening. Multiple days of sampling would have increased accuracy but this method was not chosen since it would have increased participant burden.

Based on study results, there are several suggestions for future work. The impact of ethnicity presents an area of future exploration. In our study, we asked participants to self-identify their ethnic group on a pre-selected list, with the option of "other" if needed. Data were collapsed into the categories of Caucasian and Asian for simplicity, resulting in the loss of some information and roughly two-thirds of participants classified as "Asian". It could be of interest to identify whether the assessment scales used adequately reflected the concerns of all ethnic groups. Exploring ethnicity issues also requires consideration of the degree of acculturation among participants. Acculturation varied since some participants had lived in Canada all of their lives, while others were exchange students from various parts of the world. Since regional and cultural groups vary in their beliefs about food and weight-related issues, future studies could benefit from assessing the participant's beliefs in relation to their ethnicity.

Future work examining the stress-related effects of cue exposure would need to alter the stressor used. If possible, future studies may benefit from using cues that are more provoking through sight and smell such as baked goods rather than packaged foods. Pre-study questions that discretely ask the participant of their food preferences could also help to maximize the strength of the stressor by ensuring that the cues selected are most likely to provoke a response. Lastly, it could be of interest to see if and how the study influenced the

participant's day after the lab visit. Since HR participants significantly differed from the LR group in the Disinhibition subscale, cue temptations may have had effects beyond the study procedure. Overall, this study added to the literature on cognitive dietary restraint and serves to illustrate that the relationship between CDR and physiological stress requires further research.

BIBLIOGRAPHY

1. Wansink B, Sobal J. Mindless eating: the 200 daily food decisions we overlook. *Environ Behav*. 2007;39(1):106-123.
2. Herman CP, Mack D. Restrained and unrestrained eating. *J Pers*. 1975;43(4):647-660.
3. Rideout CA, Linden W, Barr SI. High cognitive dietary restraint is associated with increased cortisol excretion in postmenopausal women. *J Gerontol A Biol Sci Med Sci*. 2006;61(6):628-633.
4. Wardle J, Haase AM, Steptoe A, Nillapun M, Jonwutiwes K, Bellisle F. Gender differences in food choice: the contribution of health beliefs and dieting. *Ann Behav Med*. 2004;27(2):107-116.
5. Lowe MR, Timko CA. What a difference a diet makes: towards an understanding of differences between restrained dieters and restrained nondieters. *Eat Behav*. 2004;5(3):199-208.
6. Beiseigel JM, Nickols-Richardson SM. Cognitive eating restraint scores are associated with body fatness but not with other measures of dieting in women. *Appetite*. 2004;43(1):47-53.
7. McLean JA, Barr SI. Cognitive dietary restraint is associated with eating behaviors, lifestyle practices, personality characteristics and menstrual irregularity in college women. *Appetite*. 2003;40(2):185-192.
8. Dykes J, Brunner EJ, Martikainen PT, Wardle J. Socioeconomic gradient in body size and obesity among women: the role of dietary restraint, disinhibition and hunger in the Whitehall II study. *Int J Obes Relat Metab Disord*. 2004;28(2):262-268.

9. Stunkard AJ, Messick S. The three-factor eating questionnaire to measure dietary restraint, disinhibition and hunger. *J Psychosom Res*. 1985;29(1):71-83.
10. Herman CP, Polivy J. Restrained eating. In: Stunkard A, ed. *Obesity*. Philedelphia, PA: Saunders;1980:208–225
11. Anderson DA, Shapiro JR, Lundgren JD, Spataro LE, Frye CA. Self-reported dietary restraint is associated with elevated levels of salivary cortisol. *Appetite*. 2002;38(1):13-17.
12. Putterman E, Linden W. Cognitive dietary restraint and cortisol: importance of pervasive concerns with appearance. *Appetite*. 2006;47(1):64-76.
13. Van Loan MD, Keim NL. Influence of cognitive eating restraint on total-body measurements of bone mineral density and bone mineral content in premenopausal women aged 18-45 y: a cross-sectional study. *Am J Clin Nutr*. 2000;72(3):837-843.
14. Rutters F, Nieuwenhuizen AG, Lemmens SG, Born JM, Westerterp-Plantenga MS. Hyperactivity of the HPA axis is related to dietary restraint in normal weight women. *Physiol Behav*. 2009;96(2):315-319.
15. Waugh EJ, Polivy J, Ridout R, Hawker GA. A prospective investigation of the relations among cognitive dietary restraint, subclinical ovulatory disturbances, physical activity, and bone mass in healthy young women. *Am J Clin Nutr*. 2007;86(6):1791-1801.
16. Rideout CA, McLean JA, Barr SI. Women with high scores for cognitive dietary restraint choose foods lower in fat and energy. *J Am Diet Assoc*. 2004;104(7):1154-1157.
17. McLean JA, Barr SI, Prior JC. Cognitive dietary restraint is associated with higher urinary cortisol excretion in healthy premenopausal women. *Am J Clin Nutr*. 2001;73(1):7-12.

18. Vescovi JD, Scheid JL, Hontscharuk R, De Souza MJ. Cognitive dietary restraint: impact on bone, menstrual and metabolic status in young women. *Physiol Behav*. 2008;95(1-2):48-55.
19. Tsigos C, Chrousos GP. Hypothalamic-pituitary-adrenal axis, neuroendocrine factors and stress. *J Psychosom Res*. 2002;53(4):865-871.
20. Pirke KM, Tuschl RJ, Spyra B, et al. Endocrine findings in restrained eaters. *Physiol Behav*. 1990;47(5):903-906.
21. Nickols-Richardson SM, Beiseigel JM, Gwazdauskas FC. Eating restraint is negatively associated with biomarkers of bone turnover but not measurements of bone mineral density in young women. *J Am Diet Assoc*. 2006;106(7):1095-1101.
22. Herman JP, Ostrander MM, Mueller NK, Figueiredo H. Limbic system mechanisms of stress regulation: hypothalamo-pituitary-adrenocortical axis. *Prog Neuropsychopharmacol Biol Psychiatry*. 2005;29(8):1201-1213.
23. Levine A, Zagoory-Sharon O, Feldman R, Lewis JG, Weller A. Measuring cortisol in human psychobiological studies. *Physiol Behav.* 2007;90(1):43-53.
24. Whitworth JA, Williamson PM, Mangos G, Kelly JJ. Cardiovascular consequences of cortisol excess. *Vasc Health Risk Manag*. 2005;1(4):291-299.
25. Mazziotti G, Angeli A, Bilezikian JP, Canalis E, Giustina A. Glucocorticoid-induced osteoporosis: an update. *Trends Endocrinol Metab*. 2006;17(4):144-149.
26. Balasch J. Sex steroids and bone: current perspectives. *Hum Reprod Update*. 2003;9(3):207-222.
27. Schweiger U, Tuschl RJ, Platte P, Broocks A, Laessle RG, Pirke KM. Everyday eating behavior and menstrual function in young women. *Fertil Steril*. 1992;57(4):771-775.

28. Barr SI, Prior JC, Vigna YM. Restrained eating and ovulatory disturbances: possible implications for bone health. *Am J Clin Nutr*. 1994;59(1):92-97.

29. Barr SI, Janelle KC, Prior JC. Vegetarian vs nonvegetarian diets, dietary restraint, and subclinical ovulatory disturbances: prospective 6-mo study. *Am J Clin Nutr*. 1994;60(6):887-894.

30. McLean JA, Barr SI, Prior JC. Dietary restraint, exercise, and bone density in young women: are they related? *Med Sci Sports Exerc*. 2001;33(8):1292-1296.

31. Young EA, Abelson J, Lightman SL. Cortisol pulsatility and its role in stress regulation and health. *Front Neuroendocrinol,*. 2004;25(2):69-76.

32. Pruessner JC, Wolf OT, Hellhammer DH, et al. Free cortisol levels after awakening: a reliable biological marker for the assessment of adrenocortical activity. *Life Sci*. 1997;61(26):2539-2549.

33. Wüst S, Wolf J, Hellhammer DH, Federenko I, Schommer N, Kirschbaum C. The cortisol awakening response - normal values and confounds. *Noise Health*. 2000;2(7):79-88.

34. Coste J, Strauch G, Letrait M, Bertagna X. Reliability of hormonal levels for assessing the hypothalamic-pituitary-adrenocortical system in clinical pharmacology. *Br J Clin Pharmacol*. 1994;38(5):474-479.

35. Clow A, Thorn L, Evans P, Hucklebridge F. The awakening cortisol response: methodological issues and significance. *Stress*. 2004;7(1):29-37.

36. Schmidt-Reinwald A, Pruessner JC, Hellhammer DH, et al. The cortisol response to awakening in relation to different challenge tests and a 12-hour cortisol rhythm. *Life Sci*. 1999;64(18):1653-1660.

37. Chida Y, Steptoe A. Cortisol awakening response and psychosocial factors: a systematic review and meta-analysis. *Biol Psychol*. 2009;80(3):265-278.

38. Schulz P, Kirschbaum C, Prüßner J, Hellhammer D. Increased free cortisol secretion after awakening in chronically stressed individuals due to work overload. *Stress Med*. 1998;14(2):91-97.

39. Wüst S, Federenko I, Hellhammer DH, Kirschbaum C. Genetic factors, perceived chronic stress, and the free cortisol response to awakening. *Psychoneuroendocrinology*. 2000;25(7):707-720.

40. Fries E, Dettenborn L, Kirschbaum C. The cortisol awakening response (CAR): facts and future directions. *Int J Psychophysiol*. 2009;72(1):67-73.

41. Wilhelm I, Born J, Kudielka BM, Schlotz W, Wüst S. Is the cortisol awakening rise a response to awakening? *Psychoneuroendocrinology*. 2007;32(4):358-366.

42. Schlotz W, Hellhammer J, Schulz P, Stone AA. Perceived work overload and chronic worrying predict weekend-weekday differences in the cortisol awakening response. *Psychosom Med*. 2004;66(2):207-214.

43. Thorn L, Hucklebridge F, Evans P, Clow A. Suspected non-adherence and weekend versus week day differences in the awakening cortisol response. *Psychoneuroendocrinology*. 2006;31(8):1009-1018.

44. Therrien F, Drapeau V, Lupien SJ, et al. Awakening cortisol response in relation to psychosocial profiles and eating behaviors. *Physiol Behav*. 2008;93(1-2):282-288.

