Cardiovascular Emotional Dampening, Disgust, and Consumption Likelihood

by

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ABSTRACT

Higher levels of resting blood pressure have tended to be associated with lower levels of emotional awareness, reactivity, and emotion recognition accuracy among highly diverse samples across the normotensive and hypertensive blood pressure ranges. The behavioral consequences of this intimacy between resting blood pressure and emotional responsivity have yet to be appreciated in the research literature, especially as they relate to the absence of disgust in situations where the experience of disgust might be adaptive. The present study compares a group of 25 healthy high-worry female participants to a group of 26 healthy low-worry female participants in their responses to a visual disgust exposure paradigm featuring contaminated images (e.g. soiled food, toilet vomit, etc.). These groups were compared on several measures (while controlling for relevant covariates) including their average ratings of the disgusting stimuli they were asked to view, their estimated likelihood of eating within the next hour following the completion of the disgust paradigm, and a portion size selection of a food stimulus presented after the likelihood of eating within the next hour was estimated. It was hypothesized that the low-worry group would report less disgust in response to the disgust paradigm, greater likelihood of eating within the next hour following the disgust paradigm, and endorse desiring a larger portion size of the presented food stimulus relative to the high-worry group. Results were largely consistent with the expected hypotheses. Implications, limitations, and future directions are discussed.

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CHAPTER I

INTRODUCTION

Cardiovascular emotional dampening has been defined as the relationship between resting blood pressure and a conglomerate of emotional experiences (McCubbin et al., 2011; Nyklíček et al., 2001; Pury et al., 2004; Shukla et al., 2017; Shukla et al., 2018a; Shukla et al., 2018b; Shukla et al., 2020; Wilkinson & France, 2009). Increased blood pressure has been associated with reduced pain sensitivity (Bruehl & Chung, 2004; Duschek et al., 2009; France, 1999; Ghione, 1996; Granot et al., 2019), lower emotion- recognition- accuracy (McCubbin et al., 2011; Nyklíček et al., 2001; Pury et al., 2004; Shukla et al., 2017; Wilkinson & France, 2009), and blunted emotional response to various emotionally evocative stimuli (Shukla et al., 2020). Due to roles that emotional awareness and responsivity play in threatening situations, emotional dampening likely influences willingness to engage in risk (Loveless et al., 2018; McCubbin et al., 2018; McCubbin et al., 2020).

Disgust is an emotion marked by avoidance of offensive presentations in the environment which could threaten health (Curtis & Barra, 2018). Specifically, contamination disgust, the feeling of disgust in the presence of soiled items, discourages interaction with health-threatening elements in the environment. Consistent with the emotional blunting effects of cardiovascular emotional dampening across a breadth of stimuli (Shukla et al., 2020), it is likely that – following exposure to soiled stimuli – those with any resting blood pressure elevation will be less sensitive to contamination disgust

than those with lower resting blood pressure. Thus, cardiovascular-emotional-dampeners should be less likely to engage in adaptive avoidance when exposed to disgust-evoking stimuli.

Despite health and wellness implications, disgust and its behavioral consequences have not been studied in the emotional dampening literature. This project seeks to address this gap by posing two main intentions. First, differences between emotional dampeners and non-emotional-dampeners in degree of contamination disgust following soiled stimulus exposure will be explored. Second, differences between emotional dampeners and non-emotional-dampeners in adaptive avoidance following soiled stimulus exposure will be explored.

Emotional Dampening

Cardiovascular emotional dampening is the term used to describe the relationship between resting blood pressure and a constellation of phenomena tied to emotional experience (McCubbin et al., 2011; Nyklíček et al., 2001; Pury et al., 2004; Shukla et al., 2017; Shukla et al., 2018a; Shukla et al., 2018b; Shukla et al., 2020; Wilkinson & France, 2009). What follows is a brief review of the emotional dampening literature which will describe what is known about its core features, the populations in which it has been observed, and what physiological mechanisms are thought to be implicated. Additionally, the potential long- and short-term implications of cardiovascular emotional dampening for human functioning also will be discussed.

Core Features

Cardiovascular emotional dampening has been established as a broadly encompassing phenomenon, with many details regarding its effects undiscovered. Though research has yet to fully define the boundaries of this phenomenon, three themes have been isolated as core features for the construct: reduced pain sensitivity, reduced emotion recognition accuracy, and reduced responding to emotional cueing.

