THE ROLE OF STRESS AND FATIGUE IN MODERATING CONSUMPTION BEHAVIORS

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Abstract

Research into factors that influence health-related behaviors has traditionally involved investigation of conscious factors, but more recent studies have begun to investigate the role of nonconscious influences on health behaviors. A promising avenue of research involves the influence of implicit attitudes about health-relevant stimuli on health-related behaviors such as food consumption. Numerous studies have suggested that a variety of variables influence the relationship between implicit attitudes and behaviors (e.g., Friese & Hoffman, 2009; Hofmann, Friese, & Roefs, 2009). This study tested the hypotheses that stress and fatigue, which have been shown in previous research to have a connection to health-related behaviors, would moderate the relationship between implicit attitudes about candy and the amount of candy eaten by participants in a mock taste test. The study recruited a total of 52 participants who were informed that the research was about how stress and fatigue influence taste perception. Participants completed self-report surveys to measure stress and fatigue and a picture categorization task designed to assess implicit attitudes about candy. Participants were then asked to rate a candy on several different taste dimensions, and following debriefing about the true aims of the study their candy consumption was measured. Data were analyzed using hierarchal linear regression to control for multiple demographic variables. The results of these analyses did not support the study hypotheses that stress and fatigue would moderate the relationship between implicit attitudes and candy consumption. However, there were significant relationships between gender and candy eaten, and between fatigue and candy eaten. The implications of these results for interventions targeting health behaviors, limitations of the research, and directions for future investigations are discussed.

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CHAPTER I

Introduction and Literature Review

Introduction

An important area of focus within health psychology is examination of the behavioral correlates of good health, with the ultimate aim of promoting an increase in behaviors that are conducive to wellness (Westmaas, Gil-Rivas, & Silver, 2007). The focus on health behaviors is an important issue within health psychology because it has clear relevance for current healthcare problems. It was estimated that in the year 2000 over 30% of deaths were attributable to tobacco use, poor diet and exercise, and alcohol consumption, all clearly behavioral problems (Mokdad, Marks, Stroup, & Gerberding, 2004). Danaei et al. (2009) estimated that of all deaths in the United States in the year 2005, about 16-20% could be attributed to tobacco smoking, and 8-9% could be explained by each of overweight-obesity, physical inactivity, and high blood-glucose levels. In 2014, the leading cause of death in the United States was heart disease, and among the top ten causes of death were cancer (2nd), chronic lower respiratory disease (3rd), accidents (4th), stroke (5th), and diabetes (7th) (U.S. Department of Health and Human Services, 2016); all of these can be associated with modifiable risk factors (Danaei et al., 2009). Health psychologists have sought to replace such negative behaviors with more positive ones, such as good dieting and exercise habits, as well as abstinence from smoking or excessive drinking. However, health habits can be a difficult thing to change, especially at a societal level.

An important component in developing plans to promote health behavior change, both for individuals and larger communities, is to develop theoretical models that explain how various factors act and interact to influence engagement in health behavior. With this knowledge, appropriate attention can be paid to the relevant variables that influence healthy behaviors, and

strategies can be developed that target these variables to maximize the effect of behavior-change programs and promote more positive health outcomes.

Statement of the Problem

Evidence from the literature suggests that health behaviors are influenced under certain circumstances by our implicit attitudes, particularly in the realm of nutrition. It may be that psychological and physiological states serve as moderators of the relationship between implicit attitudes and health behaviors. Such a relationship could explain how states that represent depletion, such as stress and fatigue, influence participation in health behaviors—people who are affected by high levels of stress and fatigue may lack the psychological resources that are necessary for regulating behavior (i.e., promoting behavior that is contrary to implicit attitudes), and thereby avoiding unhealthy practices (e.g., eating greater amounts of candy).

In the current research, I attempted to examine whether current experiences of stress and fatigue affect the relationship between implicit attitudes and unhealthy behavior. This study aimed to contribute to the body of scientific knowledge about engagement in unhealthy behaviors by investigating potential variables that would be included in a model of nonconscious processes which influence health behavior engagement. Specifically, the study addressed two questions:

1. Does stress influence the relationship between implicit attitudes and health-related behavior?
2. Does fatigue influence the relationship between implicit attitudes and health-related behavior?

The answers to these questions could add to the understanding of the role of stress and fatigue in health, and provide insight into avenues of intervention to increase healthy behaviors and reduce unhealthy ones.

Summary of the Literature

Determinants of health behaviors. Affecting change in behavior is a critical component of health psychology's efforts to promote positive health and prevent the development and impact of many diseases; to this end, several models of behavior change have been developed to describe the factors that contribute to adoption of health behaviors. One of the most prominent, the health belief model (Rosenstock, Strecher, & Becker, 1994), suggests that individuals will make changes in health-related behaviors if they perceive that there is some threat to their health which is serious, and if they believe that the benefits of making the change are greater than the costs or barriers to the change. Two other theories, the theory of reasoned action (Ajzen & Fishbein, 1980) and the theory of planned behavior (Ajzen, 2005), emphasize the importance of behavioral intentions to change. The former theory holds that behavioral intentions are affected primarily by two elements: the person's attitudes about the behavior and the perception of social norms about the behavior (Ajzen & Fishbein, 1980). The theory of planned behavior additionally suggests that perceived behavioral control, or one's confidence in one's ability to engage in a behavior, is a third factor that influences intentions and, in turn, behaviors (Ajzen, 2005). However, research findings have suggested that for many health behaviors, the key components of these three theoretical models are weak-to-moderate predictors of the actual behaviors (Westmaas et al., 2007). The transtheoretical model of change (Prochaska, DiClemente, & Norcross, 1992) is another model that explains health behavior change which proposes that individuals move through various temporal stages when implementing changes, consisting of precontemplation, contemplation, preparation, action, and maintenance. These stages involve various degrees of different change processes, and are often experienced in a repeating cycle. This model is often applied with the aim of matching interventions to the particular stage that a

person is at and the associated processes that the person is likely to find helpful. Despite wide use, several randomized control trials assessing the effectiveness of interventions based on the transtheoretical model have suggested that it may not be any more effective than usual care at fostering behavior change for a variety of health behaviors (Bridle et al., 2005). While many of the elements in these models seem to be components of individuals' adoption of healthy habits, it seems important to consider what other mechanisms may be at work.

The aforementioned theories of health behavior concern mostly conscious processes, but more recent research into the determinants of health behaviors has suggested that they are influenced by many nonconscious processes as well. A review by Sheeran, Gollwitzer, and Bargh (2013) highlights the emerging evidence that attentional processes and implicit affective attitudes to stimuli hold sway over individuals' use of health behaviors, and that certain interventions targeted at these processes may have utility in promoting positive health behaviors. It is therefore important, when constructing theoretical models of health behavior and health behavior change, that such nonconscious processes be incorporated alongside the conscious factors that are proposed by the aforementioned theories.

Implicit attitudes. Implicit attitudes are one of the nonconscious factors that Sheeran et al. (2013) suggest might influence engagement in health behaviors. Gawronski and Bodenhausen (2006) provide a conceptual model to describe implicit attitudes and their distinction from explicit attitudes. Implicit attitudes are automatic affective reactions to a stimulus, which are derived from the associative networks that are activated by that stimulus. As an example, if a person has had bad experiences with dogs, there may be an associative link between *dog* and *bad* which would lead to a negative implicit attitude about dogs. Implicit attitudes can be contrasted with explicit attitudes, which are more deliberate, conscious evaluations of a stimulus. While

implicit attitudes are reactions based on nonconscious associative networks, explicit attitudes are formed largely by transforming information from associative networks into a proposition that is then evaluated as a valid basis for the reaction by comparison to other relevant propositions. Continuing with the prior example, the person with a negative implicit attitude about dogs might form the conscious proposition, "I dislike dogs" which is then compared to other propositions. If the other propositions agree (e.g., "dogs are vicious"), the first proposition is accepted as valid and the explicit attitude is likely to match the implicit attitude; if the other propositions conflict with the original one (e.g., "nice people should like dogs" or "my friends all like dogs"), it may be rejected as a valid reason for the initial reaction, leading to an explicit attitude that differs from the implicit attitude (Gawronski & Bodenhausen, 2006).

Several tests exist for measuring implicit attitudes, with varying methodologies (Wittenbrink & Schwarz, 2007). The most frequently used is the Implicit Associations Test (IAT; Greenwald, McGhee, & Schwartz, 1998), which was initially developed for assessing racial stereotypes and self-concepts. The IAT allows for comparison of attitudes about two different target stimulus categories (e.g., cats and dogs). In the procedure, participants are tasked with sorting visually-presented stimuli into groups by pressing a button. Initially, they categorize stimuli into the two target categories (e.g., *cats* and *dogs*), and then categorize stimuli into two evaluative categories (e.g., *positive* and *negative*). Then, these two tasks are combined, so that each target category shares a button with an evaluative category (e.g., one button designates a stimulus as *cat* or *positive*, while the other designates it as *dog* or *negative*). The theory underlying the IAT is that response times will be longer when target categories are matched with evaluative categories in a manner that is opposite of a participant's implicit attitudes, because it will take more mental effort to associate the two designations to a single button-press. Using the

example with cats and dogs as target categories, if a participant likes cats and dislikes dogs, then they would be expected to respond faster when *cat* shares a button with *positive* and *dog* shares a button with *negative*, because these pairings are closer in the participant's cognitive associative network (Greenwald et al., 1998). Research on the reliability and validity of the IAT have generally supported sufficient reliability (which is often greater than other implicit attitude measures), and good criterion validity in terms of distinguishing between known groups, agreeing with explicit reports of attitudes, and predicting behaviors associated with automatic attitudes (Lane, Banaji, Nosek, & Greenwald, 2007). Research on the IAT has also led to refinement of scoring procedures (Greenwald, Nosek, & Banaji, 2003) and development of alternative forms such as the single-category IAT (SC-IAT; Karpinski & Steinman, 2006), both of which have also demonstrated good psychometric properties.

Implicit attitudes and health behaviors. The review by Sheeran et al. (2013) notes the apparent connection between implicit attitudes and health behaviors based on several research studies. However, information from other research studies suggests this relationship is not direct. Specifically, it seems that implicit attitudes about health-behavior-relevant stimuli influence behavior most strongly when there are fewer self-control resources. Friese and Hofmann (2009) found that implicit attitudes about potato chips influenced how many chips participants consumed in a taste test, but that this relationship was moderated by trait self-control, with participants with lower self-control experiencing a greater effect of implicit attitudes on their behavior. The authors also found similar results when assessing participants' implicit attitudes about alcohol and the effects of these attitudes on self-reported drinking behavior. While implicit attitudes held relatively little sway over participants with high self-control, they were much more influential for participants with low self-control; participants who had low self-control and

positive implicit attitudes tended to consume the most chips and alcohol. In another study, Hofmann, Friese, and Roefs (2009) found that executive attention, inhibitory control, and affect regulation all moderated the relationship between implicit attitudes and candy consumption, with higher scores on each variable reducing the effect of implicit attitudes on candy consumption. Working memory capacity seems to have a similar function for behavioral control (Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008). Together, all of these studies suggest that various individual traits related to self-control are important moderators of the relationship between implicit attitudes relevant to health behaviors, and the actual enactment of the behaviors. Specifically, behavior seems to be more heavily influenced by implicit attitudes when self-regulation ability is low.

Although the aforementioned studies all considered trait factors, there are also other, state-dependent variables involved in self-control that may have significance for health behaviors. In a study similar to the one by Hofmann et al. (2008), Hofmann, Rauch, and Gawronski (2007) tested the relationship between candy-eating implicit attitudes, explicit dietary restraint standards, and candy-eating behavior, but this time used an experimental manipulation meant to reduce participants' self-regulatory resources by encouraging them to suppress their emotions. The authors found that implicit attitudes had more of an effect on the amount of candy eaten for participants in the emotional restriction condition. The candy-eating behavior of participants with higher regulatory resources (in the control condition) was more strongly influenced by the subjects' explicit dietary standards. These results suggest that situational circumstances (in this case, emotional regulation capacity) may also affect the relationship between implicit attitudes and health behaviors.

If the relationship between implicit attitudes and health-relevant behaviors is influenced by self-control resources, and if these resources can be manipulated in a laboratory setting, it would make sense that environmental factors could similarly affect self-control resources, and thus influence the relationship between implicit attitudes and behaviors. The demands of daily life may function in a way similar to the experimental manipulation used by Hoffman et al. (2007) to influence the relationship between implicit attitudes and behavior. Therefore, it is worth considering whether variables like stress and fatigue, which reflect the impact of everyday demands and which have been found to be related to health behaviors, operate through this mechanism.

Stress and health behaviors. The concept of stress has been a critical element in health psychology research for decades. Stress, and an individual's ability to cope with stress, influence physical health in a variety of ways (Carver, 2007). Cohen, Kessler, and Gordon (1998) note that although different theoretical frameworks take different perspectives on the definition of stress, many seem to agree that stress encapsulates psychological and physiological responses to situations in which an organism's abilities are taxed or exceeded by current demands of the environment. Much of the research on stress within health psychology has focused on the role of stress in psychoneuroimmunology, and has found that stress impacts several different mechanisms of immune functioning in a way that increases vulnerability to disease (Kemeny, 2007). However, more recent research has considered how stress may influence health through other mechanisms, including health behaviors.

Stress has historically been measured with several different techniques, including environmental approaches (e.g., measuring the frequency or number of stressful events), biological measurements (e.g., skin conductance or cortisol concentrations in saliva), and

psychological means (e.g., self-report measures of subjective stress). Each of these perspectives makes unique contributions to the understanding of the relationship between stress and health, and the decision of which approach to use should be tailored to the particular question presented in a given research study (Cohen et al., 1998). In the consideration of how stress is related to health behaviors, psychological measures of stress are likely the most appropriate, since the subjective experience of stress involves an evaluation of coping resources, which include behaviors that are intended to deal with stressors and which may also have an effect on health (Monroe & Kelley, 1998). One widely-used measure of subjective stress is the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), which was developed to assess general stress that is nonspecific to particular life events.

Research has supported the idea that stress is a moderator of engagement in health behaviors. In a survey study of several employees entering a wellness program, Clark et al. (2011) found that individuals who reported high levels of stress in the last week also rated their exercise and nutritional habits lower than those who reported low levels of stress, suggesting a link between stress and fewer health behaviors. This is also supported by the finding that veterans with posttraumatic stress disorder (PTSD) demonstrate significantly fewer positive health behaviors than those without PTSD (Godfrey, Lindamer, Mostoufi, & Afari, 2013). Lipschitz, Paiva, Redding, Butterworth, and Prochaska (2015) found evidence from a health behavior change program that improvements in stress management were associated with improvements in other health behaviors, including diet. Although many of these studies draw a direct connection between stress and engagement in health behaviors, it may be that stress affects behavior by moderating the influence of implicit attitudes about health behavior-related stimuli.