45. Nederkoorn C, Smulders FT, Jansen A. Cephalic phase responses, craving and food intake in normal subjects. *Appetite*. 2000;35(1):45-55.

46. Mattes RD. Physiologic responses to sensory stimulation by food: nutritional implications. *J Am Diet Assoc*. 1997;97(4):406-413.

47. Tepper BJ. Dietary restraint and responsiveness to sensory-based food cues as measured by cephalic phase salivation and sensory specific satiety. *Physiol Behav*. 1992;52(2):305-311.

48. Fedoroff IC, Polivy J, Herman CP. The effect of pre-exposure to food cues on the eating behavior of restrained and unrestrained eaters. *Appetite*. 1997;28(1):33-47.

49. Vögele C, Florin I. Psychophysiological responses to food exposure: An experimental study in binge eaters. *Int J Eat Disord.* 1997;21(2):147-157.

50. Rutledge T, Linden W. To eat or not to eat: affective and physiological mechanisms in the stress-eating relationship. *J Behav Med*. 1998;21(3):221-240.

51. Overduin J, Jansen A, Eilkes H. Cue reactivity to food- and body-related stimuli in restrained and unrestrained eaters. *Addict Behav*. 1997;22(3):395-404.

52. Brydon L, Wright CE, O'Donnell K, Zachary I, Wardle J, Steptoe A. Stress-induced cytokine responses and central adiposity in young women. *Int J Obes (Lond)*. 2008;32(3):443-450.

53. Kirschbaum C, Kudielka BM, Gaab J, Schommer NC, Hellhammer DH. Impact of gender, menstrual cycle phase, and oral contraceptives on the activity of the hypothalamus-pituitary-adrenal axis. *Psychosom Med*. 1999;61(2):154-162.

54. Gibson EL, Checkley S, Papadopoulos A, Poon L, Daley S, Wardle J. Increased salivary cortisol reliably induced by a protein-rich midday meal. *Psychosom Med*. 1999;61(2):214-224.

55. Toda M, Morimoto K, Nagasawa S, Kitamura K. Effect of snack eating on sensitive salivary stress markers cortisol and chromogranin A. *Environ Health Prev Med*. 2004;9(1):27-29.

56. Kirschbaum C, Hellhammer DH. Salivary cortisol in psychoneuroendocrine research: recent developments and applications. *Psychoneuroendocrinology*. 1994;19(4):313-333.

57. Roy MP. Patterns of cortisol reactivity to laboratory stress. *Horm Behav*. 2004;46(5):618-627.

58. Pruessner JC, Kirschbaum C, Meinlschmid G, Hellhammer DH. Two formulas for computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. *Psychoneuroendocrinology*. 2003;28(7):916-931.

59. Kudielka BM, Broderick JE, Kirschbaum C. Compliance with saliva sampling protocols: electronic monitoring reveals invalid cortisol daytime profiles in noncompliant subjects. *Psychosom Med.* 2003;65(2):313-319.

60. Westenhoefer J, Stunkard AJ, Pudel V. Validation of the flexible and rigid control dimensions of dietary restraint. *Int J Eat Disord*. 1999;26(1):53-64.

61. Westenhoefer J, Broeckmann P, Münch AK, Pudel V. Cognitive control of eating behaviour and the disinhibition effect. *Appetite*. 1994;23(1):27-41.

62. Cooper PJ, Taylor MJ, Cooper Z, Fairburn CG. The development and validation of the Body Shape Questionnaire. *Int J Eat Disord*. 1987;6(4):485-494.

63. Evans C, Dolan B. Body Shape Questionnaire: derivation of shortened "alternate forms". *Int J Eat Disord*. 1993;13(3):315-321.

64. Pook M, Tuschen-Caffier B, Brähler E. Evaluation and comparison of different versions of the Body Shape Questionnaire. *Psychiatry Res*. 2008;158(1):67-73.

65. Spangler DL, Stice E. Validation of the Beliefs About Appearance Scale. *Cognit Ther and Res*. 2001;25(6):813-827.

66. Fairburn CG, Beglin SJ. Assessment of eating disorders: interview or self-report questionnaire? *Int J Eat Disord*. 1994;16(4):363-370.

67. Cooper Z, Fairburn C. The Eating Disorder Examination: a semi-structured interview for the assessment of the specific psychopathology of eating disorders. *Int J Eat Disord*. 1987;6(1):1-8.

68. Luce KH, Crowther JH. The reliability of the Eating Disorder Examination-Self-Report Questionnaire Version (EDE-Q). *Int J Eat Disord*. 1999;25(3):349-351.

69. Mond JM, Hay PJ, Rodgers B, Owen C, Beumont PJ. Temporal stability of the Eating Disorder Examination Questionnaire. *Int J Eat Disord*. 2004;36(2):195-203.

70. Baecke JA, Burema J, Frijters JE. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *Am J Clin Nutr*. 1982;36(5):936-942.

71. Philippaerts RM, Westerterp KR, Lefevre J. Doubly labelled water validation of three physical activity questionnaires. *Int J Sports Med*. 1999;20(5):284-289.

72. Brantley PJ, Waggoner CD, Jones GN, Rappaport NB. A Daily Stress Inventory: development, reliability, and validity. *J Behav Med*. 1987;10(1):61-74.

73. Brantley PJ, Dietz LS, McKnight GT, Jones GN, Tulley R. Convergence between the Daily Stress Inventory and endocrine measures of stress. *J Consult Clin Psychol*. 1988;56(4):549-551.

74. Roy M, Kirschbaum C, Steptoe A. Intraindividual variation in recent stress exposure as a moderator of cortisol and testosterone levels. *Ann Behav Med*. 2003;26(3):194-200.

75. Lovibond S, Lovibond PF. *Manual for the Depression Anxiety Stress Scales*. 2nd ed. Sydney, AU; Psychology Foundation;1995.

76. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav Res Ther*. 1995;33(3):335-343.

77. Crawford JR, Henry JD. The Depression Anxiety Stress Scales (DASS): normative data and latent structure in a large non-clinical sample. *Br J Clin Psychol*. 2003;42(2):111-131.

78. Antony M, Bieling P, Cox B, Enns M, Swinson R. Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychol Assess*. 1998;10(2):176-181.

79. Brown TA, Chorpita BF, Korotitsch W, Barlow DH. Psychometric properties of the Depression Anxiety Stress Scales (DASS) in clinical samples. *Behav Res Ther*. 1997;35(1):79-89.

80. Gotthardt U, Schweiger U, Fahrenberg J, Lauer CJ, Holsboer F, Heuser I. Cortisol, ACTH, and cardiovascular response to a cognitive challenge paradigm in aging and depression. *Am J Physiol*. 1995;268(4 pt 2):R865-873.

81. Stetler C, Miller GE. Blunted cortisol response to awakening in mild to moderate depression: regulatory influences of sleep patterns and social contacts. *J Abnorm Psychol*. 2005;114(4):697-705.

82. Pruessner M, Hellhammer DH, Pruessner JC, Lupien SJ. Self-reported depressive symptoms and stress levels in healthy young men: associations with the cortisol response to awakening. *Psychosom Med*. 2003;65(1):92-99.

83. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24(4):385-396.

84. Flint A, Raben A, Blundell JE, Astrup A. Reproducibility, power and validity of visual analogue scales in assessment of appetite sensations in single test meal studies. *Int J Obes Relat Metab Disord*. 2000;24(1):38-48.

85. Stubbs RJ, Hughes DA, Johnstone AM, et al. The use of visual analogue scales to assess motivation to eat in human subjects: a review of their reliability and validity with an evaluation of new hand-held computerized systems for temporal tracking of appetite ratings. *Br J Nutr*. 2000;84(4):405-415.

86. Kudielka BM, Kirschbaum C. Sex differences in HPA axis responses to stress: a review. *Biol Psychol*. 2005;69(1):113-132.

87. Kirschbaum C, Hellhammer DH. Salivary cortisol in psychobiological research: An overview. *Neuropsychobiology*. 1989;22(3):150-169.

88. Noble RE. Diagnosis of stress. *Metabolism*. 2002;51(6):37-39.

89. Amoore JN, Dewar D, Gough K, Padfield PL. Do SpaceLabs ambulatory non-invasive blood pressure recorders measure blood pressure consistently over several years use? *Blood Press Monit*. 2005;10(1):51-56.

90. O'Brien E, Atkins N, Mee F, O'Malley K. Comparative accuracy of six ambulatory devices according to blood pressure levels. *J Hypertens*. 1993;11(6):673-675.

91. Edwards S, Clow A, Evans P, Hucklebridge F. Exploration of the awakening cortisol response in relation to diurnal cortisol secretory activity. *Life Sci*, 2001;68(1):2093-2103.

92. Edwards S, Evans P, Hucklebridge F, Clow A. Association between time of awakening and diurnal cortisol secretory activity. *Psychoneuroendocrinology*. 2001;26(6):613-622.

93. DeSantis AS, Adam EK, Mendelsohn KA, Doane LD. Concordance between self-reported and objective wakeup times in ambulatory salivary cortisol research. *Int J Behav Med*. 2010;17(1):74-78.

94. Spangler DL. Testing the cognitive model of eating disorders: The role of dysfunctional beliefs about appearance. *Behav Ther.* 2002;33(1):87-105.

95. Luce KH, Crowther JH, Pole M. Eating Disorder Examination Questionnaire (EDE-Q): norms for undergraduate women. *Int J Eat Disord*. 2008;41(3):273-276.

96. Mond JM, Hay PJ, Rodgers B, Owen C. Eating Disorder Examination Questionnaire (EDE-Q): norms for young adult women. *Behav Res Ther*. 2006;44(1):53-62.

APPENDIX A: RECRUITMENT POSTER

The UBC Human Nutrition Lab is looking for *female* participants for a study on *eating attitudes and stress*

Your participation will involve:

1. A 2 hour lab visit where you will complete a questionnaire package while we monitor your blood pressure and collect saliva samples.
2. Providing 4 saliva samples collected within the first hour of awakening the next morning (at your own home).

You will receive a $20 gift certificate for your participation.

