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Sex Differences in the Effects of Stress-Induced Eating

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Previous research has found that restrained eaters, emotional eaters and females will eat more under stress. The current study examined sex differences in the effects of stress-induced eating. Participants were randomly assigned to a high or low-induced stress situation. Both groups, with equal numbers of males and females, solved anagrams and were given the opportunity to eat candy. A 5-minute time limit was held constant across both conditions. The high stress group was constantly reminded of their strict time limit and performed the experiment with a loud timer ticking in the background; while the low stress group had neither of these distractions. Participants filled out a self-reported stress question response as a manipulation check. These data, and amounts of candy eaten for each sex under both conditions were recorded. In the high stress condition, males ate less and females ate more; however, these effects were not statistically significant. Females also consumed significantly more candy in both conditions than males.

There is growing interest in the possibility that stress affects health not only through direct physiological processes, but also by modifying behaviours that affect health, such as physical exercise, smoking, or food choices (Oliver & Wardle, 1998). The behaviour of interest in the present study is how it affects food choice, specifically the amount of food one consumes. The existence of stress-induced eating has been generally accepted; however, the empirical basis for this relationship reveals contradictory findings. In some studies, eating behaviour increases during stress; in others, it decreases. The present study is an attempt to examine some of the major...
variables to help clarify the findings of an interesting, yet confusing literature. Studies that have reported decreased eating (Abramson & Wunderlich, 1972; Reznick & Balch, 1977; Schachter et al., 1968) used mostly male subjects; studies that have reported increased eating used mostly female subjects (Leon & Chamberlain, 1973; Slochower et al., 1981; Stunkard et al., 1955). This study is an attempt to compare both categories of male and female eating behaviour. Females may be more prone to eating under stress than males as there is a higher prevalence of restrained eaters and emotional eaters among the female population. As well, they are less competitive than males by nature, and in this process, are likely to shift their attention away from the required task towards food available.

Research has found that stress reduces the salience of internal physiological cues, such as hunger; but increases the salience of external cues, such as taste of food or amount available, which often leads to overeating when stressed (Greeno & Wing, 1994). Additionally, cues which are associated with the stress may have become conditioned to physiological responses, such as insulin release, which prepares an individual to eat. Stress can also bring on increased levels of cortisol, which can create cravings for salty and sweet foods. In previous centuries, this enabled humans to bulk up on foods that would sustain them during times in which food was scarce; however, in modern times, food is rarely scarce, so this previously adaptive mechanism is currently causing weight gain (Greeno & Wing, 1994). Another proposal is that overeating results from an attempt to escape or shift attention away from an ego-threatening stimulus. Therefore, overeating may occur through a process to modify mood or as a distraction technique to avoid aversive environmental stimuli.
Stress-Induced Eating (Heatherton & Baumeister, 1991). Certain foods, particularly carbohydrates, can change serotonin levels in the brain. During times of distress, these foods are craved to positively change mood (Oliver & Wardle 1999).

Emotional eating is the practice of consuming large quantities of food in response to feelings instead of hunger. The concept of emotional eating originates from work by Bruch (1964) who stated that emotional eaters are unable to differentiate sensations of hunger from emotional arousal. They in turn, have a tendency to overeat in response to negative emotions such as stress. Emotional eaters don’t really crave a certain food, but crave the feeling generated when they eat that specific food. Oliver, Wardle, and Gibson (2000) found that stressed emotional eaters consumed more sweet, high-fat foods and a more energy-dense meal than unstressed and non-emotional eaters.