Fatigue and health behaviors. Fatigue can be defined as a subjective experience of tiredness or weakness, which is persistent and extreme; it can be experienced both physically and mentally (Dittner, Wessely, & Brown, 2004). Although much of the research on fatigue has focused on its presence as a symptom within clinical populations, studies have suggested that fatigue is a condition experienced frequently within the general population (Pawlikowska et al., 1994). Although there is no gold standard in the measurement of fatigue (Dittner et al., 2004), the Chalder Fatigue Scale (CFS; Chalder et al., 1993) is a widely used assessment that has been used with clinical and nonclinical groups, and that can distinguish between mental and physical dimensions of fatigue.

Fatigue is another potential state that could contribute to low health behavior adherence, because it reflects a depletion of physical and mental resources. However, most research on the relationship between fatigue and health behaviors seems to focus on how healthy behaviors like exercise and balanced diet contribute to reductions in fatigue; this relationship has been documented in several studies with diverse populations (e.g., Annesi, Johnson, & Porter, 2015; George et al., 2014; Weiland et al., 2015). Fewer studies have explored how fatigue might affect engagement in these behaviors. In one analysis of a dataset from a former study, Yarcheski, Mahon, and Yarcheski (2009) looked at correlations between self-reported vigor, fatigue, and positive health behaviors such as exercise, nutrition, and relaxation. They found that, while vigor was significantly positively related to most health behaviors, fatigue was significantly negatively associated with health behaviors, particularly nutrition. Many of the studies on the relationship between fatigue and health behaviors are correlational, so the relationship between these two variables may in fact be bi-directional, and fatigue may represent another factor that could influence how implicit attitudes guide behavior.

Research Hypotheses

The hypotheses for this research study assumed the validity of the finding that there is a relationship between implicit attitudes and health behaviors, and that this relationship can be influenced by a variety of variables related to self-control. These hypotheses were also based on the findings of relationships between stress and fatigue, and health behaviors. The hypotheses implicitly propose that a mechanism by which stress and fatigue influence engagement in an unhealthy behavior is through the connection between implicit attitudes and that unhealthy behavior.

I considered whether participants who report different levels of stress and fatigue would differ in the degree to which their implicit attitudes about candy were related to their consumption of candy during a mock taste test, using a methodology similar to that employed by Hofmann et al. (2009). There were two hypotheses for this experiment:

1. Stress will moderate the relationship between implicit attitudes and candy consumption; specifically, there will be an interaction effect of stress and implicit attitudes on the amount of candy consumed, such that higher stress will be associated with a stronger relationship between implicit attitudes and candy consumption.
2. Fatigue will moderate the relationship between implicit attitudes and candy consumption; specifically, there will be an interaction effect of fatigue and implicit attitudes on the amount of candy consumed, such that higher fatigue will result in a stronger relationship between implicit attitudes and candy consumption.

Although both of these hypotheses are directional, I tested for effects in both directions to allow for unanticipated discoveries. An important assumption about the relationship between these hypotheses and the research questions stated above is that laboratory measurements of an

unhealthy behavior (in this case, candy consumption) can be used as a representative of broader health-related behaviors. This assumption is, however, not a novel one, as it has been employed in prior studies, as discussed above.

CHAPTER II

Methods

Research Participants

Participants for this study were required to be at least 18 years old and able to provide their own informed consent for participation in the study. Other than these criteria, there were no exclusion criteria for participants, although they were notified before the study that participation would involve consuming chocolate candy, and were advised not to participate if they had any problems with this (e.g., dietary restrictions). Participants were recruited to the study by word of mouth, by posting flyers in approved areas around Los Angeles, California, and Jackson, Mississippi, and by solicitations via social media. To encourage participation, participants were given the opportunity to enter a drawing to win a $50 gift card to a local coffee shop.

A total of 52 participants were recruited for this study. One of these participants was removed due to incomplete data, for a total sample of 51 participants. The sample consisted of 17 self-identified male (33.3%) and 34 female (66.7%) participants. The racial and ethnic background of the sample, as identified by participant self-report, was as follows: 18 (35.3%) White/Caucasian; 14 (27.5%) Hispanic; 7 (13.7%) mixed race; 6 (11.8%) Asian or Pacific Islander; 4 (7.8%) Black or African American; 1 (2.0%) Middle Eastern; and 1 (2.0%) Eastern European. Participant ages ranged from 18 to 76 years old, with a mean age of 35.9 years and a standard deviation of 14.7 years.

Design

This study used a correlational, cross-sectional design. Stress, fatigue, and implicit candy attitudes were assessed as independent variables, and the number of candies eaten by participants during a taste test were used as the dependent variable. Participant age, gender, race/ethnicity,

and estimated body mass index (BMI), as assessed by self-report questionnaire; explicit candy attitudes, as indicated by a question on a candy rating form; and recruitment location (California versus Mississippi) were assessed for confounding influences.

Instruments

Single Category Implicit Association Test. In order to assess participants' implicit attitudes about candy, I used a version of the Implicit Association Test (IAT) that has been adapted for assessing automatic attitudes about a single category. The SC-IAT (Karpinski & Steinman, 2006) differs from the original version of the IAT in that, while the IAT assesses associations between two categories (e.g., African-American and White names) and two evaluative dimensions (e.g., positive and negative), the SC-IAT is intended to measure association of only one category with two evaluative dimensions.

The SC-IAT is administered on a computer, and asks participants to respond to visual stimuli with button presses on a keyboard. In each trial of the test, a stimulus (in the case of this study, an image) is presented in the center of the screen, and participants must respond as quickly as possible by pressing one of two buttons to categorize the stimulus. The stimulus can be classified either in terms of an evaluative dimension (in this study, positive or negative), or in terms of its membership in a single category (in this study, candy). Stimuli for each trial within a block of trials are randomly selected from one of the three groups (positive, negative, or candy, with 12 possible stimuli per group). The two conditions of the evaluative dimension always pertain to opposite buttons, and the button for designating category membership is shared with one of the two evaluative dimensions. Halfway through the test, the button for designating category membership is switched to the opposite button while the evaluative classifications remain on their same respective buttons. To avoid a response bias, since two buttons are used to

designate three categories, stimuli are selected at a 7:7:10 ratio, with 7 stimulus pictures randomly selected from each group that shares a button with another group, and 10 stimuli randomly selected from the group that does not share a button with the other group. In the present experiment, sets of stimuli were selected independently for the two halves of the task. In this study, the buttons "z" and "/" were used for participant responses, and labels for the classifications assigned to each button were displayed in the lower left and right corners of the screen throughout the test. Designation of evaluative dimensions to those keys were counterbalanced between participants, and the initial position of the category designation button was also counterbalanced between participants. The test consisted of four blocks of trials: a practice block of 24 trials, a test block of 72 trials, a practice block of 24 trials (with the category designation button reversed from its position in the first two blocks), and a test block of 72 trials (with the category designation button in the same position as in the previous practice). For a sample breakdown of test blocks for one participant, see Table 1. Practice blocks and subsequent test blocks were experienced as continuous by participants, with no breaks between trials. Prior to each practice block, a set of instructions were displayed; the first set of instructions explained the task and button mappings, and the second set of instructions explained the new button mappings. If a participant made a mistake on a trial, an X would briefly appear in the center of the screen to indicate an error, before the next trial was started.

Table 1.

Sample Breakdown of Test Items for the SC-IAT

Block	Purpose	Trials	"z" key response	"/" key response
1	practice	24	*positive* + *candy*	*negative*
2	test	72	*positive* + *candy*	*negative*
3	practice	24	*positive*	*negative* + *candy*
4	test	72	*positive*	*negative* + *candy*

Note. There is no break between practice blocks and their subsequent test blocks. These are experienced as continuous by the participant.

The visual stimuli for *positive* and *negative* evaluative classifications consisted of 20 images from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). Of those images, 10 with a negative valence rating and 10 with a positive valence rating were selected. The stimuli for the *candy* categorical classification consisted of 7 non-copyrighted images of various candies taken from the internet (see Appendix A).

The idea behind evaluation of SC-IAT performance is that participants will tend to have longer response latencies for the category when the category designation shares a button with an evaluative designation that is incongruent, according to the participant. For example, a participant who has implicit positive attitudes about candy will tend to have faster responses when the designation of *candy* shares a button with *positive*, compared to when it shares a button with *negative*. I used the SC-IAT scoring algorithm outlined by Karpinski and Steinman (2006), which is based on an improved algorithm for IAT scoring developed by Greenwald et al. (2003). The first step in this algorithm is to discard data from practice blocks (Blocks 1 and 3), responses that are shorter than 350 ms, and nonresponses. Then, error responses (where there was an

incorrect categorization) are replaced with the mean correct response time of the block plus 400 ms. These values are used to calculate an average response time for the test blocks (Blocks 2 and 4). The average response time for the block where *candy* is paired with *positive* (Block 2 in the example from Table 1) is subtracted from the average response time for the block in which *candy* is paired with *negative* (Block 4 in the example), and then the resulting value is divided by the standard deviation of all correct response times in test blocks (Blocks 2 and 4). This results in a single *D* score for each participant, with more positive values indicating more implicit positive than negative associations with candy.

The SC-IAT was originally normed on a population of introductory psychology students. The developers of the new method (Karpinski & Steinman, 2006) found the SC-IAT to have acceptable internal reliability (r = .69 on average), which was similar to reliability of the IAT, and much higher than reliability measurements reported for other measures of implicit attitudes. The authors also determined that the SC-IAT scores on several tests were correlated to IAT scores (r = .29 to .40 for various studies involving attitudes about soda and racial groups), suggesting good concurrent validity, but also found evidence that the SC-IAT measured a construct separate from the IAT (since the latter measures dualistic associations while the former is meant to measure single-target associations). Karpinski and Steinman (2006) found that SC-IAT measures that assessed attitudes for Coca-Cola and Pepsi were predictive of participants' choice of soda after controlling for explicit attitudes, implying good predictive validity. (Only the Pepsi SC-IAT was a significant predictor before controlling for explicit attitudes, but the authors noted that participants were from a campus with Pepsi vending machines). The authors also found that a self-association SC-IAT was correlated with measures of explicit self-esteem, suggesting good concurrent validity when applied to the concept of self.

Perceived Stress Scale. To measure stress of participants, I used the 10-item English version of the Perceived Stress Scale (PSS; Cohen et al., 1983). This self-report questionnaire has participants rate the degree to which several statements apply to their lives, considering the last month, on a 5-point Likert scale. Scores can range from 0 to 40, with higher scores indicating more stress. See Appendix B for the PSS and Appendix C for permissions.

Cohen and Williamson (1988) conducted analyses of the reliability and validity of the PSS on a large sample of the United States population (n = 2387), considering the three forms of the scale (14-, 10-, and 4-item). In conducting principal component analysis of the 14-item scale, the authors found that four items had low loadings on the first component of the measure, and assessed the psychometric properties of the scale with these four items excluded. The resulting 10-item form demonstrated good internal reliability (α = .78, which was a small increase over the 14-item version's reliability), and items appeared to cluster into two factors comprising negatively- and positively-worded questions. These authors also found moderate correlations between the PSS and ad-hoc measures of stress, such as amount of stress experienced in an average week (r = .39), amount of stress experienced currently as opposed to last year (r = .26), and number of stressful life events (r = .32).

Chalder Fatigue Scale. In order to assess participants' current level of fatigue, I used the Chalder Fatigue Scale (CFS; Chalder et al., 1993). The CFS is a self-report questionnaire that consists of 11 questions, which participants answer by marking one of four responses: "less than usual," "no more than usual," "more than usual," or "much more than usual;" or "better than usual," "no worse than usual," "worse than usual," or "much worse than usual" for the question "how is your memory?". The questionnaire can be scored in two ways: The Likert method involves assigning scores of 0, 1, 2, or 3 to the respective responses, while the binary method

involves assigning respective scores of 0, 0, 1, 1 (i.e., 0 for responses denying fatigue, 1 for responses affirming fatigue). I used the Likert model of scoring, which yields a total fatigue score from 0 to 33, with higher scores indicating more fatigue. The CFS also allows for a distinction between physical fatigue (items 1-7) and mental fatigue (items 8-11). See Appendix D for the CFS and Appendix E for permissions.

The CFS was originally developed and normed for use with patients with chronic fatigue syndrome. Chalder et al. (1993) used the scale to assess a large sample of new hospital patients with a variety of complaints. Their analysis determined that the CFS has good internal consistency reliability (α = .88 to .90), good split-half reliability, and a factor structure that supported the distinction between mental and physical fatigue items. These authors also found that the measure had good ability to discriminate between patients classified as fatigued or non-fatigued based on a clinical interview schedule. Loge, Ekeburgh, and Kaasa (1998) tested the scale with a large sample of the general Norwegian population (n = 2323), and found it to have good reliability with this group (α = .86 for total fatigue). These authors also found that fatigue was significantly higher in groups who reported current health problems, and groups that were receiving disability benefits, as would be expected due to the relationship between physical health conditions and fatigue. In a study that utilized a version of the CFS with Chinese participants and assessed an alternate three-factor structure (consisting of physical fatigue, low energy, and mental fatigue), all factors of the measure were significantly correlated with anxiety, depression, and exhaustion as measured by other self-report scales (Fong et al., 2015).

Procedures

Participants were invited to participate in a study investigating the role of fatigue and stress on taste perception. Before participating in the study, volunteers were warned that

participation would involve taste-testing a candy that contains chocolate, and were advised to not participate if they had any dietary restrictions that prohibit consumption of these items. As a cover story to prevent participants from guessing the true aim of the research, participants were told that the study sought to investigate how different dimensions of taste perception change under the effects of stress and fatigue. Appendix F contains the informed consent document that was used to introduce participants to this study.

In order to improve recruitment of participants and to allow for flexibility in the timing of participation, the procedures for this study were carried out in a variety of locations. To ensure that the experimental conditions are similar for participants in these diverse locations, all testing locations included a table and a chair that allow the participant to sit at a comfortable height, and had minimal noise or other distractions. Only the participant and the experimenter were present in the room while the experiment was being conducted.

After consenting to participate, participants completed the SC-IAT on a laptop computer owned by the experimenter. Once participants finished the SC-IAT, they were given paper forms of the PSS, and then the CFS, to fill out. Throughout these tests, the experimenter was present to answer any questions that the participants had about the assessments.

After completing these steps, participants were asked to participate in a candy taste test. The experimenter gave each participant an unopened bag of plain M&M's that had been weighed beforehand, and a paper form that asked the participant to rate the candy on a 5-point scale on several taste dimensions, such as bitterness or sweetness, as well as provide ratings of agreement (also on a 5-point scale) with statements about the candy, such as "I like the way this candy looks," and "This candy tastes natural" (see Appendix G for this form). One of these statements, "I enjoy eating this candy," was used as an indication of participants' explicit attitudes about

candy on a scale from 0 to 4. Participants were told that they could take as long as they needed to complete the test, and that they could eat as much or as little of the candy as necessary to make their ratings.