If you are interested in participating or would like further information, please contact:

eatingattitude@gmail.com

Eating Attitudes Study eatingattitude@gmail.com
Eating Attitudes Study eatingattitude@gmail.com
Eating Attitudes Study eatingattitude@gmail.com
Eating Attitudes Study eatingattitude@gmail.com
Eating Attitudes Study eatingattitude@gmail.com
Eating Attitudes Study eatingattitude@gmail.com
Eating Attitudes Study eatingattitude@gmail.com
Eating Attitudes Study eatingattitude@gmail.com
Eating Attitudes Study eatingattitude@gmail.com

APPENDIX B: RECRUITMENT E-MAIL

Dear _____,

Thank you for your interest in the Eating Attitudes and Stress study! This study involves a 2 hour lab visit in which you will be asked to complete a questionnaire package while we monitor your blood pressure and collect saliva samples. On the next day, you will be asked to provide 4 saliva samples collected within the first hour of awakening (this step will be done at your own home). After returning the samples to the lab, you will receive a $20 gift certificate (Starbucks, Safeway or UBC Food Services) for all of your help!

To participate in this study, you must complete a short online screening questionnaire (less than 5 min) to determine whether you meet the eligibility criteria for our study. All participants must be between 19-35 years of age, non-smokers and fall within a range of scores on a screening questionnaire. You will be e-mailed if your score does not fall within the range required. If you are eligible, we will call you to schedule a lab visit at your convenience.

The questionnaire can be accessed by going to the following website:

https://www.surveymonkey.com/s.aspx?sm=PBtth8n_2fui1vc2roKgtyvA_3d_3d

Thanks again for your interest and participation. Feel free to forward this message to any friends you think may be interested in being involved in our study. If you have any questions, please do not hesitate to ask.

Mandeep

Please note: Survey Monkey, a commercial online survey company, is being used to host the screening questionnaire (www.surveymonkey.com). This company was selected due to its high user ratings, no spam policy, and high degree of data security. Please be advised that any information provided to a US company is subject to the Patriot Act which allows authorities access to the records of internet service providers. The websurvey company servers record incoming IP addresses of the computer that you use to access the survey but no connection is made between your data and your computer's IP address. If you choose to participate in the survey, you understand that your responses to the survey questions will be stored and accessed in the USA. The security and privacy policy for Survey Monkey can be found at the following link: http://www.surveymonkey.com/HelpCenter/Answers.aspx?CatID=6.

APPENDIX C: SCREENING QUESTIONNAIRE

The purpose of this questionnaire is to determine whether you meet the eligibility criteria for our study. Please answer the following questions as accurately as possible. All responses on this website are secure and encrypted. Your information will remain confidential and will only be used by the research team for screening assessment. You will be e-mailed if your score does not fall within the specified range required for this study. If you are eligible, we will call you to schedule a lab visit at your convenience. Thank you for your interest and participation.

Please note: This screening questionnaire is hosted on Survey Monkey, a commercial online survey company based in the US (www.surveymonkey.com). This company was selected due to its high user ratings, no spam policy, and high degree of data security. Please be advised that any information provided to a US company is subject to the Patriot Act which allows authorities access to the records of internet service providers. This company servers record incoming IP addresses of the computer that you use to access the survey but no connection is made between your data and your computer's IP address. If you choose to participate in the survey, you understand that your responses to the survey questions will be stored and accessed in the USA. The security and privacy policy for Survey Monkey can be found at the following link: http://www.surveymonkey.com/HelpCenter/Answers.aspx?CatID=6.

1. Name:_____
2. Phone number: _____
3. E-mail address: _____
4. Birthday (month/date/year): _____
5. What is your current weight in pounds (please provide best estimate)? _____ lbs
6. What is your current height (please provide best estimate): _____feet _____inches
7. Do you regularly smoke cigarettes? Please choose one: Yes No
8. Have you had an eating disorder? Please choose one: Yes No
9. Are you currently pregnant or lactating? Please choose one: Yes No
10. Do you use oral contraceptives (ie: "the pill")? Please choose one: Yes No
11. Do you take any blood pressure medications? Please choose one: Yes No
12. Do you take any corticosteroids? Please choose one: Yes No
13. Do you currently take any antihistamines? Please choose one: Yes No
14. Please list any other prescription medications you commonly take: _____

Please read each statement and answer True (T) or False (F). Please answer each question as best as you can.

	True	False
15. When I have eaten my quota of calories, I am usually good about not eating any more……	**T**	**F**
16. I deliberately take small helpings as a means of controlling my weight.	**T**	**F**
17. Life is too short to worry about dieting……..……..	**T**	**F**
18. I have a pretty good idea of the number of calories in common foods…	**T**	**F**
19. While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it……...	**T**	**F**
20. I enjoy eating too much to spoil it by counting calories or watching my weight……...	**T**	**F**
21. I often stop eating when I am not really full as a conscious means of limiting the amount of food that I eat……..……	**T**	**F**
22. I consciously hold back at meals in order to not gain weight……..	**T**	**F**
23. I eat anything I want, anytime I want……..…….	**T**	**F**
24. I count calories as a conscious means of controlling my weight…….	**T**	**F**
25. I do not eat some foods because they make me fat……..……	**T**	**F**
26. I pay a great deal of attention to changes in my figure……	**T**	**F**

Please answer the following questions by circling the number above the response that is most appropriate to you. Please answer the questions as best as you can.

27. How often are you dieting in a conscious effort to control your weight?

1	*2*	*3*	*4*
Rarely	*Sometimes*	*Usually*	*Always*

28. Would a weight fluctuation of 5 lbs (~2.3 kg) affect the way you live your life?

1	*2*	*3*	*4*
Not at all	*Slightly*	*Moderately*	*Very much*

29. Do your feelings of guilt about overeating help you to control your food intake?

1	*2*	*3*	*4*
Never	*Rarely*	*Often*	*Always*

30. How conscious are you of what you are eating?

1	*2*	*3*	*4*
Not at all	*Slightly*	*Moderately*	*Extremely*

31. How frequently do you avoid 'stocking up' on tempting foods?

1	*2*	*3*	*4*
Almost never	*Seldom*	*Usually*	*Almost always*

32. How likely are you to shop for low calorie foods?

1	*2*	*3*	*4*
Unlikely	*Slightly likely*	*Moderately likely*	*Very likely*

33. How likely are you to consciously eat slowly in order to cut down on how much you eat?

1	*2*	*3*	*4*
Unlikely	*Slightly likely*	*Moderately likely*	*Very likely*

34. How likely are you to consciously eat less than you want?

1	*2*	*3*	*4*
Unlikely	*Slightly likely*	*Moderately likely*	*Very likely*

35. On a scale of 0 to 5, where 0 means no restraint in eating (eating whatever you want, whenever you want it) and 5 means total restraint (constantly limiting food intake and never 'giving in'), what would you number yourself? Please circle the number which best applies to you most of the time.

0	Eat whatever you want, whenever you want it.
1	Usually eat whatever you want, whenever you want it
2	Often eat whatever you want, whenever you want it.
3	Often limit food intake, rarely 'give in'.
4	Usually limit food intake, rarely 'give in'.
5	Constantly limiting food intake, never 'giving in'.

Thank you for completing this questionnaire. You will be contacted within the next few days and informed whether you are or are not eligible for participation.

APPENDIX D: E-MAIL TO INELIGIBLE PARTICIPANTS

Dear _____,

Thank you for the time you took to complete the online screening questionnaire for the *Eating Attitudes and Stress* study. Unfortunately, your score on this questionnaire does not fit within the range of scores required for participation in the full study protocol.

Confidentiality of the information you provided will be fully maintained. All information provided in your questionnaire has been deleted off of the secure, encrypted website.

If you have any further questions, please do not hesitate to e-mail our research team at eatingattitude@gmail.com.

Thank you,
Mandeep

APPENDIX E: REMINDER E-MAIL

Hi _____,

I hope you're doing well since we last spoke. I'm just sending a friendly reminder of your lab visit scheduled for _____ from _____ pm. If any conflicts come up with this scheduled time, please contact me as soon as you can by e-mail or at (778) XXX-XXXX.

Your lab visit is in **Room 313** at the Food, Nutrition and Health Building (2205 East Mall). To get there, take the stairs to the third floor and turn right. There will be signs directing you to the room.

Key information:

- As you may remember, your lab visit must occur between days 2-10 of your menstrual cycle. **Please e-mail me back** once you know the date your next cycle starts to ensure that _____ falls within this time period. If your period starts significantly later than expected, I'll be in touch to discuss whether rescheduling is necessary.
- We would like to take 2 baseline samples at the beginning of your visit. Please review the attached letter of consent so that we may begin as soon as you arrive.
- A lightweight blood pressure monitor will be placed on your non-dominant arm. Please wear a loose fitting shirt, t-shirt or a cami/tank top under your shirt.
- Please do not eat **within 2 hours** of you lab visit or engage in strenuous exercise the morning of your lab visit. Have a snack/meal 2 hours prior to your visit to ensure that you are **neither overly hungry nor overly full** when you arrive.
- Lastly, if you are currently experiencing significant levels of stress, **please contact me** so we can discuss potentially rescheduling your lab visit.

If you have any questions, please do not hesitate to ask. I look forward to hearing back from you soon!

Mandeep

APPENDIX F: CONSENT FORM

THE UNIVERSITY OF BRITISH COLUMBIA

Food, Nutrition and Health
Faculty of Land and Food Systems
2205 East Mall
Vancouver, B.C. Canada V6T 1Z4
Phone: (604) 822-2502
Fax: (604) 822-5143

Title of Study:
Eating Attitudes and Physiological Stress

SUBJECT INFORMATION AND CONSENT FORM

Principal Investigator:
Susan Barr, PhD, RD
Professor; Food, Nutrition and Health, University of British Columbia (UBC);
(604) 822-6766

Co-Investigators:
Mandeeep Sanghera, BScH, BA
MSc Candidate
Human Nutrition, UBC

Wolfgang Linden, PhD
Professor
Clinical Psychology, UBC
(604) 822-4156

Tim Green, PhD
Associate Professor
Human Nutrition, UBC
(604) 822-0421

Sponsor: Canadian Institutes of Health Research (CIHR)

Invitation to Participate:
You are being invited to participate in this study after indicating your interest and meeting eligibility requirements on our study website.

Your Participation is Voluntary: It is important that before you make a decision to participate, you read the rest of this form. This consent form will tell you about the study, why the research is being done, what will happen during the study and the possible risks, benefits, and discomforts. Please read the following form carefully and ask questions if anything is not clear.