A primary model for eating behaviour comparison focuses on “restrained” eaters, who chronically control and restrict food intake on a regular basis, and “unrestrained” eaters, people who do not tend to control and restrict food intake (Herman & Mack, 1975). The concept of "restraint" originally grew out of the set-point theory of obesity (Nisbett, 1972), which proposes that each individual has a biological "set point," that is, a biologically appropriate weight. Because of cultural standards of appearance, some people will choose to try to maintain weights that are below their set points; constantly making an effort to restrain their eating and weight. Stress is expected to affect restrained eaters because it will disrupt the control that they normally try to exert over their eating.
Herman & Mack (1975) designed an experiment to analyze the eating behaviour of restrained and unrestrained eaters; the results supported the set-point theory of obesity. Questionnaires were distributed to participants to determine concern about weight and degree of restraint with a purpose of delineating two different groups: the high restraint and low restraint eaters. In the first phase of the experiment, women were required to consume 0, 1 or 2 milkshakes. Afterwards, they were allowed to eat as much ice cream as they wanted. Grams of ice cream eaten by each group were recorded. Results contradicted normative expectations. For the high restraint group, there was a positive correlation between the amount of milkshakes consumed and the amount of ice cream eaten afterwards. In contrast, the low restraint group consumed less ice cream as the number of milkshakes in the first phase increased. The study determined that once the high restraint group had consumed enough milkshake to perceive themselves as having already overeaten, they gave up the attempt to restrain themselves. However, those who had not consumed a milkshake still had their restraint intact, and therefore consumed less ice cream in the second phase of the experiment. In contrast, the low restraint group ate in accordance with internal factors, based on hunger, thus consuming less ice cream after more milkshakes. Restrained eaters are more likely to disinhibit, or lose control of restraint whilst experiencing stress. Gender differences can be predicted from the fact that women have higher levels of restraint than males.

Grunberg & Straub (1992) manipulated stress in male and female college students and measured eating behaviour. Stress and control groups were differentiated by viewing different films; one about industrial accidents (stress condition), the other a
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pleasant film (control condition). During the film, participants had access to sweet, salty and bland food types to eat. Results indicated that stress significantly decreased eating by men in all three food taste categories. In contrast, women ate more sweet and bland foods in the high stress condition than women in the control condition, but the effects were not statistically significant. These findings indicate that stress effects eating behaviour differently in men and women and may relate to the type of food available.

Niederle & Vesterlund (2008) examined why the behaviour of men and women differs in competitive environments. Nature as well as nurture have been used to explain these differences. Evolutionary psychologists state that males fight for mating with females, while females raise the offspring. In order for males to have reproductive success, they must engage in competition; however, females should not partake in competition while raising the offspring, as losing a competition would have serious consequences to their young. As well, boys and girls are raised differently. Specific gender-typed activities and behaviours have been encouraged by parents, teachers and peers. Boys are encouraged to be assertive and girls are expected to show empathy and be egalitarian (Niederle & Vesterlund 2008). Gneezy, Niederle, and Rustichini (2003) conducted an experiment where men and women were asked to solve mazes in both non-competitive and competitive scenarios. The non-competitive scenario rewarded each participant a fixed payment for every solved maze, independent of the performance of other participants. The competitive incentive scheme rewarded only the tournament winner with a larger grand prize, while the other participants received no payment. A large gender difference in performance was
found in the competitive environment, as the men solved a significantly greater number of puzzles than they did in the non-competitive scenario. The women, on the other hand, did not solve a greater number of puzzles in the competitive environment. As the environment became competitive, men seemed to react strongly to competition and improved their performance substantially. In contrast, the performance of women did not change.

These findings relate to the current study as the males, being more competitive, may have greater focus on the anagram task than snacking, especially in the high-stress condition where a strict time limit is enforced. According to Drapdeau et al. (2003), there is a greater prevalence of restrained eating and emotional susceptibility in females than in males. One population in particular which might be expected to contain restrained eaters is female university students. I estimate that females are more subject to the demands of cultural pressures to maintain "ideal" weight levels below their set points than are males. As well, Grunberg & Straub (1992) found that males ate less and females ate more during the stressful film. These findings inform my hypothesis as I presume that females will consume more candies in the high-stress condition than in the low-stress condition; while males will consume less in the high-stress condition than in the low-stress condition.