Studies exploring the relationship between blood pressure and pain sensitivity preceded those of cardiovascular emotional dampening. A sizeable body of research has been conducted in the last two decades supporting the relationship between blood pressure and the pain threshold—pain being inversely correlated with blood pressure levels (Bruehl & Chung, 2004; Duschek et al., 2009; France, 1999; Ghione, 1996; Granot et al., 2019). Explicitly, normotensive participants require less pressure to evoke pain than hypertensive participants (Duschek et al., 2009), whereas hypertensive participants have lower pain sensitivity than normotensive participants (Duschek et al., 2009; Granot et al., 2019; Guasti et al., 1999). This phenomenon is known as hypertension-induced hypoalgesia (Delgado et al., 2014). Epidemiologic studies show the impact this phenomenon has on daily living, as high blood pressure levels lead to reduced responses to pain, such as headaches and musculoskeletal complaints. Chest pain during exercise as well as post-operation pain are also inversely correlated with blood pressure. Evidence for linear change between normotensive and hypertensive groups in mechanical-pain and pain-pressure thresholds also has been found (Duschek et al.,

2009), indicating that the relationship between blood pressure and pain exist along a spectrum.

The relationship between blood pressure and pain reflects the nature of the relationship between blood pressure and emotional responding. Effects of blood pressure –induced hypoalgesia appear to generalize beyond the somatic realm, reducing emotion-recognition accuracy (Shukla et al., 2017). Blood pressure has an inhibiting influence on emotion-recognition with both negative- (McCubbin et al., 2011) and positive-valenced stimuli (Pury et al., 2004; Wilkinson & France, 2009). A positive correlation also has been found between pain sensitivity and negative appraisal of psychologic stressors, further supporting blood pressure's hypothesized generalization inhibition effects (Nyklíček et al., 2001). Additionally, influence on emotion-recognition also generalizes across the senses (e.g., visual, auditory, etc.; Shukla, 2017; Shukla et al., 2018a).

Studies that reveal generalization effects provide support for the hypothesis that blood pressure could be a contributing factor in emotional dampening as well as cognitive appraisal of emotionally valenced stimuli (McCubbin et al., 2011). Though constructs quite similar to emotional dampening exist (e.g., alexithymia- the confusion of one's own emotions) emotional dampening effects have been distinguished as an independent entity (McCubbin et al., 2014). Additionally, resting diastolic blood pressure has been found to significantly predict emotion-recognition accuracy in men. Other studies report isolated rises in either diastolic or systolic blood pressure are enough to effect emotion-recognition (Shukla et al., 2017).

Likewise, emotional dampening reduces responding to emotional cues (Shukla et al., 2020). Higher than normal blood pressure has been found to blunt emotional reactivity. Blunted responses to emotional cueing have been hypothesized to aid in controlling the effects of intense emotions. Additionally, blunting is hypothesized to be able to develop either consciously or unconsciously, and could be a significant contributor in involuntary blood pressure elevation.

Also, blood pressure has been found to have a significant effect on the startle response (Shukla et al., 2020). Slowed response-onset latency for positive stimuli - present amongst those without elevated blood pressure - is absent in those with elevated blood pressure, meaning that those with elevated blood pressure respond to positive stimuli at a faster rate. Additionally, normotensive individuals score significantly higher in labeling and matching facial emotions when compared to hypertensive individuals (Shukla et al., 2018b). No support has been found for differences in speed of emotional processing or response times between normotensive and hypertensive groups (Shukla et al., 2018a; Shukla et al., 2018b). However, hypertensives have significant reduction in accuracy of visual stimuli and report awareness of processing difficulties on an individual level (Shukla et al., 2018a).

Overall, cardiovascular emotional dampening broadly encompasses pain sensitivity (Bruehl & Chung, 2004; Delgado, 2014; Duschek et al., 2009; France, 1999; Ghione, 1996; Granot et al., 2019), emotion recognition accuracy (Shukla et al., 2017), and responding to emotional cueing (Shukla et al., 2020). Those with emotional dampening experience a reduction in these effects. It has been indicated that these

effects vary- existing along a spectrum corresponding with markers of cardiovascular dysfunction (i.e., blood pressure, heart-rate variability).

Population Features

Cardiovascular emotional dampening is not confined to a select group of individuals (McCubbin et al., 2011; Shukla et al., 2020). Studies have shown that both normotensive and hypertensive individuals experience the effects of emotional dampening along a continuum. Furthermore, while emotional dampening effects are consistent in diverse populations (McCubbin et al., 2011), effects vary between men and women (Loveless et al., 2018; McCubbin et al., 2013; McCubbin et al., 2020).