If you wish to participate, you will be asked to sign this form. If you do decide to take part in this study, you are still free to withdraw at any time and without giving any reasons for your decision. If you do not wish to participate, you do not have to provide any reason for your decision not to participate. Please take the time to read this document carefully. If you wish, you may discuss it with your family, friends and others before you decide.

Purpose: The purpose of this study is to assess the physiological response of healthy young women completing questionnaires on eating attitudes and body image.

Who Can Participate?
You are eligible to participate in this study if you: (1) are a non-smoking female, (2) are between 19 and 35 years of age, (3) have a body mass index score that is neither underweight (less than 18.5 kg/m^2) nor obese (greater than 30 kg/m^2), (4) fall within a specified range of scores on a screening questionnaire regarding eating attitudes, and (5) are able to read and understand English.

Who Should Not Participate?
You are not able to participate in this study if you: (1) do not meet the inclusion criteria listed above, (2) use blood pressure medication, antihistamines or corticosteroids, (3) have been diagnosed with or treated for an eating disorder, or (4) are pregnant or lactating.

What Does the Study Involve?
If you are eligible for this study, your score on an eating attitudes questionnaire previously completed on our study website fell within a specified range. Furthermore, you met the eligibility criteria listed above (see Who Can Participate). If you choose to participate, you will visit UBC's Human Nutrition facilities for a two-hour lab visit. In this lab visit, the study procedure will be outlined and your height, weight, waist and hip circumference will be measured. You will be asked to complete a questionnaire package consisting of various instruments designed to assess eating attitudes, body image concerns and anxiety. While completing the questionnaire package, a compact, lightweight blood pressure (BP) monitor will be fitted on your non-dominant arm to collect BP readings every 15 minutes. Upon visiting the lab and at 15 minute intervals throughout the study, you will be asked to provide saliva samples using a tool called a Salivette. Saliva samples are collected to measure cortisol, a stress hormone in the human body.

At the completion of the lab visit, you will be provided with materials to collect saliva samples within your own home the next morning. You will be provided with Salivettes and general instructions, as well as a timer to remind you of when to take a sample. Saliva samples must be collected immediately upon awakening and 15, 30 and 45 minutes post-awakening. You will not be allowed to eat during this period of time to prevent sample contamination. You will be asked to return these samples to UBC's Human Nutrition facilities later that day, at which time you will receive a $20 gift certificate for your participation.

Potential Risks:
There are no known risks involved with participating in this research study.

Potential Benefits:
There is no direct benefit to you for participating in this study. It is hoped that the information gained from this research study will provide insight into the relationship between physiological stress and eating attitudes among young women. A summary of the research results, once completed, will be provided to you, if you would like to receive it.

Your Participant Rights & Responsibilities:
Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time without penalty or repercussions. You may withdraw without providing any explanation of your reasons for doing so. If you choose to enter the study and then decide to withdraw at a later time, all data collected about you during your enrolment in the study will be retained for analysis. By law, this data cannot be destroyed. Your participation in this study is not associated with any known risks of injury or illness. However, you do not waive any of your legal rights by signing this consent form. We ask that you please inform the research team if you are no longer able or willing to participate in the study.

Remuneration/Compensation:
After returning saliva samples to the UBC Human Nutrition facilities, you will receive a $20 gift certificate in recognition of your participation.

Confidentiality:
All samples, test results, questionnaires and other documents will be labelled with code numbers only (your name will not be associated with these results or documents) and will be kept in a locked filing cabinet in the investigators' office. After your saliva samples have been analyzed, they will be disposed of. Your study-related information will be used at UBC as part of the co-investigator's graduate thesis. Your confidentiality will be respected and no information that discloses your identity will be released or published. If the results of this study are published or presented in public, information that identifies you will be removed.

Contact Information: If you have any questions or desire further information about this study before or during participation, you can contact Mandeep Sanghera at (778) XXX-XXXX or Dr. Susan Barr at (604) 822-6766. If you have any concerns about your rights as a research subject and/or your experiences while participating in this study, contact the Research Subject Information Line in the University of British Columbia Office of Research Services at (604) 822-8598.

Consent to Participate:

- ☐ I have read and understood the subject information and consent form.
- ☐ I have had the opportunity to ask questions and have had satisfactory responses to my questions.
- ☐ I understand that all of the information collected will be kept confidential and that the result will only be used for scientific objectives.
- ☐ I understand that my participation in this study is voluntary and that I am completely free to refuse to participate or to withdraw from this study at any time and without changing in any way the quality of care that I receive.
- ☐ I understand that there is no guarantee that this study will provide any benefits to me.
- ☐ I have read this form and I freely consent to participate in this study.
- ☐ I have been told that I will receive a dated and signed copy of this form to keep for my records.

Printed Name of Participant	Signature	Date

Printed Name of Principal Investigator or Designated Representative	Signature	Date

APPENDIX G: QUESTIONNAIRE PART ONE

ID #_____

QUESTIONNAIRE PACKAGE – PART ONE –

INSTRUCTIONS

- **This will take 30 minutes to complete.**
- **Please answer the questions as best you can by choosing the most appropriate answer for each question. Ignore the columns marked "Office Use Only".**
- **Please use the provided pen. If you need to make any changes, please clearly indicate the desired answer with a note in the margin.**
- **Your confidentiality will be respected and no information that discloses your identity will be released.**
- **Please do not remove any pages and keep the booklet attached.**
- **Do not hesitate to contact Mandeep at (778) XXX-XXXX if you have any questions.**

Thank you very much for accurately completing this questionnaire!

PLEASE TURN THE PAGE TO BEGIN.

1. What is your current age? _____ years

2. Are you a student?

___ No
___ Yes → If **yes**: (a) Please check off to indicate whether you are:
___ An undergraduate student
___ A graduate student
___ An unclassified student
(b) What is your major? _____

3. With what race/ethnic group do you identify? (Check all that apply)

___ Caucasian
___ Chinese
___ South Asian (Indian, Pakistani, Punjabi, Sri Lankan)
___ Black (African, Haitian, Jamaican, Somali)
___ First Nations
___ Arab/West Asian (Armenian, Egyptian, Iranian, Lebanese)
___ Filipino
___ South East Asian (Cambodian, Indonesian, Vietnamese)
___ Latin American
___ Japanese
___ Korean
___ Other (please specify): _____

The following questions relate to lifestyle behaviours. Please answer the questions choosing the most appropriate answer for each statement.

4. How would you describe your typical diet?

____ Mixed: I eat meat, dairy products, eggs, fruits & vegetables, grains
____ Lacto-ovo vegetarian: I DO NOT eat meat, fish or poultry, but I DO eat dairy, eggs, fruits & vegetables, grains
____ Pesco-pollo vegetarian: I DO NOT eat red meat, but I DO eat chicken and/or fish, dairy, eggs, fruits & vegetables, grains
____ Vegan: I exclude ALL animal products
____ Other (please specify): _____

5. Are you *currently* trying to lose weight?

___ No
___ Yes

6. How do you feel about your weight right now?
   I think I am…
   ____ Very overweight
   ____ Slightly overweight
   ____ About right
   ____ Slightly underweight
   ____ Very underweight

7. Do you *currently* take any medications (including prescription, over-the-counter, homeopathic or naturopathic)?

   ___ No
   ___ Yes → If **yes**: please list the NAME of medication(s), what you are taking it for and the FREQUENCY you take them below (i.e. twice per day, daily, weekly, etc.):

   Example: Midol, Menstrual cramps, ~5 days per month

_____
_____
_____
_____
_____
_____
___

8. Do you *currently* take any nutritional or herbal supplements?

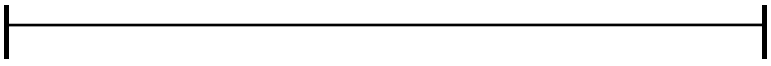
   ___ No
   ___ Yes → If **yes**: please list the NAME, DOSE, and BRAND of the supplement(s) and the FREQUENCY you use them (i.e. twice per day, daily, weekly, etc.):

   Example: Echinacea (1000 mg), Jamieson, Daily

_____
_____
_____
_____
_____

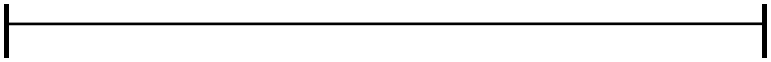
Questions 9-16 relate to your *current* level of appetite and desire for food. Please answer by placing a vertical mark in the appropriate position on the line below:

9. How hungry do you feel?



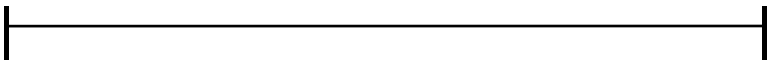
I am not hungry at all — I have never been more hungry

10. How satisfied do you feel?



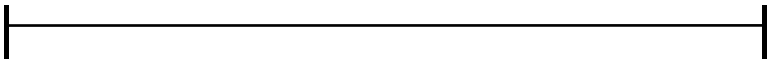
I am completely empty — I cannot eat another bite

11. How full do you feel?



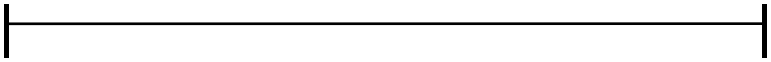
Not at all full — Totally full

12. How much do you think you can eat?



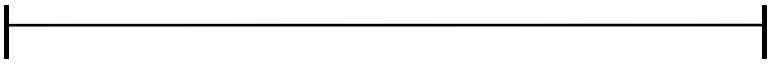
Nothing at all — A lot

13. Would you like to eat something sweet?



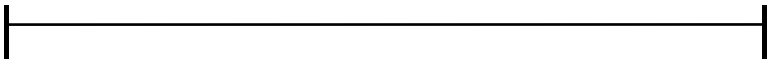
Yes, very much — No, not at all

14. Would you like to eat something salty?



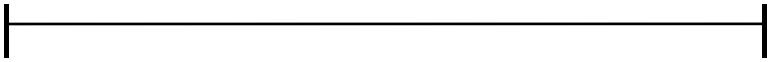
Yes, very much — No, not at all

15. Would you like to eat something savoury?



Yes, very much — No, not at all

16. Would you like to eat something fatty?



Yes, very much — No, not at all

The following questions relate to eating behaviours. Please read each statement and circle True (T) or False (F). Please answer each question as best you can.