Following the taste test, participants were asked to fill out a demographic form (see Appendix H) on which they indicated their age, gender identity, and racial/ethnic identity, and then were asked to estimate their current weight and height (which was used to calculate an estimated BMI). After completing this form, the experimenter debriefed participants on the study, and explained that the real variable of interest was the amount of candy that they ate during the taste test, and not their ratings of the candy. The experimenter then requested permission from each participant to weigh the remaining candy in their bag. Because this element of the experiment involved deception, participants were offered the opportunity to withhold this information from the experimenter and have their data discarded from the experiment, without any loss of benefits from participating. If participants consented to this additional measure, the candy that they did not consume in the taste test was weighed, and this amount was subtracted from the original weight of the full bag to arrive at a total weight of candy consumed for each participant (see Appendix I for experimental debriefing form). None of the participants involved in this experiment elected to withhold the amount of candy they ate.

After completion of the experiment, participants were thanked for their cooperation, and were free to take any candy that they did not consume with them. They were also given the opportunity to enter into a drawing to win a $50 gift card to a local coffee shop by providing an e-mail address or a phone number to the investigator.

Data Analysis

Descriptive statistics were computed for age, gender identity, and racial/ethnic group in order to determine the demographic characteristics of the sample. Missing data were excluded from analyses casewise, resulting in the removal of one participant from the analyses.

A moderation analysis, consisting of a hierarchical linear regression, was used to test the main hypotheses of this study. All tests for statistical significance were performed at an $\alpha = .05$ significance level and were non-directional. Multicollinearity was minimized by using the centered products of the independent variables to assess interaction effects. Variance inflation factors were examined to ensure acceptably low multicollinearity in the regression models. Plots of residuals of the final regression model versus expected values were examined to determine whether the homoscedasticity, normal error distribution, and linearity assumptions of linear regression had been violated.

Both hypotheses were tested with a four-step linear model with amount of candy eaten as the dependent variable. At the first step, main effects for control variables (age, gender identity, racial/ethnic group, estimated BMI, participant location, and explicit candy attitude) were entered. Participants who selected two or more racial/ethnic groups were categorized as mixed race. As there were seven racial/ethnic groups in the final sample, this variable was represented by six dummy variables in the regression equation. At the second step, main effect of PSS score, main effect of CFS score, and main effect of SC-IAT *D*-score were entered. The third step added the centered product of the PSS scores and SC-IAT *D*-scores, and the centered product of the CFS scores and SC-IAT *D*-scores. The fourth step included the centered product of all three independent variables (PSS score, CFS score, and SC-IAT *D*-score). The hypothesis that stress would moderate the relationship between implicit attitudes and candy consumption was tested by

assessing the significance of the beta weight for the centered product of the PSS scores and SC-IAT *D*-scores (entered in step three) to see whether there was a significant interaction effect on candy eaten. Similarly, the hypothesis that fatigue would moderate the relationship between implicit attitudes and candy consumption was tested by assessing the significance of the beta weight for the centered product of the CFS scores and SC-IAT *D*-scores to determine if there was a significant interaction effect on candy eaten. As an exploratory analysis distinct from the study hypotheses, the significance of the beta weight for the three-way centered product (entered in step four) was also assessed to determine whether there was an interaction effect that involved both stress and fatigue.

CHAPTER III

Results

Descriptive Statistics

Table 2 includes descriptive statistics for all measured variables in this study. The majority of participants in this study identified as female, and were recruited from the Los Angeles, CA area. Due to the limited number of male participants, and participants from Jackson, MS, inferences about these groups may have been limited by their underrepresentation in the current sample. Also notable is that the distribution of age in this study was positively skewed, so inferences with regards to older adults may be similarly limited. Two of the racial/ethnic groups represented in this study contained only one participant (Middle-Eastern American and Other). Therefore, any findings regarding characteristics of these groups cannot be reasonably assumed to be due to their racial or ethnic identity.

Table 2:

Descriptive Statistics for Measured Variables

Variable	Levels	*n* (%)	Mean (SD)	Range
age (years)			35.9 (14.7)	18 - 76
gender	*male* *female*	17 (33.3%) 34 (66.7%)		
race/ethnicity	*White/Caucasian* *Black/African American* *Hispanic/Latino/Latina* *Asian/Pacific Islander* *Middle-Eastern American* *Other* *Mixed*	18 (35.3%) 4 (7.8%) 14 (27.5%) 6 (11.8%) 1 (2.0%) 1 (2.0%) 7 (13.7%)		
BMI (kg/m^2)			24.8 (4.1)	17.5 - 36.2
location	*Los Angeles, CA* *Jackson, MS*	44 (86.3%) 7 (13.7%)		
explicit candy attitude			2.8 (1.1)	1 - 4
PSS score			17.8 (7.0)	5 - 32
CFS score			14.2 (5.8)	3 - 27
SC-IAT *D*-score			0.126 (0.414)	-1.219 - 0.935
candy eaten (g)			7.5 (5.7)	1 - 29

Reliability of Self-Report Measures

Cronbach's α was computed for the PSS and CFS to determine internal consistency reliability. Within the current sample, the PSS had an internal consistency reliability of $\alpha = .90$, which was higher than the reliability of $\alpha = .78$ found by Cohen and Williamson (1988). The

CFS had an internal consistency reliability of α = .89, which was within the bounds of .88 and .90 as reported by Chalder et al. (1993).

Linear Regression Analyses

Table 3 provides the structure of each step of the hierarchal linear regression described above, the associated R^2 values, and change statistics.

Table 3:

Hierarchal Linear Regression of Candy Eaten

Step	Predictors Added	R^2	R^2_{change}	F_{change} (df_{model},df_{res})	p_{change}
1	age, gender, race/ethnicity, BMI, location, explicit candy attitude	.4156	.4156	2.521 (11,39)	.0166*
2	PSS, CFS, D_{candy}	.5531	.1375	3.7065 (3,36)	.0211*
3	PSS*D_{candy}, CFS*D_{candy}	.5819	.0288	1.1631 (2,34)	.3250
4	PSS*CFS*D_{candy}	.5918	.0099	0.8003 (1,33)	.3775

Note. PSS = Perceived Stress Scale (standard score); CFS = Chalder Fatigue Scale (standard score); D_{candy} = *D*-score for candy derived from the Single Category Implicit Associations Test (standard score)

* $p < .05$

The second step of the regression, which included the addition of the main effects of PSS score, CFS score, and candy *D*-score to the model, constituted a statistically significant increase in the model's predictive ability, R^2_{change} = .1375, $F(3,36) = 3.7065$, p = .0211. The change in predictive ability of the model was not significant for Step 3, R^2_{change} = .0288, $F(2,34) = 1.1631$,

p = .3250, or Step 4, R^2_{change} = .0099, $F(1,33)$ = .8003, p = .3775. Thus, the addition of interaction effects between the independent variables did not produce significant changes in the model's ability to predict candy eaten. Variance inflation factors for all variables in each model were within acceptable limits, suggesting no problems with multicollinearity in the models. The distributions of residuals for all models were approximately normal, based on visual review of residual plots as well as measures of residual distribution skewness and kurtosis.

The final model was used to test the study hypotheses. Table 4 contains β weights for all variables in the final model, with the exception of the race/ethnicity variable, which was assessed using an F test to account for multiple levels. There was no significant interaction effect of PSS score and D-score on candy eaten, β_{PSS*D} = -0.1140, $t(33)$ = -0.788, p = .4361. There was also no significant interaction effect of CFS score and D-score on candy eaten, β_{CFS*D} = -0.0705, $t(33)$ = -0.489, p = .6280. The interaction between PSS score, CFS score, and D-score was also nonsignificant, $\beta_{PSS*CFS*D}$ = -0.1457, $t(33)$ = -0.895, p = .3775. The only effect of any independent variables or their interactions which reached statistical significance at the α = .05 level was the main effect of CFS score; there was a significant positive relationship between CFS score and candy eaten, β_{CFS} = 0.5182, $t(33)$ = 3.141, p = .0035, suggesting that participants who experienced more fatigue ate more candy, regardless of their implicit attitudes about candy.

Table 4:

Characteristics of Final Model Components

Variable	*F*	*p*
race/ethnicity	2.759	.0276*

Variable	*β*	*t*	*p*
age	-0.282	-1.946	.0602
gender (female)	-0.490	-3.804	.0006*
BMI	-0.085	-0.526	.6025
location (Jackson)	-0.028	-0.195	.8464
explicit candy attitude	0.060	0.473	.6390
PSS	-0.097	-0.638	.5281
CFS	0.518	3.141	.0035*
D_{candy}	-0.036	-0.224	.8238
PSS*D_{candy}	-0.114	-0.788	.4361
CFS*D_{candy}	-0.071	-0.489	.6280
PSS*CFS*D_{candy}	-0.146	-0.895	.3775

Note. PSS = Perceived Stress Scale (standard score); CFS = Chalder Fatigue Scale (standard score); D_{candy} = *D*-score for candy derived from the Single Category Implicit Associations Test (standard score)

* $p < .05$

In order to assess whether this finding was the result of outliers in the data, each case was assessed using Cook's distance. Any case with a Cook's distance of more than four times the mean Cook's distance for all cases was excluded from the analyses. This resulted in the removal of three cases from the data, leaving 48 total cases. When analyses were re-conducted without

these influential cases, all interaction effects between independent variables remained nonsignificant, and the main effect of CFS on candy eaten became nonsignificant, $\beta_{CFS} = 0.2672$, $t(30) = 1.359$, $p = .1843$, suggesting that the finding that participants with more fatigue ate more candy may have been due to a few influential cases rather than a general trend shared among the whole sample. All three of the removed cases had CFS scores above the mean, with two of the cases falling more than two standard deviations above the mean. Two of the influential cases shared gender (female) and racial identity (Hispanic), but other than this there were no consistent demographic characteristics between the excluded cases.

Influence of Demographic Variables

Racial/ethnic group arose as a significant predictor of candy eaten when all groups were considered as a whole, $F(6,33) = 2.759$, $p = 0.0276$. To assess differences between specific racial groups a Tukey's test for multiple comparisons of means was used, with probabilities adjusted for multiple comparisons. The participant in the *other* racial/ethnic group consumed significantly more candy than those in the *Hispanic* group, $\bar{X}_{other}$-$\bar{X}_{Hispanic} = 14.7$, $p_{adj} = .0464$; the *Asian/Pacific Islander* group, $\bar{X}_{other}$-$\bar{X}_{Asian} = 17.3$, $p_{adj} = .0164$; and the *mixed* group, $\bar{X}_{other}$-$\bar{X}_{mixed} = 15.1$, $p_{adj} = .0470$. No other between-group differences were significant when adjusted for multiple comparisons. As previously noted, there was only a single participant who identified in the *other* racial/ethnic group, which makes it impossible to conclude that any of these significant group differences are due to differences in racial/ethnic identity rather than individual factors. When the same analyses were conducted without this case, racial/ethnic group was not a significant predictor of candy eaten, $F(5,33) = 1.302$, $p = .2871$, demonstrating that the significant impact of racial/ethnic group on candy eaten was due to this individual case.

In the final model there was a significant main effect of gender on candy eaten, such that female participants ate significantly less candy than male participants, β_{female} = -0.4902, $t(33)$ = -3.804, p = .0006. This effect remained significant even with the exclusion of the three outlier cases, β_{female} = -0.5211, $t(30)$ = -3.490, p = .0015.

Exploratory Analysis of Gender Differences

Due to the fact that gender showed a significant main effect on candy eaten, additional exploratory analyses were conducted to assess for gender differences. The full linear regression model was reevaluated with interaction effects added for gender. Each main effect and interaction effect of independent variables had an interaction effect with gender added, so the final model included the following terms in addition to those in the 4th step of the model described above: the two-way interaction of PSS and gender; the two-way interaction of CFS and gender; the two-way interaction of SC-IAT *D*-score and gender; the three-way interaction of PSS, SC-IAT *D*-score, and gender, the three-way interaction of CFS, SC-IAT *D*-score, and gender; and the four-way interaction of PSS, CFS, SC-IAT *D*-score, and gender.

With the inclusion of these terms, there was still a significant main effect of gender on candy eaten, such that female participants ate less candy than male participants, β_{female} = -0.5617, $t(27)$ = -4.468, p = .0001. There was still a main effect of CFS score on candy eaten, with participants with higher CFS scores eating more candy, β_{CFS} = 0.9039, $t(27)$ = 2.714, p = .0114. None of the new terms added were significant predictors of candy eaten; that is to say, there were no significant interactions between gender and any of the independent variables assessed in this study.

CHAPTER IV

Discussion and Conclusions

Tests of Study Hypotheses

The results of the data analysis failed to support either of the study hypotheses. That is, neither stress nor fatigue appeared to moderate the relationship between implicit attitudes and candy consumption. It is possible that stress and fatigue do not influence individuals' self-control resources in the same way that emotional regulation does, as found by Hoffman et al. (2007). This is not to say that stress and fatigue do not influence eating behaviors at all, but rather they do not do so by moderating the influence of implicit attitudes about health behavior-related stimuli on health behaviors. Indeed, as discussed previously, other studies have suggested a link between stress and engagement in health behaviors (e.g., Clark et al., 2011), and fatigue and engagement in health behaviors (Yarcheski et al., 2009).

Implicit Attitudes and Consumption

This study did not find any significant relationship between implicit attitudes about candy, as assessed by the SC-IAT, and candy consumption in a taste test. This is surprising given that previous research has generally supported a relationship between implicit attitudes and health behaviors (Sheeran et al., 2013), and specifically a relationship between implicit attitudes about candy and consumption of candy in a mock taste test (Hoffman et al., 2008; Hoffman et al., 2009). Notably, the study by Hoffman et al. (2007) which included a manipulation of participants' emotional control resources did not find a significant relationship between implicit attitudes and candy consumption for the group that did not engage in an emotional suppression task. One reason for the present study's lack of association between implicit attitudes and candy consumption may therefore be that participants in this study did not have compromised self-

control to the extent that would result in a strong relationship between implicit attitudes and behaviors.

Another possible explanation for this null result may be due to the present study's design. The candy pictures used in the SC-IAT included multiple types of candy, and were therefore meant to assess participants' attitudes about candy in general. These particular attitudes may not have applied to participants' implicit attitudes about the specific candy used in this study. For example, an individual who likes hard candies, but does not like chocolate, may have a positive implicit attitude about candy in general but a negative implicit attitude about candies that have a lot of chocolate in them. Some participants in the present study commented after participating that they would have preferred a different candy during the taste test, suggesting that their general attitudes about candy were not the same as their attitudes about the specific candy offered. This could lead participants' SC-IAT *D*-scores to be a poor representation of their attitudes about the stimuli which were relevant to the dependent variable in this study, which may have diluted the associations between implicit attitudes and candy consumption, and may even have contributed to the lack of significant findings regarding this study's hypotheses.