Emotional dampening is not contained to those with hypertension (McCubbin et al., 2011). The phenomenon has also been found to effect those still falling within the normative range with marginal rises in blood pressure. Even slight rises in blood pressure contribute to lessened involuntary emotional reactivity amongst a range of stimuli (Shukla et al., 2020). Additionally, slight rises in blood pressure result in faster response-onset latency for positive stimuli. Thus, increases in blood pressure do not have to be dramatic in order to experience emotional dampening.

Research has shown consistency in the effects of emotional dampening in African American participants who were middle age, at high risk for heart disease, and mainly low in socioeconomic status (McCubbin et al., 2011). Facial- and sentence-valenced task scores were inversely related with both systolic and diastolic blood pressure, and positively related with cardiac output, education, mental state, and BMI. Effects represented in diverse samples reflect effects in samples of previous studies.

Emotional dampening also varies between men and women. For males, resting diastolic blood pressure predicts emotion-recognition, but it is speculated that females are not subjected to these effects until later in life, hypothesized to be due to hormonal changes. Additionally, young males with the highest blood pressures and lowest emotional-valence-accuracy–response abilities are predictive of the greatest increase in the same effects later in life (McCubbin et al., 2014). There also have been sex differences found in risk taking behaviors. Women with higher blood pressure were associated with higher driving speed as well as increased tailgating (McCubbin et al., 2020). Conversely, significance was not found in men regarding high blood pressure and risky driving.

In essence, emotional dampening is not contained to those with hypertension (McCubbin et al., 2011) and affects those even with marginal rises in blood pressure. Additionally, these effects remain consistent in diverse populations (McCubbin et al., 2011). Conversely, there are differences in emotional dampening between men and women, with women typically experiencing effects later in life (McCubbin et al., 2020). Though sex differences are present, it has been established that cardiovascular emotional dampening is not confined to a select group (i.e., hypertensives).

Physiologic Features

The physiologic means by which cardiovascular emotional dampening occurs is not confirmed, though evidence is amounting for hypothesized mechanisms. Cardiovascular control among “normal” individuals functions differently from those experiencing cardiovascular emotional dampening (Shaffer et al., 2014). Specifically,

afferent inhibitory signaling is hypothesized as one of the mechanisms effected in cardiovascular emotional dampening (Delgado et al., 2014). Additionally, functioning in the CNS is hypothesized to be altered in those with emotional dampening, driving up the blood pressure's "set point." (Delgado et al., 2014; McCubbin et al., 2020).

Cardiovascular control among "normal" individuals functions differently from those experiencing cardiovascular emotional dampening. In normal functioning, heart-rate variability (the change in time between heartbeats) and blood pressure are regulated using a negative-feedback system- the baroreflex (Delgado et al., 2014; Shaffer et al., 2014). This system specifically regulates that when one's blood pressure is high, heart-rate decreases; when blood pressure is low, heart-rate increases. This change is detected by aortic and carotid baroreceptors, which stretch or shrink in response to the changing blood pressure. These changes happen quite rapidly—in less than a second—restoring regulatory capacity and preventing the fainting response. The afferent pathways of this system send information to the medulla, while efferent pathways send information to the sympathetic and parasympathetic systems, both of which have constant influence on the heart and vascular resistance. In normal individuals, heart-rate variability can be an indicator of one's ability to react to stressors in the environment, thus indicating resiliency (Shaffer et al., 2014). Additionally, evidence supports that higher levels of resting heart-rate variability are associated with higher performance on tasks utilizing executive functions (Thayer et al., 2012).

Conversely, when functioning is disturbed, negative consequences can arise. For example, reduced baroreflex and heart-rate variability results in decreased abilities to

respond to stressors and may contribute to gastrointestinal disorders, inflammation, and hypertension (Gevirtz, 2013). Likewise, heart-rate variability indices display low vagal functioning in those diagnosed with anxiety disorders (Friedman, 2007).

Though the methods the body uses in emotional dampening are not confirmed, small changes in blood pressure are hypothesized to lead to inhibitory, or afferent pathway-signaling (Delgado et al., 2014). An increase in blood pressure during aversive stimulation contributes to increases in activity in the negative-feedback system in order to lower distress and emotional reactivity. Though actions of afferent inhibitory signaling via the baroreflex are observed, findings suggest contributions are made by other mechanisms stemming from the CNS- dysregulating autonomic control.