	True	False
17. When I smell the aroma of my favourite food, I find it very difficult to keep from eating, even if I have just finished a meal……..	T	F
18. I usually eat too much at social occasions, like parties and picnics…….	T	F
19. I am usually so hungry that I eat more than three times a day…….	T	F
20. When I have eaten my quota of calories, I am usually good about not eating any more……..……..……	T	F
21. Dieting is so hard for me because I just get too hungry……..	T	F
22. I deliberately take small helpings as a means of controlling my weight.	T	F
23. Sometimes things just taste so good that I keep on eating even when I am no longer hungry……..……..….....	T	F
24. Since I am often hungry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat…….....	T	F
25. When I feel anxious, I find myself eating……..……..	T	F
26. Life is too short to worry about dieting……..……..	T	F
27. Since my weight goes up and down, I have gone on reducing diets more than once…….	T	F
28. I often feel so hungry that I just have to eat something……..	T	F
29. When I am with someone who is overeating, I usually overeat too……	T	F
30. I have a pretty good idea of the number of calories in common foods…	T	F
31. Sometimes when I start eating, I just can't seem to stop…….	T	F
32. It is not difficult for me to leave something on my plate…….	T	F
33. At certain times of the day, I get hungry because I have gotten used to eating then……	T	F
34. While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it……..…….	T	F
35. Being with someone who is eating often makes me hungry enough to eat also….....	T	F
36. When I feel blue, I often overeat……..……	T	F
37. I enjoy eating too much to spoil it by counting calories or watching my weight……..	T	F
38. When I see a real delicacy, I often get so hungry that I have to eat right away……	T	F

39. I often stop eating when I am not really full as a conscious means of limiting the amount of food that I eat……..……	**T**	**F**
40. I get so hungry that my stomach often seems like a bottomless pit…….	**T**	**F**
41. My weight has hardly changed at all in the last two years……...	**T**	**F**
42. I am always hungry so it is hard for me to stop eating before I finish the food on my plate……..……...	**T**	**F**
43. When I feel lonely, I console myself by eating……	**T**	**F**
44. I consciously hold back at meals in order to not gain weight……..	**T**	**F**
45. I sometimes get very hungry late in the evening or at night……	**T**	**F**
46. I eat anything I want, anytime I want……..…….	**T**	**F**
47. Without even thinking about it, I take a long time to eat…….	**T**	**F**
48. I count calories as a conscious means of controlling my weight…….	**T**	**F**
49. I do not eat some foods because they make me fat……..……	**T**	**F**
50. I am always hungry enough to eat at any time……..……...	**T**	**F**
51. I pay a great deal of attention to changes in my figure……	**T**	**F**
52. While on a diet, if I eat a food that is not allowed, I often then splurge and eat other high calorie foods……..…….	**T**	**F**
53. If I eat a little bit more on one day, I make up for it the next day……...	**T**	**F**
54. I pay attention to my figure, but I still enjoy a variety of foods……..	**T**	**F**
55. I prefer light foods that are not fattening……..……...	**T**	**F**
56. If I eat a little bit more during one meal, I make up for it at the next meal……..	**T**	**F**
57. I eat diet foods, even if they do not taste very good……	**T**	**F**
58. A diet would be too boring a way for me to lose weight…….	**T**	**F**
59. I would rather skip a meal than stop eating in the middle of one……	**T**	**F**
60. I alternate between times when I diet strictly and times when I don't pay much attention to what and how much I eat……..……	**T**	**F**
61. Sometimes I skip meals to avoid gaining weight…….	**T**	**F**
62. I avoid some foods on principle even though I like them……	**T**	**F**
63. I try to stick to a plan when I lose weight……..……..	**T**	**F**
64. Without a diet plan I wouldn't know how to control my weight…….	**T**	**F**
65. Quick success is most important to me during a diet……...	**T**	**F**

Please answer the following questions by circling the number above the response that is most appropriate to you. Please answer the questions as best as you can.

66. How often are you dieting in a conscious effort to control your weight?

1	*2*	*3*	*4*
Rarely	*Sometimes*	*Usually*	*Always*

67. Would a weight fluctuation of 5 lbs (~2.3 kg) affect the way you live your life?

1	*2*	*3*	*4*
Not at all	*Slightly*	*Moderately*	*Very much*

68. How often do you feel hungry?

1	*2*	*3*	*4*
Only at mealtimes	*Sometimes between meals*	*Often between meals*	*Almost always*

69. Do your feelings of guilt about overeating help you to control your food intake?

1	*2*	*3*	*4*
Never	*Rarely*	*Often*	*Always*

70. How difficult would it be for you to stop eating halfway through dinner and not eat for the next four hours?

1	*2*	*3*	*4*
Easy	*Slightly difficult*	*Moderately difficult*	*Very difficult*

71. How conscious are you of what you are eating?

1	*2*	*3*	*4*
Not at all	*Slightly*	*Moderately*	*Extremely*

72. How frequently do you avoid ‘stocking up’ on tempting foods?

1	*2*	*3*	*4*
Almost never	*Seldom*	*Usually*	*Almost always*

73. How likely are you to shop for low calorie foods?

1	*2*	*3*	*4*
Unlikely	*Slightly likely*	*Moderately likely*	*Very likely*

74. Do you eat sensibly in front of others and splurge alone?

1	*2*	*3*	*4*
Never	*Rarely*	*Often*	*Always*

75. How likely are you to consciously eat slowly in order to cut down on how much you eat?

1	*2*	*3*	*4*
Unlikely	*Slightly likely*	*Moderately likely*	*Very likely*

76. How frequently do you skip dessert because you are no longer hungry?

1	*2*	*3*	*4*
Almost never	*Seldom*	*At least once a week*	*Almost every day*

77. How likely are you to consciously eat less than you want?

1	*2*	*3*	*4*
Unlikely	*Slightly likely*	*Moderately likely*	*Very likely*

78. Do you go on eating binges though you are not hungry?

1	*2*	*3*	*4*
Never	*Rarely*	*Sometimes*	*At least once a week*

79. Do you deliberately restrict your intake during meals even though you would like to eat more?

1	*2*	*3*	*4*
Never	*Rarely*	*Often*	*Always*

80. On a scale of 0 to 5, where 0 means no restraint in eating (eating whatever you want, whenever you want it) and 5 means total restraint (constantly limiting food intake and never 'giving in'), what number would you give yourself? Please circle the number which best applies to you most of the time.

0	Eat whatever you want, whenever you want it.
1	Usually eat whatever you want, whenever you want it
2	Often eat whatever you want, whenever you want it.
3	Often limit food intake, but often 'give in'.
4	Usually limit food intake, rarely 'give in'.
5	Constantly limiting food intake, never 'giving in'.

81. To what extent does this statement describe your eating behaviour? 'I start dieting in the morning, but because of any number of things that happen during the day, by evening I have given up and eat what I want, promising myself to start dieting again tomorrow'.

1	*2*	*3*	*4*
Not like me	*Little like me*	*Pretty good description of me*	*Describes me perfectly*

"I used to crave bad foods all the time. Now I value clean eating because I love the feeling of being in control of my diet, rather than have it control me."
Kate, 23, fitness model.

Kate Richards
Daily Calories: 1,600

To keep in shape, Kate includes a variety of foods in her six daily meals. She focuses on a diet that includes lean meats, whole grains and healthy fats from sources like olive oil.

FAVOURITE CLEAN MEAL: pumpkin pancakes (½ cup oatmeal, ½ cup canned pumpkin and 3 egg whites, topped with Splenda)

COULDN'T LIVE WITHOUT: "My food scale. It's easy to overestimate portion sizes so I measure out my foods to keep track of calories and make sure I meet my goals."

| July 2008 |

What are your thoughts on Kate's diet? Is this eating attitude similar to your own? Why or why not? Please continue on the back of this page if needed.

The questions in this scale relate to stress and 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 alternative that seems like a reasonable estimate.

82. In the last month, how often have you been upset because of something that happened unexpectedly?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

83. In the last month, how often have you felt that you were unable to control the important things in your life?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

84. In the last month, how often have you felt nervous and "stressed"?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

85. In the last month, how often have you dealt successfully with irritating life hassles?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

86. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

87. In the last month, how often have you felt confident about your ability to handle your personal problems?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

88. In the last month, how often have you felt that things were going your way?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

89. In the last month, how often have you found that you could not cope with all the things that you had to do?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

90. In the last month, how often have you been able to control irritations in your life?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

91. In the last month, how often have you felt that you were on top of things?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

92. In the last month, how often have you been angered because of things that happened that were outside of your control?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

93. In the last month, how often have you found yourself thinking about things that you have to accomplish?

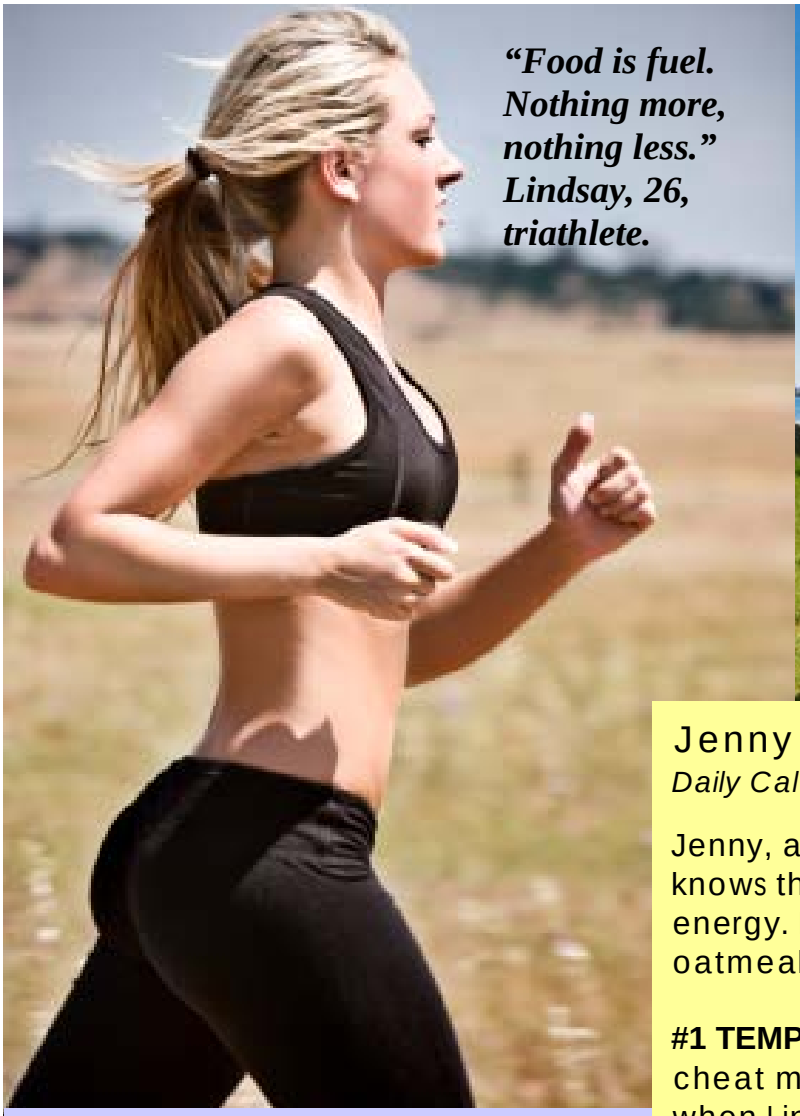
0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

94. In the last month, how often have you been able to control the way you spend your time?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*

95. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

0	*1*	*2*	*3*	*4*
Never	*Almost never*	*Sometimes*	*Fairly often*	*Very often*



"Food is fuel. Nothing more, nothing less." Lindsay, 26, triathlete.