Stress and Consumption

The lack of a significant main effect of stress scores on candy consumption is at odds with previous research suggesting a connection between stress and health behavior (or in the case of this study, unhealthy behavior) engagement. Due to the existence of prior research establishing this connection (for example, Clark et al., 2011), it is possible that some of the limitations of this study prevented this from being observed within the current sample. There is a good deal of research supporting the concept of emotional eating, or impulsive eating in response to emotional distress. This concept is closely tied to problems with binge eating, as indicated by

measures of emotional eating and incidence of binge eating (Arnow, Kendardy, & Agras, 1995). There are several potential explanations for this phenomenon, including the idea that stress reduces dietary restraint, that eating can be a learned response for dealing with difficult emotions, or that a reversal of the usual physiological stress response results in an increase in appetite in response to stress instead of the usual decrease in appetite (van Strien, 2018). One research study with adolescents found an association between perceived stress as measured by the PSS, and scores on a measure of emotional eating, with higher levels of perceived stress contributing to higher degrees of emotional eating (Young & Limbers, 2017).

One reason for the lack of a significant relationship between stress and eating behaviors in the present study may have to do with the ways that stress and eating behaviors were measured. The association between emotional eating and binge eating suggests that increased eating in response to stress is an impulsive process, occurring quickly. For the present study, stress was measured on a much longer-term basis than eating behaviors; the PSS assesses experiences of stress over the past month, and may not have accurately captured the emotional state of participants in the moment when they were engaging in the candy taste test. A participant may have reported experiencing a stressful month, but may not have felt particularly stressed during the experiment. In this case, that participant's eating behavior may not have been influenced by the stress they experienced earlier. This idea, that eating behaviors are influenced more by moment-to-moment emotional state than by longer-term experiences of stress, could still be consistent with findings relating stress to emotional eating, such as the study by Young and Limbers (2017). In that study, although the PSS was used to assess stress, the measure of emotional eating was also a self-report measure designed to assess a long period of time, so it may have captured behaviors coinciding more closely with distressed emotional states.

This idea has some implications for interventions to address stress-related eating. If it is the case that emotional distress is most influential on eating behaviors in the moments when those eating behaviors occur, it may be most effective to encourage the use of stress reduction techniques immediately before eating (such as, engaging in relaxation exercises just before dinner time). It may be relatively less effective to implement skills for emotional regulation at other points in the day, if the goal is to limit binge eating. It may also be helpful to encourage individuals to plan their schedules so that meals or snacks are not eaten during times where high stress is expected. Recommendations for meal scheduling could include incorporating a sort of buffer time between stressful activities and meals.

Fatigue and Consumption

This study found a significant direct relationship between fatigue and candy consumption, such that greater fatigue was associated with more candy consumption, although this relationship did not maintain statistical significance when influential cases were removed from the sample. A connection between fatigue and candy consumption could make sense from a variety of perspectives. As previously noted, prior research about the association between health behaviors and fatigue have focused on how engagement in healthy behaviors contributes to lower levels of fatigue (e.g., Annesi et al., 2015; George et al., 2014; Weiland et al., 2015). It may be that individuals who tend to eat more candy, or who have a "sweet tooth," experience more fatigue due to a generally poorer diet. This observation is already a good tool for promoting reduction of unhealthy eating based on the health belief model (Rosenstock et al., 1994), because it could help an individual understand the additional benefits of making positive changes to diet. However, it may also be that individuals who are fatigued have a greater craving for foods that are calorie-dense or contain simple sugars that can be rapidly metabolized, regardless of their

implicit attitudes about those foods. Further investigation, perhaps using experimental manipulation, is needed to determine the direction of the relationship between healthy or unhealthy eating behaviors, and fatigue.

The fact that a few influential cases, all of which had fatigue scores above the sample mean, contributed to the significance of the fatigue-consumption relationship could indicate that this was a statistical anomaly, but may also suggest that fatigue is more closely related to candy consumption at extreme values. If this is the case, then interventions targeted at changing eating behaviors should account for the presence of psychosocial or medical factors that would contribute to a high degree of fatigue, such as long work hours, sleep deprivation, or anemia. It may be that such conditions place a person at greater risk of engaging in unhealthy eating habits.

If fatigue promotes unhealthy eating in this way, then techniques aimed at reducing fatigue, such as improving sleep quality or promoting regular physical exercise, may also help to curb urges to engage in unhealthy eating. Individuals who can go through their day without a sense of depleted energy may feel less compelled to turn to easy and unhealthy sources of energy, and may be more receptive to other, more healthy means to maintain their vigor throughout the day. One small study by Thayer (1987) found that eating a candy bar was associated with a brief increase in energy for students (supporting the idea that consumption of sugary foods could be a way to increase energy), but that a brief walk led to a greater increase in energy that was longer-lasting. Teaching such healthier (and ultimately more effective) means of combatting fatigue may contribute both to improved dietary health and better long-term management of fatigue.

Gender and Consumption

The analyses in this study suggested a difference between males and females with regards to candy consumption, with female participants consuming less candy in general. When additional analyses were conducted to assess any gender differences in the impact of independent variables, no other significant relationships were found, suggesting that differences in fatigue, stress, and implicit attitudes do not moderate gender differences in eating.

Differences between men and women's eating behaviors in this study may be explainable based on differences between socially constructed gender roles or differences between social pressures placed on males and females. One study of adolescents in the northeastern United States found that female students reported more sociocultural pressure regarding their weight than male students, including teasing from families about weight, pressure from friends and family to lose weight, and media pressure to maintain an ideal body type. Male students, on the other hand, faced greater pressure to gain muscle. For all adolescents, pressure from family and friends to lose weight was associated with having more negative eating attitudes and behaviors (i.e., attitudes and behaviors more conducive to development of an eating disorder; Ata, Ludden, & Lally, 2007). Another study with undergraduate students found that women had a higher tendency toward dieting and bulimia than men, and that for women the tendency toward dieting was not influenced by BMI, suggesting a pervasive drive to engage in dieting (Robinson, Kosmerly, Mansfield-Green, & Lafrance, 2014). Due to expectations about their ideal body type, women may feel more pressure than men to limit their intake of calorie-dense foods like candy. This fits with the theory of reasoned action (Ajzen & Fishbein, 1980) which holds that social norms are a determinant of behavioral intentions which in turn affect behavior. For women, a social norm that promotes dieting would promote more restricted eating. This could also explain

the findings of the current study; even if female participants were not aware that their candy consumption was being watched or measured, they may have been more conscious of their eating and therefore limited their behavior more closely. This could be due to the fact that social norms prohibit consumption of candy (a calorie-dense and unhealthy food), or the belief that eating candy would have a negative impact on health or progress toward an ideal body type (which is also a product of social expectations). It is worth noting that in this study, the specific eating behavior in question was an unhealthy behavior, so reduced consumption would promote positive health; however, in the other studies discussed (Ata et al., 2007; Robinson et al., 2014), restriction of eating was considered a risk marker for development of eating disorders. This illustrates the point that although some outcomes of social pressures on female eating habits could be viewed as beneficial (when they reduce consumption of unhealthy foods), they are substantially harmful in other important ways.

Given the differences between eating habits of men and women, interventions that seek to address eating habits should consider how gender identity might affect attitudes about food and motivation to engage in particular behaviors. These interventions should take into account the different expectations associated with masculine or feminine body types, and be wary of supporting psychosocial pressures that contribute to problematic eating habits such as excessive dieting or binge-eating. One way of doing this may be placing an emphasis on markers of health (e.g., blood pressure, cholesterol levels, blood-glucose levels) rather than markers of weight or muscle mass.

Study Assumptions and Limitations

This study included several assumptions which may limit its validity. One of the major assumptions of this research study involved the similarity between candy consumption in a

laboratory setting and candy consumption in everyday life. Participants' consumption behaviors may have been influenced by the context of participating in a research study, even though they were not informed beforehand that their behavior was being monitored. Some participants even remarked during the experimental debriefing that they had suspicions that their eating was being measured. If participants were still monitoring their behavior, this conscious control may have diluted the influence of the variables of interest and resulted in nonsignificant effects in the analyses. Other potential issues with measurements in this study have been discussed as well, including the fact that SC-IAT candy stimuli may not have matched the candy used in this study closely enough, and the idea that measuring stress (as well as fatigue) over a long time period may not be as relevant when assessing a behavior occurring within a short timeframe.

This study is also limited by its correlational design. The findings with regard to the association between fatigue and candy consumption cannot be assumed to be causal or directional, because neither variable was manipulated by the experimenter. Although it may be that greater fatigue causes people to eat more candy, it may also be that eating more candy on a regular basis contributes to more fatigue. It is also possible that other variables not assessed in this study influence both fatigue and candy consumption: For example, socioeconomic status may be associated with both elevated fatigue and a tendency to consume more calorie-dense foods.

Directions for Future Research

Given that the results of this study suggested a substantial difference between males and females in terms of consumption behaviors, future research into health behaviors should include gender as a variable of interest. It seems likely due to findings of previous studies that different social norms for men and women promote different kinds of eating behaviors. Another study

might investigate how perceptions of social pressure to maintain a particular body type factor into the relationship between implicit attitudes and eating behaviors. Furthermore, given the diversity of other gender identities which were not represented in this study (e.g., transgender, gender-queer), future studies should seek to include individuals with non-cisgender identities to increase the knowledge of how these diverse identities and the norms that may accompany them affect relationships between stress, fatigue, and eating behaviors.

The relationship between fatigue and candy consumption also bears further investigation, to determine whether there is a causal relationship between these variables and to test whether the relationship observed in this study was due to statistical error or extreme cases. A future study could replicate this study, but include participants drawn from clinical populations that experience elevated fatigue (for example, individuals with chronic fatigue syndrome or anemia) to see whether there is a stronger relationship between fatigue and eating behaviors for these participants. Using an experimental manipulation to induce fatigue prior to the candy taste-test, such as vigorous exercise or a difficult mental task, could help answer the question of whether fatigue directly influences eating choices.

Future research will also have the opportunity to address some of the limitations of the current study. Using means to reduce the likelihood of participants guessing that their behaviors are being assessed could contribute to more accurate measurements of eating behaviors, and could increase the generalizability of findings to real-world scenarios. Some modifications to achieve this include allowing participants to conduct the taste test without the experimenter present, or framing the experiment as a consumer satisfaction study rather than a research study. Using an experimental manipulation to influence participants' stress or fatigue could ensure that the measures of these variables matched participants' state in the moment in which they are

engaging in health-relevant behaviors. Using a narrower set of target stimuli for the SC-IAT, which include only pictures of the specific candy used in the taste-test, may also ensure that the implicit attitudes measured in future experiments are directly relevant to the behaviors being observed.

Given that the focus of this study was on a very specific health behavior, further research may also help to determine whether stress and fatigue influence the relationship between implicit attitudes and other types of health-relevant behaviors, such as alcohol use, smoking, sexual activity, and physical exercise.

Conclusion

In conclusion, the hypothesized moderation effects of stress and fatigue on the relationship between implicit attitudes and candy consumption were not observed in this study. However, a direct relationship between fatigue and candy consumption was observed, though this was largely due to particularly influential cases. This implies that health interventions may benefit from addressing fatigue as a means of changing eating habits. There were also substantial differences between men and women in terms of overall candy consumption, which could be explained by differing gender norms about eating behaviors and ideal body types. This finding speaks to the importance of tailoring health behavior interventions to avoid endorsing problematic gender norms. There is need for more research to evaluate the directional associations between fatigue and health behaviors, particularly as they may relate to populations with clinically-significant fatigue, and to consider how diverse gender identities influence health-related behaviors. A better understanding of these mechanisms could improve the quality of interventions to reduce unhealthy eating behaviors, and promote more positive behaviors, on both an individual and societal level.

References

Ajzen, I. (2005). *Attitudes, personality and behavior* (2nd Ed.). New York, NY: McGraw-Hill Professional Publishing.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall Inc.

Annesi, J. J., Johnson, P. H., & Porter, K. J. (2015). Bi-directional relationship between self-regulation and improved eating: Temporal associations with exercise, reduced fatigue, and weight loss. *The Journal of Psychology, 149*(6). 535-553. doi:10.1080/00223980.2014.913000

Arnow, B., Kenardy, J., & Agras, W. S. (1995). The emotional eating scale: The development of a measure to assess coping with negative affect by eating. *International Journal of Eating Disorders, 18*(1), 79-90.

Ata, R. N., Ludden, A. B., & Lally, M. M. (2007). The effects of gender and family, friend, and media influences on eating behaviors and body image during adolescence. *Journal of Youth and Adolescence, 36,* 1024-1037. doi:10.1007/s10964-006-9159-x

Bridle, C., Riemsma, R. P., Pattenden, J., Sowden, A. J., Mather, L., Watt, I. S., & Walker, A. (2005). Systematic review of the effectiveness of health behavior interventions based on the transtheoretical model. *Psychology and Health, 20*(3), 283-301. doi:10.1080/08870440512331333997

Carver, C. S. (2007). Stress, coping, and health. In H. S. Friedman & R. C. Silver (Eds.), *Foundations of health psychology* (pp. 117-144). New York, NY: Oxford University Press.

Chalder, T., Berelowitz, G., Pawlikowska, T., Watts, L., Wessely, S., Wright, D., & Wallace, E. P. (1993). Development of a fatigue scale. *Journal of Psychosomatic Research, 37*(2), 147-153.

Clark, M. M., Warren, B. A., Hagen, P. T., Johnson, B. D., Jenkins, S. M., Werneburg, B. L., & Olsen, K. D. (2011). Stress level, health behaviors, and quality of life in employees joining a wellness center. *American Journal of Health Promotion, 26*(1), 21-25. doi:10.4278/ajhp.090821-QUAN-272

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396.

Cohen, S., Kessler, R. C., & Gordon, L. U. (1998). Strategies for measuring stress in studies of psychiatric and physical disorders. In S. Cohen, R. C. Kessler, & L. U. Gordon (Eds.), *Measuring stress: A guide for health and social scientists*. Cary, NC: Oxford University Press.

Cohen, S., & Williamson, G. M. (1988). Perceived stress in a probability sample of the United States. In S. Spacapam & S. Oskamp (Eds.), *The social psychology of health: Claremont Symposium on Applied Social Psychology*. Newbury Park, CA: Sage.