Research suggests important links with CNS emotion regulation, as well as hemodynamic processes and development of hypertension. Previous research has suggested a similar notion that subtle changes in CNS function can precede blood pressure increases, even when that increase is within the normotensive range (e.g., Bruehl et al., 1992; France, 1999; Ghione, 1996; Jennings & Zanstra, 2009). It has been hypothesized that connection through a CNS mechanism -which enables emotional dampening- could be a contributor to hypertension, heart disease, and stroke (McCubbin, 2014). Additionally, hypertension has been hypothesized to develop by raising the “set point” of resting blood pressure by means of CNS functioning (Delgado et al., 2014; McCubbin et al., 2020).

Implications

Evidence is amounting that the effects of cardiovascular emotional dampening have both short- and long-term implications for human functioning (McCubbin et al., 2020). Hypothesized effects of long-term consequences are actualized by the short-term consequences of failing to respond appropriately to environmental demands due to reduced threat detection.

Emotional dampening can hold consequences for one's health from engaging in more extreme, risky behaviors (Loveless et al., 2018; McCubbin et al., 2018; McCubbin et al., 2020). A tendency to engage in approach behaviors, which could lead to engagement in risk (Loveless et al., 2018), has been linked with emotional dampening. Greater right-frontal asymmetry is associated with a disposition toward behavioral avoidance while greater left-frontal asymmetry is associated with a dispositional tendency toward behavioral approach (Davidson & Fox, 1982; Stewart et al., 2011). Furthermore, higher resting systolic blood pressure has been associated with greater left-frontal asymmetry, which was associated with more neutral stimuli in an emotional appraisal paradigm that measured implicit as well as explicit emotion-processing. Hence, emotional-dampeners are motivated to seek out reinforcement but have a reduced capacity to experience said reinforcement. This could have important implications for the health and wellness of these individuals as they might engage in more excessive or extreme appetitive behaviors to experience reinforcement.

The short-term consequences of failing to engage in appropriate threat response actualize long-term consequences. Higher resting blood pressure corresponds with

mitigated emotional reaction to threat, thereby increasing involvement in risk-taking behaviors in individuals with high blood pressure. For example, risky behaviors while driving (i.e. speeding, tailgating) were found amongst women with higher blood pressure. Engaging in risk taking behaviors could continue to drive up blood pressure and emotional dampening—further increasing engagement in the cycle (McCubbin et al., 2020).

In essence, emotional dampeners are less sensitive not only to reinforcement (Loveless et al., 2018), but also to threats in the environment (McCubbin et al., 2020) leading emotional dampeners to be more likely to engage in risky behaviors. Together, these features can create a cascading effect on blood pressure, reinforcing the effects of emotional dampening.

Disgust

Disgust is defined as an emotional response of repulsion or aversion to offensive things in the environment (Curtis & Barra, 2018). Though this protection mechanism is a common response, individuals experience disgust differently (e.g. Cisler et al., 2009; Egolf et al., 2018; Eysenck & Eysenck, 1975; Haidt et al., 1994; Rozin et al., 2008; Quigley et al., 1997). Reflecting its complex nature, understanding of disgust has evolved over time. What follows is a brief review of the disgust literature, its physiologic features, and its related features. Then, an experiment on emotional dampening, disgust, and implication of consumption behaviors related to disgust sensitivity will be outlined.

Disgust Literature

There have been many attempts to define disgust. Namely, Charles Darwin attributed disgust as a feeling that was related to the avoidance of food (Haidt et al., 1994). In *The Expression of the Emotions in Man and Animals* (1872), Darwin referred to disgust as "something revolting, primarily in relation to the sense of taste, as accurately perceived or imagined; and secondarily to anything which [*sic*] causes a similar feeling, through the sense of smell, touch, and even eyesight" (p. 253). Reflecting this, Darwinian disgust ideology was inherently based on biology as well as recognizing multiple sensations as integral features of the emotion of disgust. During the Victorian Era, though, disgust models were centrally focused on the Freudian idea that disgust was a defense mechanism against the id, which was thought to host desires too taboo for a person's own acknowledgement. In other words, disgust was theorized as a means to protect oneself against one's own underlying incestual urges (Menninghaus, 2003). Turning away from Freudianism, Angyal proposed in 1941 that disgust is a mechanism of many purposes, including preserving oneself from overindulgence, repulsion of oral intrusions of offensive objects, and repulsion of body-waste products. He also proposed, for the first time in the literature, that the intimacy of disgust stimuli is related to the degree of disgust. Recent theories on disgust have centralized on the idea that humans are animals bound to mortality and in order to escape from the reality of death, an inherent feature of mortality, humans utilize disgust as a defense mechanism. Consequentially, it is theorized that this is the means by which human moral order is maintained (Haidt et al., 1994; Rozin et al., 2008).