Method

Participants

The participants were 20 male and 20 female undergraduate students at The University of Western Ontario. Data was collected over a one-week span and individuals were randomly selected among various centre spots on campus; many
were friends and acquaintances of the researcher. Participants were randomly divided into two groups: low and high induced stress, each consisting of 10 males and 10 females. The participants in the study were primarily Caucasian and the ages ranged from 18 years to 23 years. The vast majority were of an upper middle class socioeconomic status, with a large percentage coming from the GTA.

Materials

Letters of information were provided to explain the purpose of the study, how long it would take and that participation was voluntary. Participants then signed consent forms, given that they wished to participate in the study and did not have any food allergies. The materials used in the present study included a list of 12 anagrams and a subjective stress scale as a manipulation check; both constructed by the researcher. The anagrams, which can be viewed in Appendix A, were used in both the high-stress and low-stress groups. A standard five-point stress scale was used for the purpose of a manipulation check to measure the effectiveness of the stress induction among the intended group. Clear instructions on the scale asked the participant to circle how stressed they felt from 1-5. Participants were presented with a bowl of 20 Hershey's kisses and 20 Starburst candies. Participants in the high-stress group solved anagrams with a loud timer ticking in the background, to make their task more stressful. A stopwatch was used to keep track of the 5-minute time limit. Debriefing forms were distributed to participants after completion, which thanked them for their participation and welcomed questions about the study.
Procedure

Participants were chosen randomly in the University Community Centre and Weldon library. They were asked to read the letter of information and sign a consent form before taking part in the study. Each participant, on a random basis was put into the low-stress condition or the high-stress condition, so that each group would consist of 10 males and 10 females. All participants were told to help themselves to the candy as they solved 12 anagrams. Participants in the low-stress condition were told they had an unlimited lime to do so and that they should be relaxed since there was no rush. Participants in the high-stress condition were asked to solve the anagrams as well, but were given a strict time limit of 5-minutes and were notified every 30 seconds to hurry up and that time was running out. There was also a loud timer ticking to induce more stress. Following the anagram task, after the 5 minutes had elapsed, all participants were asked to rate their current stress level between 1 and 5. The number of candy eaten for each participant along with their self-reported stress score were recorded and used for analysis. After this was completed, participants were given a debriefing form. All trials took approximately 7 minutes to complete.

Results

A 2 X 2 between-subjects analysis of variance was conducted with number of candies eaten as the dependent variable and sex (male/female) and condition (high-stress/low-stress) as the independent variables. Group means are graphically depicted in Figure 1. The results indicated that there was a significant main effect of sex, F(1,36) = 10.78, p < .05, with females (M = 4.10, SD = 1.77) eating significantly more
Figure 1: Mean number of candy consumed by Males and Females in the Hi and Lo Stressor Conditions.
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candies than males (M = 2.25, SD = 1.80). Group means can also be seen in Table 1. There was not a significant main effect of stress, F(1,36) = .008, p > .05, as those in the low-stress condition did not eat an amount significantly more than those in the high-stress condition. The interaction of sex and stress on number of candies consumed, F(1,36) = 2.28, p < .05, was not statistically significant. These results can be found in Table 2.

In order to test the effect of the stress manipulation, an independent-samples t-test was conducted. Participants in the high-stress condition (M = 3.05, SD = 0.83) reported significantly higher stress scores than those in the low-stress condition (M = 2.10, SD = 0.64), t(38) = 4.07, p < .05, d = 1.29.