Jenny Kim

Daily Calories: 1,200 – 1,500

Jenny, a gymnast and fitness instructor, knows that carbs are a key source of energy. Her favourite sources are oatmeal and sweet potatoes.

#1 TEMPTATION: Fast-food. "I have a cheat meal once a week and that's when I indulge with all the pizza and ice cream I can eat!"

Lindsay Marshall

Lindsay believes in clean eating every day and think cheat meals do more harm than good. She believes in intuitive eating rather than counting calories: "I try to eliminate all distractions during meals so I'm aware of my hunger signals and stop eating when full."

BIGGEST NUTRITIONAL CHALLENGE: "I have a HUGE sugar tooth!! I stay away from high calorie desserts by choosing low-fat, low-calorie foods." Some of Lindsay's favourites are protein brownies and sugar-free hot ch

Do you identify more with Lindsay or Jenny's diet strategy?
Please explain and continue on the back of this page if necessary.

These questions are designed to assess emotional state. Please read each statement and circle a number 0, 1, 2 or 3 that indicates how much the statement applied to you over the *past week*. There are no right or wrong answers. Do not spend too much time on any statement.

96. I found myself getting upset by quite trivial things…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

97. I was aware of dryness of my mouth…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

98. I couldn't seem to experience any positive feeling at all…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

99. I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

100. I just couldn't seem to get going…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

101. I tended to over-react to situations…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

102. I had a feeling of shakiness (eg, legs going to give way)…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

103. I found it difficult to relax…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

104. I found myself in situations that made me so anxious I was most relieved when they ended…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

105. I felt that I had nothing to look forward to…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

106. I found myself getting upset rather easily…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

107. I felt that I was using a lot of nervous energy…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

108. I felt sad and depressed…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

109. I found myself getting impatient when I was delayed in any way (eg, elevators, traffic lights, being kept waiting)…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

110. I had a feeling of faintness…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

111. I felt that I had lost interest in just about everything…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

112. I felt I wasn't worth much as a person…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

113. I felt that I was rather touchy…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

114. I perspired noticeably (eg, hands sweaty) in the absence of high temperatures or physical exertion…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

115. I felt scared without any good reason…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

116. I felt that life wasn't worthwhile…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

117. I found it hard to wind down…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

118. I had difficulty in swallowing…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

119. I couldn't seem to get any enjoyment out of the things I did…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

120. I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

121. I felt down-hearted and blue…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

122. I found that I was very irritable…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

123. I felt I was close to panic…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

124. I found it hard to calm down after something upset me…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

125. I feared that I would be "thrown" by some trivial but unfamiliar task…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

126. I was unable to become enthusiastic about anything…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

127. I found it difficult to tolerate interruptions to what I was doing…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

128. I was in a state of nervous tension…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

129. I felt I was pretty worthless…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

130. I was intolerant of anything that kept me from getting on with what I was doing…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

131. I felt terrified…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

132. I could see nothing in the future to be hopeful about…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

133. I felt that life was meaningless…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

134. I found myself getting agitated…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

135. I was worried about situations in which I might panic and make a fool of myself…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

136. I experienced trembling (eg, in the hands)…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

137. I found it difficult to work up the initiative to do things…

0	*1*	*2*	*3*
Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me a considerable degree, or a good part of the time*	*Applied to me very much, or most of the time*

138. Please indicate, by placing a vertical mark in the appropriate position on the line below, how stressful your participation in this study has been so far:

****

Thank you for completing this questionnaire!

****

APPENDIX H: QUESTIONNAIRE PART TWO

ID #_____

QUESTIONNAIRE PACKAGE – PART TWO –

INSTRUCTIONS

- **This will take 30 minutes to complete.**
- **Please answer the questions as best you can by choosing the most appropriate answer for each question. Ignore the columns marked "Office Use Only".**
- **Please use the provided pen. If you need to make any changes, please clearly indicate the desired answer with a note in the margin.**
- **Your confidentiality will be respected and no information that discloses your identity will be released.**
- **Please do not remove any pages and keep the booklet attached.**
- **Do not hesitate to contact Mandeep at (778) XXX-XXXX if you have any questions.**

Thank you very much for accurately completing this questionnaire!

PLEASE TURN THE PAGE TO BEGIN.

We would like to know how you have been feeling about your appearance over the *past month*. Please read each question and circle the appropriate number. Please answer the questions the best you can.

1. Have you been afraid that you might become fat (or fatter)?

1	*2*	*3*	*4*	*5*	*6*
Never	*Rarely*	*Sometimes*	*Often*	*Very often*	*Always*

2. Has feeling full (e.g., after eating a large meal) made you feel fat?

1	*2*	*3*	*4*	*5*	*6*
Never	*Rarely*	*Sometimes*	*Often*	*Very often*	*Always*

3. Has thinking about your shape interfered with your ability to concentrate (e.g., while watching television, reading, listening to conversations)?

1	*2*	*3*	*4*	*5*	*6*
Never	*Rarely*	*Sometimes*	*Often*	*Very often*	*Always*

4. Have you imagined cutting off fleshy areas of your body?

1	*2*	*3*	*4*	*5*	*6*
Never	*Rarely*	*Sometimes*	*Often*	*Very often*	*Always*

5. Have you felt excessively large and rounded?

1	*2*	*3*	*4*	*5*	*6*
Never	*Rarely*	*Sometimes*	*Often*	*Very often*	*Always*

6. Have you thought that you are the shape you are because you lack self-control?

1	*2*	*3*	*4*	*5*	*6*
Never	*Rarely*	*Sometimes*	*Often*	*Very often*	*Always*

7. Has seeing your reflection (e.g. in a mirror or shop window) made you feel bad about your shape?

1	*2*	*3*	*4*	*5*	*6*
Never	*Rarely*	*Sometimes*	*Often*	*Very often*	*Always*

8. Have you been particularly self-conscious about your shape when in the company of other people?

1	*2*	*3*	*4*	*5*	*6*
Never	*Rarely*	*Sometimes*	*Often*	*Very often*	*Always*

The following section is designed to assess attitudes, feelings and behaviours related to eating. These questions are concerned with the *past four weeks* only.

9. On how many of the past 28 days, have you been deliberately trying to limit the amount of food you eat to influence your shape or weight (whether or not you have succeeded)?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

10. On how many of the past 28 days, have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

11. On how many of the past 28 days, have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

12. On how many of the past 28 days, have you tried to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

13. On how many of the past 28 days, have you had a definite desire to have an empty stomach with the aim of influencing your shape or weight?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

14. On how many of the past 28 days, have you had a definite desire to have a totally flat stomach?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

15. On how many of the past 28 days, has thinking about <u>food, eating or calories</u> made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

16. On how many of the past 28 days, has thinking about <u>shape or weight</u> made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

17. On how many of the past 28 days, have you had a definite fear of losing control over eating?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

18. On how many of the past 28 days, have you had a definite fear that you might gain weight?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

19. On how many of the past 28 days, have you felt fat?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

20. On how many of the past 28 days, have you had a strong desire to lose weight?

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

For questions 21-25, please fill in the appropriate number in the blank on the right. Please remember that the questions only refer to the past four weeks (28 days).

21. Over the past 28 days, how many <u>times</u> have you eaten what other people would regard as an <u>unusually large amount of food</u> (given the circumstances)? _____

- On how many of these times did you have a sense of having lost control over your eating (at the time that you were eating)? _____

22. Over the past 28 days, on how many **DAYS** have such episodes of overeating occurred (i.e., you have eaten an unusually large amount of food and have had a sense of loss of control at the time)? _____

23. Over the past 28 days, how many times have you made yourself sick (vomit) as a means of controlling your shape or weight? _____

24. Over the past 28 days, how many times have you taken laxatives as a means of controlling your shape or weight? _____

25. Over the past 28 days, how many times have you exercised in a "driven" or "compulsive" way as a means of controlling your weight, shape or amount of fat, or to burn off calories? _____

For the following questions, please circle the appropriate number. Please note that for these questions the term "binge eating" means eating what others would regard as an unusually large amount of food for the circumstances, accompanied by a sense of having lost control over eating.

26. Over the past 28 days, on how many days have you eaten in secret (ie, furtively)? Do not count episodes of binge eating.

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

27. Over the past 28 days, on what proportion of the times that you have eaten have you felt guilty (felt that you've done wrong) because of its effect on your shape or weight? Do not count episodes of binge eating.

0	*1*	*2*	*3*	*4*	*5*	*6*
No days	*1-5 days*	*6-12 days*	*13-15 days*	*16-22 days*	*23-27 days*	*Every day*

28. Over the past 28 days, how concerned have you been about other people seeing you eat? Do not count episodes of binge eating.

Not at All		Slightly		Moderately		Markedly
0	1	2	3	4	5	6

29. Over the past 28 days, has your weight influenced how you think about (judge) yourself as a person?

Not at All		Slightly		Moderately		Markedly
0	1	2	3	4	5	6

30. Over the past 28 days, has your shape influenced how you think about (judge) yourself as a person?

Not at All		Slightly		Moderately		Markedly
0	1	2	3	4	5	6

31. Over the past 28 days, how much would it have upset you if you had been asked to weigh yourself once a week (no more, or less, often) for the next four weeks?