Danaei, G., Ding, E. L., Mozaffarian, D., Taylor, B., Rehm, J., Murray, C. J. L., & Ezzati, M. (2009). The preventable causes of death in the United States: Comparative risk assessment of dietary, lifestyle, and metabolic risk factors. *PLoS Medicine, 6*(4), 1-23. doi:10.1371/journal.pmed.1000058

Dittner, A. J., Wessely, S. C., & Brown, R. G. (2004). The assessment of fatigue: A practical guide for clinicians and researchers. *Journal of Psychosomatic Research, 56*, 157-170. doi:10.1016/S0022-3999(03)00371-4

Fong, T. C. T., Chan, J. S. M., Chan, C. L. W., Ho, R. T. H., Ziea, E. T. C., Wong, V. C. W., . . . Ng, S. M. (2015). Psychometric properties of the Chalder Fatigue Scale revisited: An exploratory structural equation modeling approach. *Quality of Life Research, 24*, 2273-2278. doi:10.1007/s11136-015-0944-4

Friese, M., & Hofmann, W. (2009). Control me or I will control you: Impulses, trait self-control, and the guidance of behavior. *Journal of Research in Personality, 43*, 795-805. doi:10.1016/j.jrp.2009.07.004

Gawronski, B., & Bodenhausen, G. V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. *Psychological Bulletin, 132*(5), 692-731. doi:10.1037/0033-2909.132.5.692

George, S. M., Alfano, C. M., Neuhouser, M. L., Smith, A. W., Baumgartner, R. N., Baumgartner, K. B., . . . Ballard-Barbash, R. (2014). Better postdiagnosis diet quality is associated with less cancer-related fatigue in breast cancer survivors. *Journal of Cancer Survivorship, 8*(4), 680-687. doi:10.1007/s11764-014-0381-3

Godfrey, K. M., Lindamer, L. A., Mostoufi, S., & Afari, N. (2013). Posttraumatic stress disorder and health: A preliminary study of group differences in health and health behaviors. *Annals of General Psychiatry, 12*(1), 30. doi:10.1186/1744-859X-12-30

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology, 74*(6), 1464-1480. doi:10.1037/0022-3514.74.6.1464

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology, 85*(2), 197-216. doi:10.1037/0022-3514.85.2.197

Hofmann, W., Friese, M., & Roefs, A. (2009). Three ways to resist temptation: The independent contributions of executive attention, inhibitory control, and affect regulation to the impulse control of eating behavior. *Journal of Experimental Social Psychology, 45*, 431-435. doi:10.1016/j.jesp.2008.09.013

Hofmann, W., Gschwendner, T., Friese, M., Wiers, R. W., & Schmitt, M. (2008). Working memory capacity and self-regulatory behavior: Toward and individual differences perspective on behavior determination by automatic versus controlled processes. *Journal of Personality and Social Psychology*, *95*(4), 962-977. doi:10.1037/a0012705

Hofmann, W., Rauch, W., & Gawronski, B. (2007). And deplete us not into temptation: Automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior. *Journal of Experimental Social Psychology, 43*, 497-504. doi:10.1016/j.jesp.2006.05.004

Karpinski, A., & Steinman, R. B. (2006). The single category implicit associations test as a measure of implicit social cognition. *Journal of Personality and Social Psychology, 91*(1), 16-32. doi:10.1037/0022-3514.91.1.16

Kemeny, M. E. (2007). Psychoneuroimmunology. In H. S. Friedman & R. C. Silver (Eds.), *Foundations of health psychology* (pp. 52-70). New York, NY: Oxford University Press.

Lane, K. A., Banaji, M. R., Nosek, B. A., & Greenwald, A. G. (2007). Understanding and using the implicit association test: IV. In B. Wittenbrink & N. Schwarz (Eds.), *Implicit measures of attitudes*. New York, NY: The Guilford Press.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2008). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-8.* University of Florida, Gainesville, FL.

Lipschitz, J. M., Paiva, A. L., Redding, C. A., Butterworth, S., & Prochaska, J. O. (2015). Co-occurrence and coaction of stress management with other health risk behaviors. *Journal of Health Psychology, 20*(7), 1002-1012. doi:10.1177/1359105313506026

Loge, J. H., Ekeberg, Ø., & Kaasa, S. (1998). Fatigue in the general Norwegian population: Normative data and associations. *Journal of Psychosomatic Research, 45*(1), 53-65.

Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States, 2000. *JAMA, 291*(10), 1238-1245.

Monroe, S. M., & Kelley, J. M. (1998). Measurement of stress appraisal. In S. Cohen, R. C. Kessler, & L. U. Gordon (Eds.), *Measuring stress: A guide for health and social scientists*. Cary, NC: Oxford University Press.

Pawlikowska, T., Chalder, T., Hirsch, S. R., Wallace, P., Wright, D. J. M., & Wessely, S. C. (1994). Population based study of fatigue and psychological distress. *BMJ, 308*, 763-766.

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist, 47*(9), 1102-1114. doi:10.1037/0003-066X.47.9.1102

Robinson, A. L., Kosmerly, S., Mansfield-Green, S., & Lafrance, G. (2014). Disordered eating behaviours in an undergraduate sample: Associations among gender, body mass index, and difficulties in emotional regulation. *Canadian Journal of Behavioural Science, 46*(3), 320-326. doi:10.1037/a0031123

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1994). The health belief model and HIB risk behavior change. In R. J. DiClemente & J. L. Peterson (Eds.), *Preventing AIDS: Theories and methods of behavioral interventions*. New York, NY: Plenum Press.

Sheeran, P., Gollwitzer, P. M., & Bargh, J. A. (2013). Nonconscious processes and health. *Health Psychology, 32*(5), 460-473. doi:10.1037/a0029203

Thayer, R. E. (1987). Energy, tiredness, and tension effects of a sugar snack versus moderate exercise. *Journal of Personality and Social Psychology, 52*(1), 119-125.

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. (2016). *Health, United States, 2015: With special feature on racial and ethnic health disparities*. Retrieved from http://www.cdc.gov/nchs/data/hus/hus15.pdf#019

van Strien, T. (2018). Causes of emotional eating and matched treatment of obesity. *Current Diabetes Report, 18*, 35 (8 pages). doi:10.1007/s11892-018-1000-x

Weiland, T. J., Jelinek, G. A., Marck, C. H., Hadgkiss, E. J., van der Meer, D. M., Pereira, N. G., & Taylor, K. L. (2015). Clinically significant fatigue: Prevalence and associated factors in an international sample of adults with multiple sclerosis recruited via the internet. *PLoS ONE, 10*(2), 1-18. doi:10.1371/journal.pone.0115541

Westmaas, J. L., Gil-Rivas, V., & Silver, R. C. (2007). Designing and implementing interventions to promote health and prevent illness. In H. S. Friedman & R. C. Silver (Eds.), *Foundations of health psychology* (pp. 52-70). New York, NY: Oxford University Press.

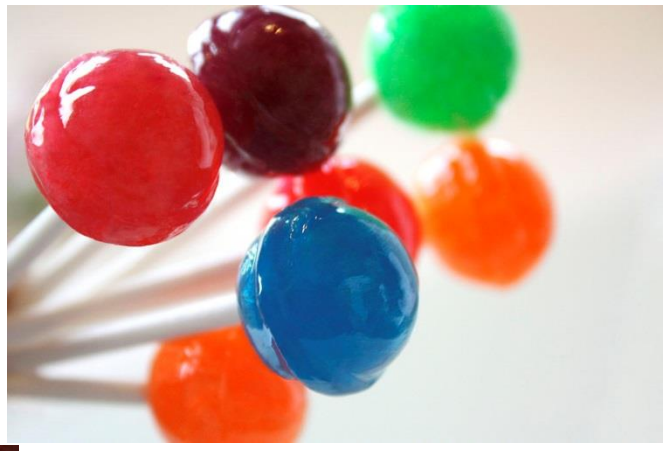
Wittenbrink, B., & Schwarz, N. (2007). Introduction. In B. Wittenbrink & N. Schwarz (Eds.), *Implicit measures of attitudes*. New York, NY: The Guilford Press.

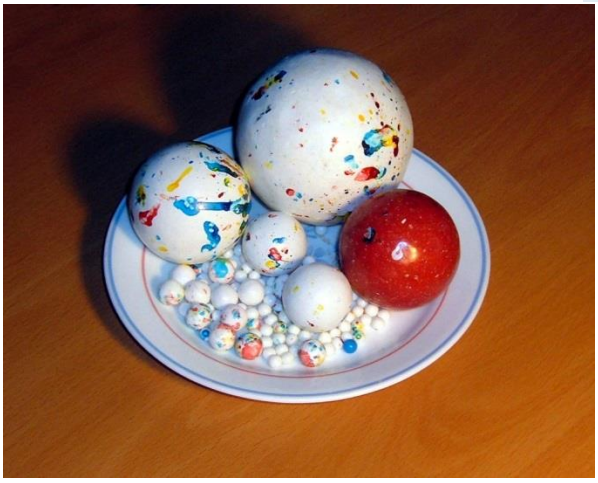
Yarcheski, T. J., Mahon, N. E., & Yarcheski, A. (2009). Vigor and fatigue and positive health practices in young adolescents. *Psychological Reports, 104*, 693-697. doi:10.2466/PR0.104.2.693-697

Young, D., & Limbers, C. A. (2017). Avoidant coping moderates the relationship between stress and depressive emotional eating in adolescents. *Eating and Weight Disorders, 22*, 683-691. doi:10.1007/s40519-017-0396-7

Appendix A

Candy Stimuli for SC-IAT





Appendix B

Perceived Stress Scale

PSS

INSTRUCTIONS:

The questions in this scale ask you about your feelings and thoughts during THE LAST MONTH. In each case, please indicate your response by placing an "X" over the circle representing HOW OFTEN you felt or thought a certain way.

	Never	Almost Never	Sometimes	Fairly Often	Very Often
	0	1	2	3	4
1. In the last month, how often have you been upset because of something that happened unexpectedly?	○	○	○	○	○
2. In the last month, how often have you felt that you were unable to control the important things in your life?	○	○	○	○	○
3. In the last month, how often have you felt nervous and "stressed"?	○	○	○	○	○
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
5. In the last month, how often have you felt that things were going your way?	○	○	○	○	○
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	○	○	○	○	○
7. In the last month, how often have you been able to control irritations in your life?	○	○	○	○	○
8. In the last month, how often have you felt that you were on top of things?	○	○	○	○	○
9. In the last month, how often have you been angered because of things that were outside your control?	○	○	○	○	○
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○

Appendix C

Permission for Perceived Stress Scale

Permission for use of the Perceived Stress Scale in academic research is granted through the website on which the scale is available for download, at:

http://www.psy.cmu.edu/~scohen/scales.html

Appendix D

Chalder Fatigue Scale

CFS

Instructions: We would like to know about any problems you have had with feeling tired, weak, or lacking in energy in the last month. Please answer ALL the questions by marking the answer which applies to you most closely with an X. If you have been feeling tired for a long while, then compare yourself to how you felt when you were last well. Please mark only one circle per question.

	Less than usual	No more than usual	More than usual	Much more than usual
Do you have problems with tiredness?	O	O	O	O
Do you need to rest more?	O	O	O	O
Do you feel sleepy or drowsy?	O	O	O	O
Do you have problems starting things?	O	O	O	O
Are you lacking in energy?	O	O	O	O
Do you have less strength in your muscles?	O	O	O	O
Do you feel weak?	O	O	O	O
Do you have difficulty concentrating?	O	O	O	O
Do you have problems thinking clearly?	O	O	O	O
Do you make slips of the tongue when speaking?	O	O	O	O

	Better than usual	No worse than usual	Worse than usual	Much worse than usual
How is your memory?	O	O	O	O

Appendix E

Permission for Chalder Fatigue Scale

Email Correspondence

Email 1
From: Matthew Baker (mbaker1@alliant.edu)
To: Trudie Chalder (trudie.chalder@kcl.ac.uk)
Date/Time: 9/18/2014 at 8:47 PM

Hello, Dr. Chalder,

My name is Matthew Baker, and I am a clinical psychology PhD student at Alliant International University in the United States. I'm currently preparing a research project as part of my program, and I would like to use the Fatigue Questionnaire that you published in the following article:

Chadler, T., Berelowitz, G., Pawlikowska, T., Watts, L., Wessely, S., Wright, D, & Wallace, E. P. (1993). Development of a fatigue scale. Journal of Psychosomatic Research, 37(2), 147-153.

In short, I'm trying to establish whether fatigue (either mental or physical) and stress contribute to the connection between a person's implicit attitudes about candy and the consumption of candy. In perusing the literature for a scale of fatigue, the one you developed stood out because it assesses both mental and physical fatigue in a short questionnaire.

Please let me know if I could use this scale in my research. Of course, I will cite the relevant articles (both the one above and the 1989 article by Wessely and Powell that first used a version of the scale) in any presentations of my research. If you need more information from me about my prospective study, please feel free to ask.

Thank you!

Sincerely,

Matthew Baker
Clinical Psychology PhD Student, California School of Professional Psychology
Alliant International University

Email 2
From: Trudie Chalder (trudie.chalder@kcl.ac.uk)
To: Matthew Baker (mbaker1@alliant.edu)
Date/Time: 9/22/2014 at 7:19 AM

Dear Matthew

Yes that's fine. Articles attached

BW trudie

Appendix F

Informed Consent Form

CONSENT TO PARTICIPATE IN RESEARCH

You are asked to participate in a research study conducted by Matthew Baker, B.A., a Ph.D. student from the Department of Clinical Psychology at the Alliant International University, Los Angeles. This research is for educational purposes and is conducted under the faculty supervision of Nicholas Noviello, Ph.D. (nnoviello@alliant.edu), a professor at Alliant International University, Los Angeles. Your participation in this research study is voluntary. If you have questions about this study, please ask the principal investigator, Matthew Baker.

PURPOSE OF THE STUDY
The purpose of this study is to investigate how taste perception and preference of candy changes under the influence of stress or fatigue.

PROCEDURES
If you volunteer to participate in this study, we will ask you to complete: a demographic survey that will ask you about your age, your gender, your racial/ethnic identity, your height, and your weight; a survey that will ask about your recent experiences of stress; and a survey that will ask about your recent experiences of fatigue. You will also be asked to complete a computer-based task where you will categorize positive, negative, and candy-related pictures. You will also be asked to perform a taste test of some candy. **Please note that this taste test will involve the consumption of candy that contains chocolate. If you have any dietary restrictions that prevent you from eating chocolate, you should not participate in this study.** None of the tasks are designed, intended, or expected to be painful, offensive, or dangerous to perform, although some of the stimuli in the picture-categorization task may contain mildly unpleasant material.

For scientific reasons, this consent form does not include complete information about the study hypotheses and the research questions being tested. After you are done with the tasks selected for you today, you will debriefed more fully as to the nature of the study. You will be given more background information about what we are studying and the nature of our hypotheses and you will receive our contact information so that you can contact us if you have any questions about your participation or the nature of the research.

HOW LONG WILL I BE IN THE RESEARCH STUDY?
The study consists of a single session. You should plan to spend about an hour completing all of the tasks in this study.

POTENTIAL RISKS AND DISCOMFORTS
There are no potential risks and discomfort beyond what you would encounter in daily life in this study, although some of the images in the picture-categorization task depict negative events such as rioting, fires, and upset people. If you experience any adverse reaction to any of the material in this study, the experimenter will be available to discuss these feelings with you; you may also contact the study's faculty supervisor to discuss any distress related to your participation. If you feel that you require any formal psychological treatment as a result of this study, it must be at your own expense.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY
We cannot promise you any individual benefits from participation in this study. However, your participation will likely contribute to society's understanding of the topic we are investigating.