Discussion

The purpose of the current study was to explore sex differences in the vulnerability to stress-induced eating. It was hypothesized that in the high-stress condition, women would consume more candy and men would consume less candy in comparison with consumption in the control condition. The results were not statistically significant; however, the means were in the predicted direction, and therefore lend some support to the findings of the literature. Oliver, Wardle, & Gibson (2000) found that emotional eaters consumed more while stressed and Drapteau et al. (2003) state that there is a greater prevalence of emotional eating in females than in males, contributing to the fact that females ate more than males in the high-stress condition. Due to cultural pressures, females are more likely to try to maintain weights below their set-points. Intuitively, it would seem that in the current study, the women
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in the high-stress condition lost control of their restraint; in turn, consuming more candies. Differences in the prevalence of dieting between males and females may contribute to an explanation of gender differences in stress-induced eating.

The choice of food available, chocolates and candies, was likely more favourable among the women than the men. This was seen in the results, as women ate significantly more sweets overall. The men, on the other hand, consumed less in both conditions, especially in the high stress condition. They were more focused on solving the anagram task, rather than unwrapping and eating candies. They reacted strongly to the competition, which is consistent with Gneezy, Niederle, and Rustichini (2003) experiment, which found that men solved a greater number of puzzles in the competitive scenario, as opposed to the non-competitive scenario. These results represent an evolutionary norm, where the genetic advantage lies with competitive males and cautious females. Culture and upbringing also contribute to the differences in competitive behaviour. Self-discipline may have also played a role. Perhaps those who ate less candy simply had better self-discipline, meaning that they had persistence to continue with the anagram task despite the other distractions. Individuals low in self-discipline are prone to procrastination and are likely to give up a task when faced with frustration (Costa, McCrae, & Dye, 1991).

It is possible that characteristics of this experimental study prevent me from showing a true relationship between sex and stress-induced eating. The absence of an effect was not due to a lack of induced stress, as a significant main effect of self-reported stress was revealed. However, stress is a complex, multilevel phenomenon, which is difficult to induce among individuals; because what overtaxes one person
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may be pleasantly stimulating for another. There were likely individual differences in
the perception of how stressful the high-stress condition was; many may not have
actually been stressed enough to change their eating behaviour as the manipulated
stressors were short term and of low intensity. It could be that stressors must be
substantially more severe or of a considerable greater intensity and duration to reveal
the interaction between stress and eating. It is also possible that the stressors used in a
laboratory setting are not of the correct type to affect eating behaviour. This
experiment must be productively examined in larger, more realistic studies. Some of
the participants in the present study finished the anagram task before the time limit
was up. For this reason, studies similar to the current one should attempt higher stress
manipulations seen in previous literature, such as unsolvable puzzles, stressful films or
telling participants that they must make a speech in front of an audience (Greeno &
Wing, 1994). Surely, the participants initial stress levels prior to the experiment
differed. As well, there are several stress-related behavioural mechanisms that may
mediate changes in food intake. As the data was collected around exam time, it is
probable that this kind of stress will had an impact on sleep, meal times and access to
food. A more thorough understanding of the stress-eating relationship requires a more
complete measurement of the stress response, including physiological and biochemical
dimensions.

Some participants may not have been hungry; it is difficult to control how soon
they had eaten prior to the experiment. Others simply don’t like sweets, as there were
participants who did not consume any candies. Future studies should include a
subjective rating of general hunger, to ensure that any variation in consumption was
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not due to hunger, instead of stress. In addition, they should include a greater variety of food to eliminate the possibility that an individual dislikes that which is available. Moreover, 5 minutes spent with candy in a laboratory setting may not provide an accurate assessment of eating. Longer term and more realistic measures of eating may enhance the likelihood of finding an effect. Another limitation of the study is that some people may not have consumed the candies, as they generally don’t accept food from strangers. Social desirability may have also played a role in that people may not feel comfortable eating in the presence of others.

Certain kinds of stress cause a decrease in food intake. In the "fight-or-flight" model of stress, the body prepares to protect itself by decreasing the blood flow to the digestive system (Greeno & Wing, 1994). There are many people, both males and females, who under-eat when they are stressed and this may have affected the ability to find a significant effect. It may be necessary to develop new categorizations of types of stress to determine which types of stress relate to over or under-eating. Stressors that disrupt time schedules may be less likely to increase consumption than stressors that cause a general feeling of discomfort or anxiety. Anecdotal evidence suggests that people facing a major emergency, such as a flood or hurricane, go for long periods of time without realizing they are hungry or stopping to eat (Greeno & Wing, 1994).