Not at All		Slightly		Moderately		Markedly
0	1	2	3	4	5	6

32. Over the past 28 days, how dissatisfied have you been with your weight?

Not at All		Slightly		Moderately		Markedly
0	1	2	3	4	5	6

33. Over the past 28 days, how dissatisfied have you been with your shape?

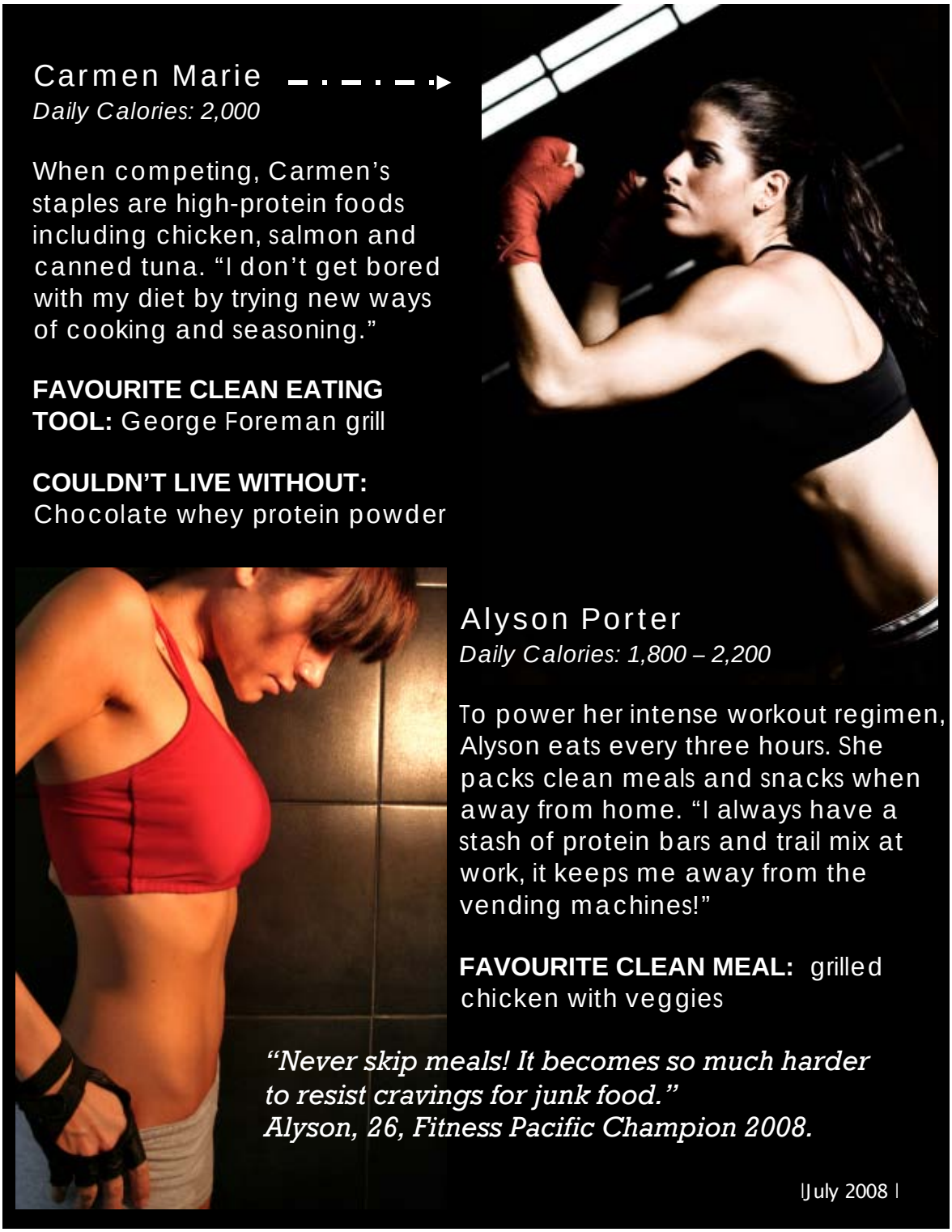
Not at All		Slightly		Moderately		Markedly
0	1	2	3	4	5	6

34. Over the past 28 days, how uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in a shop window reflection, while undressing or taking a bath or shower)?

Not at All		Slightly		Moderately		Markedly
0	1	2	3	4	5	6

35. Over the past 28 days, how uncomfortable have you felt about others seeing your shape of figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?

Not at All		Slightly		Moderately		Markedly
0	1	2	3	4	5	6



After reading Carmen and Alyson's profile, how would you describe your usual diet? What do you define as "clean eating"? Please continue on the back of this page if needed.

The following questions ask about <u>usual</u> physical activity. Please answer the questions choosing the most appropriate answer for each statement.

36. What is your main occupation? _____.

37. At work I sit:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Always*

38. At work I stand:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Always*

39. At work I walk:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Always*

40. At work I lift heavy loads:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Always*

41. After working I am tired:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Always*

42. At work I sweat:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Always*

43. In comparison with others of my own age I think my work is physically:

1	*2*	*3*	*4*	*5*
Much lighter	*Lighter*	*As heavy*	*Heavier*	*Much heavier*

44. Do you play a sport (running & biking are considered sports)?

___ No
___ Yes → If **yes**: which sport do you play <u>most</u> frequently? _____

a. How many hours a week?

___ Less than 1 hour
___ 1 to 2 hours
___ 2 to 3 hours
___ 3 to 4 hours
___ More than 4 hours

b. How many months a year?

___ Less than 1 month ___ 1 to 3 months
___ 4 to 6 months ___ 7 to 9 months
___ More than 9 months

45. Do you play a second sport (running & biking are considered sports)?

___ No
___ Yes → If **yes**: Which sport is it? _____

a. How many hours a week?

___ Less than 1 hour ___ 1 to 2 hours
___ 2 to 3 hours ___ 3 to 4 hours
___ More than 4 hours

b. How many months a year?

___ Less than 1 month ___ 1 to 3 months
___ 4 to 6 months ___ 7 to 9 months
___ More than 9 months

46. In comparison with others of my own age I think my physical activity during leisure time is:

1	*2*	*3*	*4*	*5*
Much less	*Less*	*The same*	*More*	*Much more*

47. During leisure time I sweat:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Very often*

48. During leisure time I play sport:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Very often*

49. During leisure time I watch television:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Very often*

50. During leisure time I walk:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Very often*

51. During leisure time I cycle:

1	*2*	*3*	*4*	*5*
Never	*Seldom*	*Sometimes*	*Often*	*Very often*

52. How many minutes do you walk and/or cycle per day to and from work, school and shopping?

___ Less than 5 minutes
___ 5 to 15 minutes
___ 15 to 30 minutes
___ 30 to 45 minutes
___ More than 45 minutes

The following series of questions ask you to indicate the degree of agreement with the following statements about appearance. Please answer each question as best as you can by circling the appropriate number.

53. The opinion others have of me is based on my appearance…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

54. The amount of influence I have on other people depends upon how I look…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

55. People would be more interested in me if I looked better…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

56. My relationships would improve if I looked the way I wished…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

57. The amount of success I have in my future job or career depends largely upon how I look…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

58. My appearance influences my ability to do things…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

59. My performance in activities (e.g. school, work, hobbies) is influenced by how I look…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

60. The opportunities that are available to me depend upon how I look…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

61. My school and work performance or opportunities would improve if I looked the way I wished…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

62. My value as a person depends upon how I look…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

63. How I feel about myself is largely based on my appearance…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

64. I would think more highly of myself if I looked the way I wished…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

65. How I look is a large part of who I am…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

66. It is difficult to feel good about myself when I am not looking my best…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

67. My ability to feel happy depends upon how I look…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

68. Improving my appearance is one of the few activities that makes me feel good or like I am accomplishing something…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

69. My life will be more exciting or rewarding if I look good…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

70. My moods are influenced by how I look…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

71. I would enjoy life more if I looked the way I wished…

1	*2*	*3*	*4*	*5*
Not at all	*Somewhat*	*Moderately*	*A lot*	*Extremely*

"I eat protein at every meal and have a meal or snack every 3 hours to keep my metabolism going. My diet helps me feel healthy and fuels my day." Sarah, 24, fitness instructor.

After reading the article, do you agree with Sarah's diet strategy? Why or why not? Please write on the back of this page if necessary.

Sarah Miller

Daily Calories: 1,800 – 2,100

Sarah wakes up to her daily routine of a morning workout, followed with quick oats mixed with protein powder. Snacks include protein shakes with soy milk, fat-free cottage cheese or scrambled egg whites with veggies.

ALWAYS IN HER KITCHEN: liquid egg whites, protein powder and quick oats.

HER LAST MEAL WOULD BE: waffles with ice cream and chocolate sau

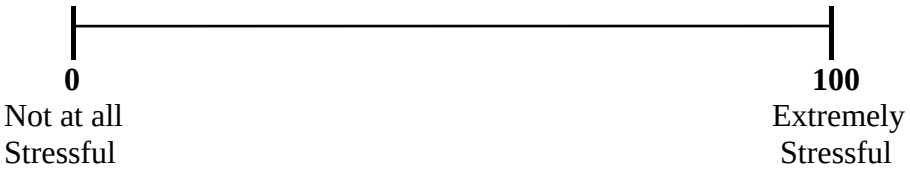
72. Below are listed a variety of events that may be viewed as stressful or unpleasant. Read each item carefully and **decide whether or not that event occurred within the PAST 24 HOURS**. Indicate if the event did occur (**Y**) or did not occur (**N**) in the **DID EVENT OCCUR? column**. If the event **DID** occur, indicate the amount of stress that it caused on a scale of **1 to 7** by checking the appropriate column. Please answer honestly as you can so that we may obtain accurate information.