PAYMENT FOR PARTICIPATION
There is no direct payment for participation in this study. No credit for any academic course is offered for participation in this study. At the end of your participation, you will be given the opportunity to enter your e-mail address or phone number in a drawing to win a $50 Starbucks gift card. The winner for this drawing will be determined at the conclusion of the study.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of assigning a numeric code to your data and removing any identifying information from your data. Only the principal investigator and trained research assistants will have access to these data. When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity. Raw data for the study will be destroyed no later than five years after completion of the study. Paper data will be disposed of in a secure manner, and electronic data will be deleted from all storage devices used for this study.

LIMITS TO CONFIDENTIALITY
By law, the researchers on this study are required to report incidents of child abuse, elder abuse, or dependent adult abuse to appropriate organizations. The researchers are also obligated to report situations involving an express threat of harm toward an identifiable other, or imminent danger of harm to oneself, to appropriate authorities. If the researchers for on this study become aware of any of these situations, confidentiality cannot be guaranteed.

PARTICIPATION AND WITHDRAWAL
You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may refuse to answer any questions you don't want to answer and still remain in the study. If you decide to leave the study before you have completed all of the procedures, you are still eligible to enter the drawing for the $50 Starbucks gift card.

IDENTIFICATION OF INVESTIGATORS
If you have any questions or concerns about the research, please feel free to contact: Matthew Baker (phone: 530-604-4582, e-mail: mbaker1@alliant.edu) or Nicholas Noviello, Ph.D. (e-mail: nnoviello@alliant.edu).

RIGHTS OF RESEARCH SUBJECTS
You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal rights because of your participation in this research study. If you have any questions about the rights of research participants, you may contact the Alliant International University Institutional Review Board at alliant-irb@alliant.edu (e-mail) or (858) 635-4741 (phone).

As a participant, you have the right to request a summary of the aggregate results of this study, once the study has been completed. If you would like this information, please contact Matthew Baker by e-mail at mbaker1@alliant.edu.

SIGNATURE OF RESEARCH SUBJECT

I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

_____

Name of Subject

_____ _____

Signature of Subject Date

SIGNATURE OF INVESTIGATOR OR DESIGNEE

In my judgment the subject is voluntarily and knowingly giving informed consent and possesses the legal capacity to give informed consent to participate in this research study.

_____

Name of Investigator or Designee

_____ _____

Signature of Investigator or Designee Date

Appendix G

Candy Rating Scale

Candy Rating Scale

Instructions: Please consider the candy you have been given, and mark you answers on the form below with an X over the corresponding circle for each item. You may consume as much or as little of the candy as you would like in the completion of this evaluation.

Please rate the degree to which the candy has the following tastes:

Taste	0 (not at all)	1	2 (somewhat)	3	4 (very much)
Sweetness	O	O	O	O	O
Bitterness	O	O	O	O	O
Saltiness	O	O	O	O	O
Sourness	O	O	O	O	O
Savoriness	O	O	O	O	O

Please rate your agreement with the following statements about the candy:

Statement	0 (strongly disagree)	1	2 (undecided)	3	4 (strongly agree)
I like the way this candy looks.	O	O	O	O	O
This candy tastes natural.	O	O	O	O	O
I like this candy's texture.	O	O	O	O	O
This candy is better than other, similar candies.	O	O	O	O	O
I enjoy eating this candy.	O	O	O	O	O

Appendix H

Demographic Questionniare

Demographic Information

NOTE: Please do not write your name on this sheet.

Age (in years): _____

Gender Identity (circle one):

Male Female Other (please specify): _____

Racial/Ethnic Identity (circle all that apply):

White/Caucasian/European American Black/African American

Hispanic/Latino/Latina Native American/American Indian

Asian/Pacific Islander Middle-Eastern American

Other (please specify): _____

Current Estimated Weight (in pounds): _____

Current Estimated Height (in feet/inches): _____

Appendix I

Experiment Debriefing Form

EXPERIMENT DEBRIEFING

Thank you for your participation in our research study. At this time, we would like to provide you with a little more information about the study. You were informed that the study sought to investigate how taste perception and preference of candy changed under stress and fatigue. The actual purpose of this study is to investigate how candy-eating behavior is influenced by stress, fatigue, and unconscious attitudes about candy. This deception was necessary to ensure accurate results of the study.

During the course of your participation, you completed a picture-categorization task that asked you to assign pictures to categories by pressing buttons. This is a task, called the Single Category Implicit Associations Test, is meant to measure your unconscious attitudes about something (in this case, candy) by measuring how quickly you respond on the test.

During your participation, you were also asked to perform a taste test. While you may have believed that we were interested in how much you liked the candy or how it tasted, in fact, we are more interested in how much of the candy you ate. Before the taste test, we weighed the full bag of candy, so that we could weigh it after the taste test to find out how much you ate. We could not tell you beforehand that we would be measuring this, because you might have changed how much you ate if you knew.

In order to minimize the impact of this misdirection, we have not yet weighed any of the remaining candy, so we don't know how much you ate. You have the right to refuse to give us this information. If you do refuse, there will be no adverse impact for you. However, we will be unable to use the other information that you provided to us, and any data from your participation will be destroyed. If you consent to having us weigh the remaining candy from the taste test, please sign this form below to indicate that consent.

SIGNATURE OF RESEARCH SUBJECT
I understand the information above. My questions have been answered to my satisfaction, and I agree to allow the investigator to weigh the remaining candy from my taste test. I have been given a copy of this form.

_____
Name of Subject

_____ _____
Signature of Subject Date

SIGNATURE OF INVESTIGATOR OR DESIGNEE
In my judgment the subject is voluntarily and knowingly giving informed consent and possesses the legal capacity to give informed consent to allow collection of this additional data.

_____
Name of Investigator or Designee

_____	_____
Signature of Investigator or Designee	Date

Appendix J

Extended Literature Review

Introduction

The discipline of health psychology seeks to bring psychological perspectives into the medical community, to enhance our understanding of the ways in which the mind and body interact with each other. One of the core principles of health psychology is the biopsychosocial model, which considers the important impact of biological, psychological, and social influences and their interactions on health outcomes. With this model in mind, researchers have explored many non-medical factors that play a role in promoting physical health, including relationship dynamics between doctors and their patients, social support that a person has, and how an individual copes with daily stressors, to name only a few (Friedman & Adler, 2007). A particular area of focus within health psychology is examination of the behavioral correlates of good health, with the ultimate aim of promoting an increase in behaviors that are conducive to wellness (Westmaas, Gil-Rivas, & Silver, 2007).

The focus on health behaviors is an important issue within health psychology because it has clear relevance for current healthcare problems. It was estimated that in the year 2000 over 30% of deaths were attributable to tobacco use, poor diet and exercise, and alcohol consumption, all clearly behavioral problems (Mokdad, Marks, Stroup, & Gerberding, 2004). Danaei et al. (2009) estimated that of all deaths in the United States in the year 2005, about 16-20% could be attributed to tobacco smoking, and 8-9% could be explained by each of overweight-obesity, physical inactivity, and high blood-glucose levels. In 2014, the leading cause of death in the United States was heart disease, and among the top ten causes of death were cancer (2nd), chronic lower respiratory disease (3rd), accidents (4th), stroke (5th), and diabetes (7th) (U.S. Department of Health and Human Services, 2016); all of these can be associated with modifiable risk factors (Danaei et al., 2009). Health psychologists have sought to replace such negative

behaviors with more positive ones, such as good dieting and exercise habits, as well as abstinence from smoking or excessive drinking. However, health habits can be a difficult thing to change, especially at a societal level.

An important component in developing plans to promote health behavior change, both for individuals and larger communities, is to develop theoretical models that explain how various factors act and interact to influence engagement in health behavior. With this knowledge, appropriate attention can be paid to the relevant variables that influence healthy behaviors, and strategies can be developed that target these variables to maximize the effect of behavior-change programs and promote more positive health outcomes.

Statement of the Problem

Evidence from the literature suggests that health behaviors are influenced under certain circumstances by our implicit attitudes, particularly in the realm of nutrition. It may be that psychological and physiological states serve as moderators of the relationship between implicit attitudes and health behaviors. Such a relationship could explain how states that represent depletion, such as stress and fatigue, influence participation in health behaviors—people who are affected by high levels of stress and fatigue may lack the psychological resources that are necessary for regulating behavior (i.e., promoting behavior that is contrary to implicit attitudes), and thereby engaging in healthy practices.

In the current research, I attempted to examine whether current experiences of stress and fatigue affect the relationship between implicit attitudes and health behavior. This study aimed to contribute to the body of scientific knowledge about engagement in health behaviors by investigating potential variables that would be included in a model of nonconscious processes which influence health behavior engagement. Specifically, the study addressed two questions:

1. Does stress influence the relationship between implicit attitudes and health-related behavior?
2. Does fatigue influence the relationship between implicit attitudes and health-related behavior?

The answers to these questions could add to the understanding of the role of stress and fatigue in health, and provide insight into avenues of intervention to increase health behavior adoption and retention.

Summary of the Literature

Health Behaviors

Behavioral components of health are a substantial part of health psychology, to the point that the field is sometimes called *behavioral medicine*. The high incidence of mortality from preventable conditions has prompted to researchers to place an emphasis on assessment of health behaviors. Kasl and Cobb (as cited in Rosenstock, 1974) defined health behaviors as actions that are undertaken in a state of good health to ensure continued good health through prevention or preemptive detection of disease. Health behaviors can be distinguished from illness behaviors, which are actions taken by a person who feels sick in order to clarify the illness or discover a remedy, and sick-role behaviors, which are actions taken by a sick person for the purpose of alleviating the sickness. Some examples of common health behaviors would include regular exercise, eating a healthy diet, abstaining from excessive drinking, and visiting a doctor regularly (Kasl and Cobb, as cited in Rosenstock, 1974).

Measurement of health behaviors in research. A wide variety of methods have been used within the research literature to measure health behaviors. Particularly for population-focused evaluations, surveys are often utilized to assess the frequency and quality of health behaviors. These can be administered through a variety of methods, including face-to-face

contact with surveyors, telephone interviews, or distribution through the mail or over the internet. Such methods, especially self-administered self-report procedures, are attractive due to their low cost and ease of distribution, which allow the inclusion of a larger research sample. However, there can be several issues with such methods of evaluation, especially when they rely on participant reports of behaviors. Nonresponse to surveys can bias a sample, and wording of survey questions can lead to variation in responses due to different interpretations by survey-takers (Mokdad & Remington, 2010). Furthermore, for any self-report measurements, there is an inherent risk of participants modifying their responses based on the perceived social desirability of these responses. This risk may be particularly large for health behaviors that are associated with clear social evaluative connotations, such as diet and exercise; participants may be especially likely to under-report behaviors that are perceived unfavorably, such as physical inactivity and excessive calorie intake (Smith, 2007). Several other issues might affect the validity of self-report measures: People tend to be more inaccurate in estimates of activity over longer periods of time (e.g., frequency of a behavior over a month as opposed to over a week), and estimates of the frequency of behaviors tend to vary based on other cognitive or emotional factors such as mood (which can influence the ability to recall specific mood-congruent or mood-incongruent activities) (Smith, 2007).

Due to these threats to the reliability and validity of self-report measures of health behaviors, better information may be gained from measurement methods that do not involve participant responses to questions, such as direct observation and recording of health-related behaviors. Such measurements have been used in experimental studies of health behaviors--for example, studies by Houben (2011) and Hoffman, Rauch, and Gawronski (2007) both utilized discreet measurements of the amount of food participants ate during a taste test to assess

consumption behaviors. There are some obvious problems with such direct observations of behaviors. For example, it is unclear how closely participants' behavior within laboratory settings would reflect their behavior in the world outside of the experimental setting, and it is also uncertain how well the specific behaviors measured in experiments (e.g., the amount of candy eaten in a taste test) would generalize to other behaviors that form the pattern of a particular health behavior (e.g., regulating consumption of all foods to ensure a healthy diet). However, this approach still solves many of the problems inherent in self-report measures; measurements are less likely to vary based on different interpretations of questions or variations in participants' cognitive operations or emotional states. There is still the possibility of participants altering their behavior based on self-presentation concerns, but if observations are made without participant awareness (as they were in the aforementioned studies), this source of bias might also be minimized.

Research on determinants of health behaviors. Affecting change in behavior is a critical component of health psychology's efforts to promote positive health and prevent the development and impact of many diseases; to this end, several models of behavior change have been developed to describe the factors that contribute to adoption of health behaviors. Westmaas et al. (2007) provide a summary of several notable models, many of which cover overlapping concepts. One of the most prominent, the health belief model (Rosenstock, Strecher, & Becker, 1994), suggests that individuals will make changes in health-related behaviors if they perceive that there is some threat to their health which is serious, and if they believe that the benefits of making the change are greater than the costs or barriers to the change. Two other theories, the theory of reasoned action (Ajzen & Fishbein, 1980) and the theory of planned behavior (Ajzen, 2005), emphasize the importance of behavioral intentions to change. The former theory holds

that behavioral intentions are affected primarily by two elements: the person's attitudes about the behavior and the perception of social norms about the behavior (Ajzen & Fishbein, 1980). The theory of planned behavior additionally suggests that perceived behavioral control, or one's confidence in one's ability to engage in a behavior, is a third factor that influences intentions and, in turn, behaviors (Ajzen, 2005). However, research findings have suggested that for many health behaviors, the key components of these three theoretical models are weak-to-moderate predictors of the actual behaviors (Westmaas et al., 2007). The transtheoretical model of change (Prochaska, DiClemente, & Norcross, 1992) is another model that explains health behavior change which proposes that individuals move through various temporal stages when implementing changes, consisting of precontemplation, contemplation, preparation, action, and maintenance. These stages involve various degrees of different change processes, and are often experienced in a repeating cycle. This model is often applied with the aim of matching interventions to the particular stage that a person is at and the associated processes that the person is likely to find helpful. Despite wide use, several randomized control trials assessing the effectiveness of interventions based on the transtheoretical model have suggested that it may not be any more effective than usual care at fostering behavior change for a variety of health behaviors (Bridle et al., 2005). While many of the elements in these models seem to be components of individuals' adoption of healthy habits, it seems important to consider what other mechanisms may be at work.

The aforementioned theories of health behavior concern mostly conscious processes, but more recent research into the determinants of health behaviors has suggested that they are influenced by many nonconscious processes as well. A review by Sheeran, Gollwitzer, and Bargh (2013) highlights the emerging evidence that attentional processes and implicit affective

attitudes to stimuli hold sway over individuals' use of health behaviors, and that certain interventions targeted at these processes may have utility in promoting positive health behaviors. It is therefore important, when constructing theoretical models of health behavior and health behavior change, that such nonconscious processes be incorporated alongside the conscious factors that are proposed by the aforementioned theories of health behavior change.