The modern theory of disgust is that it serves as an adaptive emotion that protects humans from potential parasites in the environment, according to the parasite theory (Curtis & Barra, 2018). It also has been proposed that there are three distinguished types of disgust: Pathogen, Sexual, and Moral Disgust (Tybur et al., 2009). Specifically, Pathogen Disgust is a behavioral means of survival and also the body's, "first line of defense," against potentially harmful things in the environment such as pathogens. Pathogen Disgust, also known as contamination disgust, can be further broken down into three categories consisting of objects, practices, and people (Curtis & Barra, 2018).

Physiologic Features

Reflecting the complicated nature of its theories, disgust also has complex physiological features. Namely, distinct associations have been made between emotions (i.e., disgust) and select markers of cardiovascular health (Lane et al., 2009; Rozin et al., 1994). Research has supported that there is a clear and distinguished physiologic relationship between disgust and cardiac features such as heart rate, heart rate variability, and blood pressure (Lane et al., 2009; Rozin et al., 1994).

Heart rate and heart rate variability changes are associated with disgust. Specifically, heart rate and heart rate variability have been observed to decrease when disgust is elicited (Lane et al., 2009). Further, eliciting disgust also is associated with a temporary, responsive decrease in blood pressure (Rozin et al., 1994). Changes in heart rate, heart rate variability, and blood pressure are temporary as the levels of the three

indicators increase following the removal of a disgusting stimulus. Therefore, when produced, the emotion of disgust corresponds with cardiovascular physiologic response.

Though disgust corresponds with cardiovascular-physiologic response in healthy controls, emotional-dampeners are less likely to be sensitive to disgust, resulting in a weaker physiologic response (McCubbin et al., 2011). It has been suggested that the way in which this effect is regulated is through CNS emotion-regulation, and that even subtle changes in CNS function precede increases in blood pressure, even within the normotensive range (Bruehl et al., 1992; France, 1999; Ghione, 1996; Jennings & Zanstra, 2009). Further, the inhibitory influence even slight increases in blood pressure exert over negative emotions (i.e. disgust) and corresponding physiologic reactivity is regarded as emotional dampening (McCubbin et al., 2011). Therefore, emotional-dampeners are likely to be less sensitive to disgust, and likewise, show less of a physiologic response. Specifically, it is likely that when emotional-dampeners are presented with disgusting stimuli, they may display less of a decrease in heart rate, heart rate variability, and blood pressure than non-emotional-dampeners.

There is much evidence to support the existence of a relationship with disgust and physiologic response. Specifically, in healthy controls, disgust elicits a reduction in heart rate, heart rate variability, and blood pressure (Lane et al., 2009; Rozin et al., 1994). On the other hand, this physiological response is likely to be attenuated in emotional dampened individuals (McCubbin et al., 2011). Therefore, disgust sensitivity differences correspond with physiological response differences, and the degree to which this occurs likely varies between individuals as a function of resting blood pressure.

Related Features

Disgust has dynamic features that present differently on the individual level. A growing body of research supports associations between disgust sensitivity and a realm of factors. Not only has research shown that disgust sensitivity varies based on consequences in the environment (Borg & Jong, 2012; Fleischman et al., 2015; Goldenberg et al., 2001; Hoefling et al., 2009; Lee et al., 2014), but also differs amongst various mental illnesses (Cisler et al., 2009; Eysenck & Eysenck, 1975; Rozin et al., 2008). Additionally, research supports that disgust sensitivity differs based on sex and gender, as well as age (Egolf et al., 2018; Haidt et al., 1994; Quigley et al., 1997), and that behavioral features such as approach and avoidance tendencies are dynamic within the continuum of disgust sensitivity (Curtis & Barra, 2018; Deacon & Olatunji, 2007; Herbert et al., 2014; Olatunji et al., 2014).