EVENT	**In the Past 24 Hours, Did Event Occur? (Y or N)**	Amount of Stress Event Caused (**only answer if the event occurred and you marked "Y" in the leftmost column**):						
		1 Not stressful	*2 Very Little Stress*	*3 A little stress*	*4 Some stress*	*5 Much stress*	*6 Very much stress*	*7 Caused me to panic*
Performed poorly at a task								
Performed poorly due to others								
Thought about unfinished work								
Hurried to meet a deadline								
Interrupted during a task/activity								
Someone spoiled your completed task								
Did something you are unskilled at								
Unable to complete a task								
Was unorganized								
Criticized or verbally attacked								
Ignored by others								
Spoke or performed in public								
Dealt with rude waiter/waitress/salesperson								
Interrupted while talking								
Was forced to socialize								
Someone broke a promise/appointment								
Competed with someone								
Was misunderstood								

EVENT	**In the Past 24 Hours, Did Event Occur? (Y or N)**	Amount of Stress Event Caused (**only answer if the event occurred and you marked "Y" in the leftmost column**):						
		1 Not stressful	*2 Very Little Stress*	*3 A little stress*	*4 Some stress*	*5 Much stress*	*6 Very much stress*	*7 Caused me to panic*
Did not hear from someone you expected to hear from								
Was embarrassed								
Had your sleep disturbed								
Forgot something								
Feared illness/pregnancy								
Experienced illness/physical discomfort								
Had car trouble								
Your property was damaged								
Unable to complete all plans for today								
Thought about future								
Ran out of food/personal article								
Argued with spouse/boyfriend/girlfriend								
Argued with another person								
Waited longer than you wanted								
Interrupted while thinking/relaxing								
Someone 'cut' ahead of you in line								
Performed poorly at sport/game								
Had minor accident (broke something, tore clothing)								
Did something you did not want to do								
Someone borrowed something without your permission								

EVENT	**In the Past 24 Hours, Did Event Occur? (Y or N)**	Amount of Stress Event Caused (**only answer if the event occurred and you marked "Y" in the leftmost column**):						
		1 Not stressful	*2 Very Little Stress*	*3 A little stress*	*4 Some stress*	*5 Much stress*	*6 Very much stress*	*7 Caused me to panic*
Was stared at								
Had difficulty in traffic								
Money problems								
Misplaced something								
Bad weather								
Unexpected expense (fines, ticket, etc.)								
Had confrontation with an authority figure								
Heard some bad news								
Concerned over personal appearance								
Exposed to feared situation/object								
Exposed to upsetting TV show/movie/book								
'Pet peeve' violated								
Failed to understand something								
Worried about another's problems								
Experienced narrow escape from danger								
Had problem with kid(s)								
Was late for work/appointment								
Stopped unwanted personal habit (smoking, nail biting)								
Other? _____								
Other? _____								

73. Please indicate, by placing a vertical mark in the appropriate position on the line below, how stressful your participation in this study has been so far:



****

Thank you for completing the questionnaire!

****

APPENDIX I: MORNING SAMPLING INSTRUCTIONS

Instructions for Morning Saliva Collection

ID # _____

We are asking for **four** saliva samples to be collected **tomorrow morning** to help measure your levels of the stress hormone cortisol. Please collect these samples **immediately** after awakening**. Do *not* eat, drink, brush your teeth or engage in strenuous physical activity during the 45 minute sampling period**. These activities will cause sample contamination. You may go about your usual routine (ex: showering, getting dressed, etc) but please remember to sample at the appropriate times since this is a *highly* time-sensitive procedure.

Please read and carefully follow these instructions:

(a) Preparing for morning sampling:

1. Tonight, place the following materials by your bed:
    - Salivette tubes
    - One glass of water
    - Sampling log (page 3
    - Timer
    - One empty glass

(b) Morning sampling procedure

1. **Immediately** after you wake up, rinse your mouth with water and spit the water into the empty glass.

2. Collect first saliva sample using the salivette labelled *Morning Sample #1* using the same procedure as in your lab visit. As a reminder, the instructions are as follow:

    a. Take off the top of the tube and drop the cotton roll in your mouth. Avoid using your hands. Record the time you completed this step on your sampling log under the column "Time of sample: _____".
    b. Keep the cotton roll in your mouth for one full minute.
    c. While the cotton roll is in your mouth, start the timer for sample #2. The timer will countdown as a reminder of when to take the next sample since samples must be taken in 15 minute intervals. Set the timer by pressing "Min" repeatedly until it reads 0:15. Press the "Start/Stop" button once this is done.
    d. After the roll has been in your mouth for roughly one minute, place it back in the tube *without* using your hands.
    e. Place the Salivette back in the Ziploc bag. You may go about your usual morning routine until it is time for the next sample.

3. **15 minutes** later**,** repeat steps (a) through (e) using the tube labelled *Morning Sample #2*. The timer should beep to remind you when to sample but please pay attention to the time in case of technical problems. After the timer beeps, press "Start/Stop". Place the cotton roll in your mouth and record the time you do this step in the log. Reset the timer for 15 minutes by pressing "Min" repeatedly until it reads 0:15. Start the countdown for the next sample by pressing "Start/Stop".

4. Repeat steps (a) through (e) 30 minutes after Sample #1 was collected.

5. Repeat steps (a) through (e) 45 minutes after Sample #1 was collected.

*If you forget to collect a sample, continue with the next sample as scheduled. For example, if you wake up and take your first sample at 8:15, the other samples should be collected at 8:30, 8:45 and 9:00. If you miss sample 2, continue with sample 3 at 8:45.

*Record any difficulties that may arise during this procedure on your sampling log. If you have any questions, please do not hesitate to call Mandeep at (778) XXX-XXXX.

How to Use the Timer

- The timer has two useful settings marked "clock" and "timer" in the red panel next to the time. To switch settings, slide the red button up/down (located on the right side of the timer).
- When recording the time, the timer must be in "clock" mode. For all other steps, make sure it is in "timer" mode.
- To set the timer for 15 minutes, press "Min" repeatedly until the timer reads 0:15. Press "Start/Stop" to start the countdown.

(c) Returning your sampling kit

- Please return the kit containing the 5 Salivettes, timer, sampling log and this instruction sheet to the Food, Nutrition and Health Building.
- If you cannot return the kit on the same day as sampling, store all materials in your freezer until you are ready to return the kit.
- You will receive $20 for your participation after returning all of the study materials.

THANK YOU FOR YOUR CAREFUL COMPLETION OF THIS TASK!

Sampling Log

ID # _____

Sample Number	**Time of Sample** Please record the time you first place the cotton roll in your mouth
Sample #1 (collect immediately after you wake up)	
Sample #2 (collect roughly 15 minutes after sample #1)	
Sample #3 (collect roughly 15 minutes after sample #2)	
Sample #4 (collect roughly 15 minutes after sample #3)	

When you are ready to return the samples to the lab, place all materials back in the Ziploc bag (5 Salivettes, timer, instruction sheet and sampling log). Thank you!

APPENDIX J: DEBRIEFING FORM

Eating Attitudes and Physiological Stress Study

Cognitive dietary restraint (CDR) reflects the perception that one is constantly monitoring and attempting to restrict food intake as a means to control body weight, rather than eating in response to hunger cues. Recent research suggests that high CDR may act as a subtle and consistent stressor that activates the physiological stress response. This study aims to provide additional evidence to support this hypothesis by investigating differences in the stress response of high and low restraint women after exposure to food and weight-related cues. The awakening cortisol response of participants is also examined since differences can suggest increased levels of chronic stress.

In this study, you completed an online screening questionnaire. The purpose of this questionnaire was to assess your level of dietary restraint. Women with either high or low levels of dietary restraint were invited to participate in the full procedure. During the lab visit, you were asked to complete a questionnaire package while blood pressure and saliva samples were collected. The experimenter also placed a tray of food options near you, explaining that the food was leftover from another study. However, the food was presented to simulate everyday food-related stress. We will examine the blood pressure and salivary cortisol levels before and after cue exposure to look for relationships among levels of CDR and physiological stress.

We expect to find that women with high levels of CDR will have elevated levels of salivary cortisol and blood pressure after exposure to tempting food options. The awakening cortisol response is also hypothesized to differ among women with high and low levels of CDR.

If you are interested in receiving a summary of the research findings, please let us know by contacting us at eatingattitude@gmail.com. If you have any further questions, please feel free to ask the experimenter or use the contact information provided below to contact a member of the research team at a later time.

Contact Information about the Experiment

This experiment is being conducted under the supervision of Dr. Susan Barr, the primary investigator, with Mandeep Sanghera as the co-investigator. Please call one of them if you have any further questions about this study. Mandeep Sanghera may be reached at (778) XXX-XXXX and Dr. Barr may be reached at (604) 822-6766. You may also e-mail our research team at eatingattitude@gmail.com.

Please do not share information outlined in this debriefing form because this could impact our research findings.

Thank you for your participation!

APPENDIX K: UBC BEHAVIOURAL RESEARCH ETHICS BOARD'S CERTIFICATE OF APPROVAL

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road,
Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL - FULL BOARD

PRINCIPAL INVESTIGATOR:	INSTITUTION / DEPARTMENT:	UBC BREB NUMBER:
Susan I. Barr	UBC/Land and Food Systems/Human and Animal Nutrition	H08-01745

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

Institution	Site
UBC	Vancouver (excludes UBC Hospital)

Other locations where the research will be conducted:
Subject's home: the participant will be asked to provide four salivary cortisol samples collected the morning following her lab visit.

CO-INVESTIGATOR(S):
Wolfgang Linden
Mandeep Sanghera
Tim John Green

SPONSORING AGENCIES:
Canadian Institutes of Health Research (CIHR)

PROJECT TITLE:
Eating Attitudes and Physiological Stress

REB MEETING DATE:	CERTIFICATE EXPIRY DATE:
September 11, 2008	**September 11, 2009**

DOCUMENTS INCLUDED IN THIS APPROVAL: **DATE APPROVED: December 10, 2008**

Document Name	Version	Date
Protocol:		
Research Proposal	N/A	November 1, 2008
Consent Forms:		
Consent form	N/A	November 1, 2008
Advertisements:		
Recruitment poster	N/A	November 1, 2008
Questionnaire, Questionnaire Cover Letter, Tests:		
Questionnaire (Part One)	N/A	November 1, 2008
Questionnaire (Part Two)	N/A	November 1, 2008
Other Documents:		
Debriefing form	N/A	November 1, 2008
Screening questionnaire	N/A	December 1, 2008
Proviso response	N/A	November 1, 2008
E-mail drafts	N/A	December 1, 2008

Deception form	N/A	July 1, 2008

Other:
The website for the screening questionnaire is still in development; however, the questionnaire is provided in part 9.8.A.

The application for ethical review and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board and signed electronically by one of the following:

Dr. M. Judith Lynam, Chair
Dr. Ken Craig, Chair
Dr. Jim Rupert, Associate Chair
Dr. Laurie Ford, Associate Chair
Dr. Daniel Salhani, Associate Chair
Dr. Anita Ho, Associate Chair