Implicit Attitudes

Implicit attitudes are one of the nonconscious factors that Sheeran et al. (2013) suggest might influence engagement in health behaviors. Gawronski and Bodenhausen (2006) provide a conceptual model to describe implicit attitudes and their distinction from explicit attitudes. Implicit attitudes are automatic affective reactions to a stimulus, which are derived from the associative networks that are activated by that stimulus. As an example, if a person has had bad experiences with dogs, there may be an associative link between *dog* and *bad* which would lead to a negative implicit attitude about dogs. Implicit attitudes can be contrasted with explicit attitudes, which are more deliberate, conscious evaluations of a stimulus. While implicit attitudes are reactions based on nonconscious associative networks, explicit attitudes are formed largely by transforming information from associative networks into a proposition that is then evaluated as a valid basis for the reaction by comparison to other relevant propositions. Continuing with the prior example, the person with a negative implicit attitude about dogs might form the conscious proposition, "I dislike dogs" which is then compared to other propositions. If the other propositions agree (e.g., "dogs are vicious"), the first proposition is accepted as valid and the explicit attitude is likely to match the implicit attitude; if the other propositions conflict with the original one (e.g., "nice people should like dogs" or "my friends all like dogs"), it may be

rejected as a valid reason for the initial reaction, leading to an explicit attitude that differs from the implicit attitude (Gawronski & Bodenhausen, 2006).

Although more recent research has applied the concept of implicit attitudes to areas such as health behaviors, this area of study developed initially within social psychology, due to its relevance for understanding mechanisms of group bias. The authors of one early measure of implicit attitudes, the Implicit Attitudes Test (IAT), noted its usefulness as a tool for assessing racial stereotypes and self-concepts (Greenwald et al., 1998). Measures of implicit attitudes became popular due to their utility in avoiding strategic responding, or the tendency of people to modify their responses based on perceived social desirability; implicit measures could even circumvent self-deception in a way that more circuitous explicit measures could (Wittenbrink & Schwarz, 2007). This is important for understanding group bias because stigma against racist attitudes might promote strategic responding, or even cause explicit attitudes to diverge from implicit attitudes. However, as previously indicated, studies have demonstrated that implicit attitudes have utility in the field of health psychology as well, due to their application in understanding health behaviors (Sheeran et al., 2013).

Measurement of implicit attitudes. Several methods have been developed to assess implicit attitudes (Wittenbrink & Schwarz, 2007). These include paper-and-pencil measurements, many of which rely on the ways that participants respond differently to situations in which implicit expectations are either upheld or violated. Research on implicit attitudes has also traditionally involved physiological measurements, from stress-response metrics like cardiovascular activity all the way to measurements of brain activity by way of fMRI. However, the most commonly used methods in this line of research assess unconscious attitudes by

measuring participants' reaction times during tasks that involve stimuli of interest (Wittenbrink & Schwarz, 2007).

One class of these reaction time measures relies on the concept of sequential priming, which suggests that exposure to a stimulus will increase the speed of responses to other stimuli that are related within an associative network (Wittenbrink, 2007). Procedures that involve sequential priming generally display a target stimulus (the one for which participants' attitudes are to be assessed) that serves as a prime, and then ask participants to perform some lexical task that includes words which reflect some evaluation of that target. For example, a participant might be primed with the word *dog* and then asked to perform a task that requires identifying words that are synonymous with *good* or *bad*. If the participant has a negative attitude about dogs, they would be expected to respond faster when they encounter words in the lexical task that are consistent with this negative attitude, such as *terrible*. While research has suggested that sequential priming methods have fairly good validity for measuring implicit attitudes, they tend to be fairly technically complex, making them harder to implement than other measures, and they tend to generate small effect sizes, which can limit the power of experimental studies (Wittenbrink, 2007).

The other class of response time measures that is used to assess implicit attitudes relies on interference effects that can occur when attitudes about a target stimulus conflict with a response (Wittenbrink & Schwarz, 2007). The most widely used procedure of this type is the Implicit Associations Test (IAT; Greenwald, McGhee, & Schwartz, 1998), which allows comparison of attitudes about two different target stimulus categories (e.g., cats and dogs). In the procedure, participants are tasked with sorting visually-presented stimuli into groups by pressing a button. Initially, they categorize stimuli into the two target categories (e.g., *cats* and *dogs*), and

then categorize stimuli into two evaluative categories (e.g., *positive* and *negative*). Then, these two tasks are combined, so that each target category shares a button with an evaluative category (e.g., one button designates a stimulus as *cat* or *positive*, while the other designates it as *dog* or *negative*). The theory underlying the IAT is that response times will be longer when target categories are matched with evaluative categories in a manner that is opposite of a participant's implicit attitudes, because it will take more mental effort to associate the two designations to a single button-press. Using the example with cats and dogs as target categories, if a participant likes cats and dislikes dogs, then they would be expected to respond faster when *cat* shares a button with *positive* and *dog* shares a button with *negative*, because these pairings are closer in the participant's cognitive associative network (Greenwald et al., 1998).

Much research has been done on the reliability and validity of the IAT, and these studies have generally supported sufficient reliability (which is often greater than other implicit attitude measures), and good criterion validity in terms of distinguishing between known groups, agreeing with explicit reports of attitudes, and predicting behaviors associated with automatic attitudes (Lane, Banaji, Nosek, & Greenwald, 2007). Research on the IAT has also led to refinement of scoring procedures (Greenwald, Nosek, & Banaji, 2003) and development of alternative forms such as the single-category IAT (SC-IAT; Karpinski & Steinman, 2006), both of which have also demonstrated good psychometric properties.

Stress

The concept of stress has been a critical element in health psychology research for decades. Stress, and an individual's ability to cope with stress, influence physical health in a variety of ways (Carver, 2007). Cohen, Kessler, and Gordon (1998) note that although different theoretical frameworks take different perspectives on the definition of stress, many seem to agree

that stress encapsulates psychological and physiological responses to situations in which an organism's abilities are taxed or exceeded by current demands of the environment. These authors propose an integrated model of the stress process which incorporates environmental, psychological, and biological mechanisms. Generally, the process of experiencing stress begins with some environmental situation, or stressor, that places demands upon someone. The person will then appraise the situation to evaluate whether its demands strain or exceed the individual's coping resources, and if this is the case, he or she will subjectively experience stress, which often leads to negative emotions. Both the stressor and the perception of stress can lead to activation of physiological systems, such as the hypothalamic-pituitary-adrenocortical axis (HPA) or the sympathetic-adrenal medullary system (SAM), which mobilize the person's bodily resources to respond to stress. Activation of biological systems, as well as negative emotional states, can impact physical health in a variety of ways (Cohen et al., 1998).

Much of the research on stress within health psychology has focused on the role of stress in psychoneuroimmunology. This discipline is concerned with discovering relationships between psychological factors and immune system functioning, and the physiological mechanisms that underlie these relationships (Kemeny, 2007). Research in this area has demonstrated that experiences of stress can impact multiple mechanisms of immune functioning in a way that increases vulnerability to disease, through the biological systems (HPA and SAM) which are involved in stress responses. However, the relationship seems to depend on several personal factors (such as coping ability and support), suggesting that the subjective experience of distress is more important than stressful events in this regard (Kemeny, 2007). Although stress is clearly relevant to health outcomes through these mechanisms, other studies have suggested that this is not the only way in which stress is related to health.

Measurement of stress. In terms of health research, the most commonly utilized perspectives for measuring stress are environmental, biological, and psychological, each of which concerns a different part of the stress process (Cohen et al., 1998). The environmental perspective focuses on objective assessment of the events that place demands upon a person. The psychological perspective attempts to measure the role of a person's subjective appraisal of their ability to cope with stressors and the subsequent subjective experience of stress. The biological perspective is concerned with measuring the action of the physiological systems that respond to stressors and the subjective experience of stress. Each of these perspectives makes unique contributions to the understanding of the relationship between stress and health, and the decision of which approach to use should be tailored to the particular question presented in a given research study (Cohen et al., 1998). In the consideration of how stress is related to health behaviors, psychological measures of stress are likely the most appropriate, since the subjective experience of stress involves an evaluation of coping resources, which include behaviors that are intended to deal with stressors. The process of appraisal of stressors drives a person's response to those stressors, which may include health-affecting behaviors in addition to emotional reactions (Monroe & Kelley, 1998).

Although there are a few different methodological approaches to assessing stress appraisal, there are fewer specific measures for its evaluation compared to environmental and biological measures of stress (Monroe & Kelley, 1998). One method for assessing appraisal builds on the environmental approach for measurement, by assessing recent stressful life events but weighting the value of each based on individuals' determination of the stressfulness of those events. However, this approach doesn't seem to add much to stress ratings beyond the basic environmental approach, based on validity research. Another method involves structured

interviews that assess the context of life events, but again, this method is likely to add little in the way of assessing overall perceived stress relative to a straightforward environmental approach. A third approach to measuring stress appraisal involves self-report survey measures. One such scale is the Stress Appraisal Measure (Peacock & Wong, 1990), which evaluates the appraisal of a specific event on several dimensions. Another scale, the Perceived Stress Scale (PSS) serves as a more general measure of overall perceived stress, and has been widely used and validated (Monroe & Kelley, 1998).

The PSS (Cohen, Kamarck, & Mermelstein, 1983) was developed to assess subjective stress experience in a more general sense than many of the previously-developed scales, which were often specific to certain situations or life events. This scale was developed in 14-, 10- and 4-item forms, all of which demonstrated good reliability, as well as concurrent validity with other ad-hoc evaluations of stress and measures of metrics that would be expected to be related to stress, such as job responsibilities and number of stressful life events (Cohen & Williamson, 1988).

Fatigue

Fatigue can be defined as a subjective experience of tiredness or weakness, which is persistent and extreme; it can be experienced both physically and mentally (Dittner, Wessely, & Brown, 2004). Although much of the research on fatigue has focused on its presence as a symptom within clinical populations, studies have suggested that fatigue is a condition experienced frequently within the general population (Pawlikowska et al., 1994). Large surveys have demonstrated that women tend to experience more fatigue than men, and that there is a fairly weak correlation between age and overall fatigue (Loge, Ekeberg, & Kaasa, 1998; Pawlikowska et al., 1994).

Measurement of fatigue. Dittner et al. (2004) provide a review on several scales that have been developed to measure fatigue in a variety of populations. Due to the fact that fatigue is generally a subjective experience and is usually assessed as a symptom of other medical conditions, the measures covered in the review are all self-report scales, although some attempt to assess behavioral indicators of fatigue, such as activity level. The authors of the review note that many of the available measures of fatigue have been developed for specific populations (such as cancer patients or patients with multiple sclerosis), and that they vary widely in terms of their questions and therefore the constructs that they assess. Some are unidimensional, assessing overall fatigue or one aspect of fatigue, and others are multidimensional, evaluating various types or correlates of fatigue. The authors note that there is no gold standard measurement for the assessment of fatigue, and thus suggest that selection of a measure be based on the needs of the assessor and the population with which the measure will be used (Dittner et al., 2004).

The Chalder Fatigue Scale (CFS; Chalder et al., 1993) is a popular measure of fatigue that was originally developed for use with hospitalized populations, and was created based on a measure used in a previous study of patients with chronic fatigue syndromes (Wessely & Powell, 1989). However, subsequent research with a large sample from the general Norwegian population demonstrated that the CFS is also a robust measure of fatigue in non-clinical populations, with good reliability (Loge et al., 1998). Other research has used the CFS to measure fatigue in non-clinical groups in the United Kingdom (Pawlikowska et al., 1994) and Japan (Yoshikawa, Tanaka, Ishii, & Watanabe, 2014). The CFS is a multidimensional measure of fatigue, able to generate an overall fatigue score and able to generate separate scores for mental and physical fatigue (Chalder et al., 1993).

Relationships between Health Behaviors, Implicit Attitudes, Stress, and Fatigue

Implicit attitudes and health behaviors. The review by Sheeran et al. (2013) notes the apparent connection between implicit attitudes and health behaviors based on several research studies. However, based on other research studies, this relationship does not appear to be direct. Specifically, it seems that implicit attitudes about health-behavior-relevant stimuli influence behavior most strongly when there are fewer self-control resources. Friese and Hofmann (2009) found that implicit attitudes about potato chips influenced how many chips participants consumed in a taste test, but that this relationship was moderated by trait self-control, with participants with lower self-control experiencing a greater effect of implicit attitudes on their behavior. The authors also found similar results when assessing participants' implicit attitudes about alcohol and the effects of these attitudes on self-reported drinking behavior. While implicit attitudes held relatively little sway over participants with high self-control, they were much more influential for participants with low self-control; participants who had low self-control and positive implicit attitudes tended to consume the most chips and alcohol. In another study, Hofmann, Friese, and Roefs (2009) examined the independent contributions of executive attention, inhibitory control, and affect regulation to the relationship between implicit attitudes and behavior for candy consumption. All three of the variables moderated the relationship, with higher scores on each variable reducing the effect of implicit attitudes on candy consumption. Working memory capacity seems to have a similar function for behavioral control, as indicated in a publication by Hofmann, Gschwendner, Friese, Wiers, and Schmitt (2008). The authors conducted two studies that assessed the moderating effect of participants' working memory capacity on the relationship between their attitudes and behaviors. The first study found that, for participants with high working memory capacity, viewing time of erotic stimuli was more strongly influenced by explicit attitudes about these stimuli than by implicit attitudes; the

opposite was true for participants with lower working memory capacity. The second study found similar results for consumption of candy, with working memory capacity influencing whether implicit attitudes or goals to forego candy consumption would affect consumption more. Together, all of these studies suggest that various individual traits related to self-control are important moderators of the relationship between implicit attitudes relevant to health behaviors, and the actual enactment of the behaviors. Specifically, behavior seems to be more heavily influenced by implicit attitudes when self-regulation ability is low.

There are trait variables that moderate the effect of implicit attitudes on behaviors, indicating that certain individuals will likely have an easier time moderating their health behaviors in the face of unfavorable implicit attitudes than other individuals. However, there are also other, state-dependent variables involved in self-control that may have significance for health behaviors. In a study similar to the one by Hofmann et al. (2008), Hofmann et al. (2007) tested the relationship between candy-eating implicit attitudes, explicit dietary restraint standards, and candy-eating behavior, but this time used an experimental manipulation meant to influence participants' self-regulatory resources. The manipulation involved an emotional suppression task for participants in the experimental condition, which was intended to reduce resources for self-regulation prior to a candy tasting. The authors found that implicit attitudes had more of an effect on the amount of candy eaten for participants in the experimental condition, relative to the control condition. The candy-eating behavior of participants with higher regulatory resources (in the control condition) was more strongly influenced by the subjects' explicit dietary standards. These results suggest that situational circumstances (in this case, emotional regulation capacity) may also affect the relationship between implicit attitudes and health behaviors.

If the relationship between implicit attitudes and health-relevant behaviors is influenced by self-control resources, and if these resources can be manipulated in a laboratory setting, it would make sense that environmental factors could similarly affect self-control resources, and thus influence the relationship between implicit attitudes and behaviors. The demands of daily life may function in a way similar to the experimental manipulation used by Hoffman et al. (2007) to influence the relationship between implicit attitudes and behavior. Therefore, it is worth considering whether variables which reflect the impact of everyday demands and which have been found to be related to health behaviors operate through this mechanism.