Nonetheless, the evidence presented in this review provides some guidelines for future research. Based on the present study, I believe that there are consistent stress-eating relationships but that they are not simple, one-directional phenomena. Rather, sex, food type and dietary restraint are all necessary to consider in determining
the mechanisms behind stress-induced eating. The findings of the present study
strongly suggest that future studies construct a multivariate model to account for all
the underlying factors responsible.

In a comprehensive review of the effects of stress on eating, Greeno & Wing
(1994) stated that women are more prone to stress-induced eating than are men. The
present study partially supported this claim; however, the differences were not
statistically significant. The review of this literature has led to the conclusion that
many questions pertaining to stress-related eating have yet to even be raised. In
determining the mechanisms underlying stress-induced eating, future studies should
examine different kinds of stresses and various kinds of foods.

Notwithstanding the limitations, the findings of the present study contain many
implications. Keeping a journal of eating patterns and how they link to emotional
states would be beneficial for those finding themselves overeating in times of stress.
Being educated and consciously aware that stress may cause us to lose control of our
healthy eating restraint will help prevent us from doing so. Weight loss clinics can
assist individuals with finding different ways to release stress in unpleasant situations.
They can also recommend foods which will help reduce the negative effects of stress.
For example, those which are high in vitamin C such as oranges, as well as whole
grains, which supply serotonin producing carbohydrates, will be beneficial during
times of stress (Sonstroem & Morgan, 1989). Although it is difficult to eliminate
stress from life, it is possible to keep it from damaging health. Yoga, meditation,
breathing techniques, and regular physical activity can all help to dissipate stress and
keep the body from producing undesirable levels of cortisol. A long-term exercise
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program has the ability to increase self-esteem and reduce stress and anxiety (Sonstroem & Morgan, 1989). Individuals must discover a better way to release their physical and emotional stress than overeating, and they will find themselves in a much healthier mind frame to live their best life.
Works Cited


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APPENDIX A:

Please complete the following anagram tasks. You must rearrange the letters to make a word. For example, the word “THA” can be unscrambled to HAT.

1) TIYKT

2) DCYAN

3) CTDORO

4) TAMNOIUN

5) EBTAL

6) HEALPENT

7) THREA

8) RWAET

9) TOGNERA

10) EPHNO

11) UINEVSRHY

12) ASCSL

WHEN FINISHED: How stressed, on a scale of 1 to 5, do you feel right now? (1 = low; 5 = high) ___
Table 1: Mean Candy Consumption

<table>
<thead>
<tr>
<th>Stress Groups</th>
<th>Mean (M)</th>
<th>Standard Deviation (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>1.80</td>
<td>0.56</td>
</tr>
<tr>
<td>Females</td>
<td>4.50</td>
<td>0.56</td>
</tr>
<tr>
<td>LO</td>
<td>2.70</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>3.70</td>
<td>0.56</td>
</tr>
</tbody>
</table>
Table 2: Tests of Between-Subjects Effects on the Dependent Variable Candy Consumption

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>34.23</td>
<td>1</td>
<td>34.23</td>
<td>10.78*</td>
</tr>
<tr>
<td>Stress</td>
<td>0.03</td>
<td>1</td>
<td>0.03</td>
<td>.01</td>
</tr>
<tr>
<td>Sex*Stress</td>
<td>7.23</td>
<td>1</td>
<td>7.23</td>
<td>2.28</td>
</tr>
<tr>
<td>Error</td>
<td>114.300</td>
<td>36</td>
<td>3.18</td>
<td></td>
</tr>
</tbody>
</table>

Note: * Deontes $p < .05$