Fatigue, stress, and health behaviors. Several research studies have explored the relationship between negative emotional states and health behaviors. A review of the literature by Salovey, Rothman, Detweiler and Steward (2000) explores some of the relationships between emotional states and health behaviors. The authors suggest that positive emotional states, such as hope and optimism, may serve to increase psychological resources available to address health concerns, which could in turn promote more positive health behaviors. The previously-mentioned study by Hofmann et al. (2007) substantiates the claim that psychological resources are linked to health behaviors. It is not unreasonable, then, to suppose that negative emotional states (which can be linked to stress) might have the opposite effect, reducing psychological resources and thereby reducing the probability of engaging in positive health behaviors. Salovey et al. (2000) further note that negative mood tends to promote some negative health behaviors, likely as a means of improving mood. For example, someone who smokes may do so in order to reduce negative feelings of depression or anxiety.

Research has supported the idea that stress is a moderator of engagement in health behaviors. In a survey study of several employees entering a wellness program, Clark et al.

(2011) found that individuals who reported high levels of stress in the last week also rated their exercise and nutritional habits lower than those who reported low levels of stress, suggesting a link between stress and fewer health behaviors. This is also supported by the finding that veterans with posttraumatic stress disorder (PTSD) demonstrate significantly fewer positive health behaviors than those without PTSD (Godfrey, Lindamer, Mostoufi, & Afari, 2013). Lipschitz, Paiva, Redding, Butterworth, and Prochaska (2015) found evidence from a health behavior change program that improvements in stress management were associated with improvements in other health behaviors, including diet.

Fatigue is another potential state that could contribute to low health behavior adherence, because it reflects a depletion of physical and mental resources. However, most research on the relationship between fatigue and health behaviors seems to focus on how healthy behaviors like exercise and balanced diet contribute to reductions in fatigue; this relationship has been documented in several studies with diverse populations (e.g., Annesi, Johnson, & Porter, 2015; George et al., 2014; Weiland et al., 2015). Fewer studies have explored how fatigue might affect engagement in these behaviors. In one analysis of a dataset from a former study, Yarcheski, Mahon, and Yarcheski (2009) looked at correlations between self-reported vigor, fatigue, and positive health behaviors such as exercise, nutrition, and relaxation. They found that, while vigor was significantly positively related to most health behaviors, fatigue was significantly negatively associated with health behaviors, particularly nutrition. Many of the studies on the relationship between fatigue and health behaviors are correlational, so the relationship between these two variables may in fact be bi-directional.

Appendix K

Extended Reference List

Ajzen, I. (2005). *Attitudes, personality and behavior* (2nd Ed.). New York, NY: McGraw-Hill Professional Publishing.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall Inc.

Annesi, J. J., Johnson, P. H., & Porter, K. J. (2015). Bi-directional relationship between self-regulation and improved eating: Temporal associations with exercise, reduced fatigue, and weight loss. *The Journal of Psychology, 149*(6). 535-553. doi:10.1080/00223980.2014.913000

Arnow, B., Kenardy, J., & Agras, W. S. (1995). The emotional eating scale: The development of a measure to assess coping with negative affect by eating. *International Journal of Eating Disorders, 18*(1), 79-90.

Ata, R. N., Ludden, A. B., & Lally, M. M. (2007). The effects of gender and family, friend, and media influences on eating behaviors and body image during adolescence. *Journal of Youth and Adolescence, 36,* 1024-1037. doi:10.1007/s10964-006-9159-x

Bridle, C., Riemsma, R. P., Pattenden, J., Sowden, A. J., Mather, L., Watt, I. S., & Walker, A. (2005). Systematic review of the effectiveness of health behavior interventions based on the transtheoretical model. *Psychology and Health, 20*(3), 283-301. doi:10.1080/08870440512331333997

Carver, C. S. (2007). Stress, coping, and health. In H. S. Friedman & R. C. Silver (Eds.), *Foundations of health psychology* (pp. 117-144). New York, NY: Oxford University Press.

Chalder, T., Berelowitz, G., Pawlikowska, T., Watts, L., Wessely, S., Wright, D., & Wallace, E. P. (1993). Development of a fatigue scale. *Journal of Psychosomatic Research, 37*(2), 147-153.

Clark, M. M., Warren, B. A., Hagen, P. T., Johnson, B. D., Jenkins, S. M., Werneburg, B. L., & Olsen, K. D. (2011). Stress level, health behaviors, and quality of life in employees joining a wellness center. *American Journal of Health Promotion, 26*(1), 21-25. doi:10.4278/ajhp.090821-QUAN-272

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396.

Cohen, S., Kessler, R. C., & Gordon, L. U. (1998). Strategies for measuring stress in studies of psychiatric and physical disorders. In S. Cohen, R. C. Kessler, & L. U. Gordon (Eds.), *Measuring stress: A guide for health and social scientists*. Cary, NC: Oxford University Press.

Cohen, S., & Williamson, G. M. (1988). Perceived stress in a probability sample of the United States. In S. Spacapam & S. Oskamp (Eds.), *The social psychology of health: Claremont Symposium on Applied Social Psychology*. Newbury Park, CA: Sage.

Danaei, G., Ding, E. L., Mozaffarian, D., Taylor, B., Rehm, J., Murray, C. J. L., & Ezzati, M. (2009). The preventable causes of death in the United States: Comparative risk assessment of dietary, lifestyle, and metabolic risk factors. *PLoS Medicine, 6*(4), 1-23. doi:10.1371/journal.pmed.1000058

Dittner, A. J., Wessely, S. C., & Brown, R. G. (2004). The assessment of fatigue: A practical guide for clinicians and researchers. *Journal of Psychosomatic Research, 56*, 157-170. doi:10.1016/S0022-3999(03)00371-4

Fong, T. C. T., Chan, J. S. M., Chan, C. L. W., Ho, R. T. H., Ziea, E. T. C., Wong, V. C. W., . . . Ng, S. M. (2015). Psychometric properties of the Chalder Fatigue Scale revisited: An exploratory structural equation modeling approach. *Quality of Life Research, 24*, 2273-2278. doi:10.1007/s11136-015-0944-4

Friedman, H. S., & Adler, N. E. (2007). The history and background of health psychology. In H. S. Friedman & R. C. Silver (Eds.), *Foundations of health psychology* (pp. 3-18). New York, NY: Oxford University Press.

Friese, M., & Hofmann, W. (2009). Control me or I will control you: Impulses, trait self-control, and the guidance of behavior. *Journal of Research in Personality, 43*, 795-805. doi:10.1016/j.jrp.2009.07.004

Gawronski, B., & Bodenhausen, G. V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. *Psychological Bulletin, 132*(5), 692-731. doi:10.1037/0033-2909.132.5.692

George, S. M., Alfano, C. M., Neuhouser, M. L., Smith, A. W., Baumgartner, R. N., Baumgartner, K. B., . . . Ballard-Barbash, R. (2014). Better postdiagnosis diet quality is associated with less cancer-related fatigue in breast cancer survivors. *Journal of Cancer Survivorship, 8*(4), 680-687. doi:10.1007/s11764-014-0381-3

Godfrey, K. M., Lindamer, L. A., Mostoufi, S., & Afari, N. (2013). Posttraumatic stress disorder and health: A preliminary study of group differences in health and health behaviors. *Annals of General Psychiatry, 12*(1), 30. doi:10.1186/1744-859X-12-30

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology, 74*(6), 1464-1480. doi:10.1037/0022-3514.74.6.1464

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology, 85*(2), 197-216. doi:10.1037/0022-3514.85.2.197

Hofmann, W., Friese, M., & Roefs, A. (2009). Three ways to resist temptation: The independent contributions of executive attention, inhibitory control, and affect regulation to the impulse control of eating behavior. *Journal of Experimental Social Psychology, 45*, 431-435. doi:10.1016/j.jesp.2008.09.013

Hofmann, W., Gschwendner, T., Friese, M., Wiers, R. W., & Schmitt, M. (2008). Working memory capacity and self-regulatory behavior: Toward and individual differences perspective on behavior determination by automatic versus controlled processes. *Journal of Personality and Social Psychology, 95*(4), 962-977. doi:10.1037/a0012705

Hofmann, W., Rauch, W., & Gawronski, B. (2007). And deplete us not into temptation: Automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior. *Journal of Experimental Social Psychology, 43*, 497-504. doi:10.1016/j.jesp.2006.05.004

Houben, K. (2011). Overcoming the urge to splurge: Influencing eating behavior by manipulating inhibitory control. *Journal of Behavior Therapy and Experimental Psychiatry, 42*, 384-388. doi:10.1016/j.jbtep.2011.02.008

Karpinski, A., & Steinman, R. B. (2006). The single category implicit associations test as a measure of implicit social cognition. *Journal of Personality and Social Psychology, 91*(1), 16-32. doi:10.1037/0022-3514.91.1.16

Kemeny, M. E. (2007). Psychoneuroimmunology. In H. S. Friedman & R. C. Silver (Eds.), *Foundations of health psychology* (pp. 52-70). New York, NY: Oxford University Press.

Lane, K. A., Banaji, M. R., Nosek, B. A., & Greenwald, A. G. (2007). Understanding and using the implicit association test: IV. In B. Wittenbrink & N. Schwarz (Eds.), *Implicit measures of attitudes*. New York, NY: The Guilford Press.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2008). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-8.* University of Florida, Gainesville, FL.

Lipschitz, J. M., Paiva, A. L., Redding, C. A., Butterworth, S., & Prochaska, J. O. (2015). Co-occurrence and coaction of stress management with other health risk behaviors. *Journal of Health Psychology, 20*(7), 1002-1012. doi:10.1177/1359105313506026

Loge, J. H., Ekeberg, Ø., & Kaasa, S. (1998). Fatigue in the general Norwegian population: Normative data and associations. *Journal of Psychosomatic Research, 45*(1), 53-65.

Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States, 2000. *JAMA, 291*(10), 1238-1245.

Mokdad, A. H., & Remington, P. L. (2010). Measuring health behaviors in populations. *Preventing Chronic Disease: Public Health Research, Practice, and Policy, 7*(4), A75. Retrieved from http://www.cdc.gov/pcd/issues/2010/jul/10_0010.htm

Monroe, S. M., & Kelley, J. M. (1998). Measurement of stress appraisal. In S. Cohen, R. C. Kessler, & L. U. Gordon (Eds.), *Measuring stress: A guide for health and social scientists*. Cary, NC: Oxford University Press.

Pawlikowska, T., Chalder, T., Hirsch, S. R., Wallace, P., Wright, D. J. M., & Wessely, S. C. (1994). Population based study of fatigue and psychological distress. *BMJ, 308*, 763-766.

Peacock, E. J., & Wong, P. T. P. (1990). The stress appraisal measure (SAM): A multidimensional approach to cognitive appraisal. *Stress Medicine, 6*, 227-236.

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist, 47*(9), 1102-1114. doi:10.1037/0003-066X.47.9.1102

Robinson, A. L., Kosmerly, S., Mansfield-Green, S., & Lafrance, G. (2014). Disordered eating behaviours in an undergraduate sample: Associations among gender, body mass index, and difficulties in emotional regulation. *Canadian Journal of Behavioural Science, 46*(3), 320-326. doi:10.1037/a0031123

Rosenstock, I. M. (1974). The health belief model and preventive health behavior. *Health Education Monographs, 2*(4), 354-386.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1994). The health belief model and HIB risk behavior change. In R. J. DiClemente & J. L. Peterson (Eds.), *Preventing AIDS: Theories and methods of behavioral interventions*. New York, NY: Plenum Press.

Salovey, P., Rothman, A. J., Detweiler, J. B., & Steward, W. T. (2000). Emotional states and physical health. *American Psychologist, 55*(1), 110-121. doi:10.1037/0003-066X.55.1.110

Sheeran, P., Gollwitzer, P. M., & Bargh, J. A. (2013). Nonconscious processes and health. *Health Psychology, 32*(5), 460-473. doi:10.1037/a0029203

Smith, T. (2007). Measurement in health psychology research. In H. S. Friedman & R. C. Silver (Eds.), *Foundations of health psychology* (pp. 19-51). New York, NY: Oxford University Press.

Thayer, R. E. (1987). Energy, tiredness, and tension effects of a sugar snack versus moderate exercise. *Journal of Personality and Social Psychology, 52*(1), 119-125.

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. (2016). *Health, United States, 2015: With special feature on racial and ethnic health disparities*. Retrieved from http://www.cdc.gov/nchs/data/hus/hus15.pdf#019

van Strien, T. (2018). Causes of emotional eating and matched treatment of obesity. *Current Diabetes Report, 18*, 35 (8 pages). doi:10.1007/s11892-018-1000-x

Weiland, T. J., Jelinek, G. A., Marck, C. H., Hadgkiss, E. J., van der Meer, D. M., Pereira, N. G., & Taylor, K. L. (2015). Clinically significant fatigue: Prevalence and associated factors in an international sample of adults with multiple sclerosis recruited via the internet. *PLoS ONE, 10*(2), 1-18. doi:10.1371/journal.pone.0115541

Wessely, S., & Powell, R. (1989). Fatigue syndromes: A comparison of chronic "postviral" fatigue with neuromuscular and affective disorders. *Journal of Neurology, Neurosurgery, and Psychiatry, 52*, 940-948.

Westmaas, J. L., Gil-Rivas, V., & Silver, R. C. (2007). Designing and implementing interventions to promote health and prevent illness. In H. S. Friedman & R. C. Silver (Eds.), *Foundations of health psychology* (pp. 52-70). New York, NY: Oxford University Press.

Wittenbrink, B. (2007). Measuring attitudes through priming. In B. Wittenbrink & N. Schwarz (Eds.), *Implicit measures of attitudes*. New York, NY: The Guilford Press.

Wittenbrink, B., & Schwarz, N. (2007). Introduction. In B. Wittenbrink & N. Schwarz (Eds.), *Implicit measures of attitudes*. New York, NY: The Guilford Press.

Yarcheski, T. J., Mahon, N. E., & Yarcheski, A. (2009). Vigor and fatigue and positive health practices in young adolescents. *Psychological Reports, 104*, 693-697. doi:10.2466/PR0.104.2.693-697

Yoshikawa, T., Tanaka, M., Ishii, A., & Watanabe, Y. (2014). Association of fatigue with emotional-eating behavior and the response to mental stress in food intake in a young adult population. *Behavioral Medicine, 40,* 149-153. doi:10.1080/08964289.2013.833082

Young, D., & Limbers, C. A. (2017). Avoidant coping moderates the relationship between stress and depressive emotional eating in adolescents. *Eating and Weight Disorders, 22*, 683-691. doi:10.1007/s40519-017-0396-7

Appendix L

Journals for Submission

Health Psychology

Psychology and Health

American Journal of Health Promotion

Journal of Health Psychology

Journal of Experimental Social Psychology