Disgust sensitivity is not fixed and responds accordingly to environmental demands. One example of a context in which disgust sensitivity is apt to change is when the consequences of disgust are highly costly. When the consequences of disgust behaviors are high, such as during periods of food-deprivation or the loss of the opportunity to mate, sensitivity to disgust decreases (Borg & Jong, 2012; Fleischman et al., 2015; Hoefling et al., 2009; Lee et al., 2014). Likewise, when people are asked to imagine their own deaths, sensitization to disgust ensues (Goldenberg et al., 2001). High environmental consequences of disgust will lessen sensitivity while high consequences of ignoring disgust will increase sensitivity, ultimately aiding in the survival of the individual.

Another instance of variation in disgust sensitivity is displayed by associations with a realm of mental illnesses- particularly among those with high and low sensitivity. Disgust is regarded as having protective benefits to survival, yet if one is particularly sensitive to its effects, different emotional disorders—such as obsessive–compulsive disorder (OCD) and arachnophobia—can ensue (Cisler et al., 2009; Rozin et al., 2008). Additionally, a positive relationship has been found between disgust sensitivity and neuroticism in the Big Five with mortality anxiety and bodily concerns (Cisler et al., 2009; Rozin et al., 2008).

Conversely, particularly low sensitivity to disgust is related to antisocial behaviors. It is theorized that this relationship is likely due to the moral ideology that disgust is theorized to maintain— and that those who score higher in psychopathy on the Eysenck Personality Questionnaire score lower on disgust sensitivity (Eysenck & Eysenck, 1975; Rozin et al., 2008). Therefore, disgust is thought not only to serve as a tool in survival, but also is associated with behaviors congruent with social appropriateness.

Disgust sensitivity also differs between sexes and genders and over time. Studies have consistently found that females score higher on scales of disgust than males (Haidt et al., 1994). Additionally, disgust sensitivity has been found to decrease through adulthood (Egolf et al., 2018; Quigley et al., 1997) and has been found to decrease at a higher rate for women than for men (Egolf et al., 2018). Therefore, there are sex differences in disgust sensitivity not only in the level of disgust experienced, but also in the progression of disgust sensitivity changes over time.

Additionally, behavioral features such as approach and avoidance tendencies are dynamic within the continuum of disgust sensitivity. Some research has been conducted on approach and avoidance behaviors in tandem with taste sensitivity. More importantly, approach and avoidance behaviors have been related to the capacity to experience reinforcement, which is theorized to play a role in risk-engagement. There has been some research on approach/avoidance behaviors and taste sensitivity. Herbert and colleagues (2014) explored the relationship between approach and avoidance behaviors and sensitivity for bitter tastes. Participants classified by the researchers as more sensitive to tastes were also more sensitive to disgust. Participants with higher sensitivity to taste were particularly sensitive to disgust stimuli related to products of the body. Taste sensitivity has not been heavily researched in tandem with disgust sensitivity, but the research that has been conducted suggests that a relationship between the factors is present.

Additionally, research reflects a relationship between approach and avoidance behaviors and sensitivity to disgust related to body products; otherwise known as contamination disgust (Curtis & Barra, 2018). A subsect of contamination disgust, contaminated objects, specifically consist of bodily fluids, infected lesions, spoilt foodstuffs, and animal disease vectors (e.g. cockroaches). Research shows that object contamination concerns are robustly associated with OCD (Deacon & Olatunji, 2007), and that contamination disgust sensitivity can predict behavioral avoidance in public restrooms (Olatunji et al., 2014). Therefore, contamination disgust sensitivity can be

used as a behavioral predictor towards contaminated stimuli and is associated with OCD and OCD-like features.

Disgust sensitivity presents differently based on a realm of factors including environmental features (Borg & Jong, 2012; Fleischman et al., 2015; Goldenberg et al., 2001; Hoefling et al., 2009; Lee et al., 2014), mental illness (Cisler et al., 2009; Eysenck & Eysenck, 1975; Rozin et al., 2008), gender (Haidt et al., 1994), age (Egolf et al., 2018; Quigley et al., 1997), and behavior tendencies (Curtis & Barra, 2018; Deacon & Olatunji, 2007; Herbert et al., 2014; Olatunji et al., 2014). In environments in which disgust is costlier, sensitivity decreases and vice versa (Borg & Jong, 2012; Fleischman et al., 2015; Goldenberg et al., 2001; Hoefling et al., 2009; Lee et al., 2014). Additionally, high sensitivity to disgust is associated with anxious-type features while low sensitivity is associated with antisocial-type features (Cisler et al., 2009; Eysenck & Eysenck, 1975; Rozin et al., 2008). Furthermore, women experience higher levels of disgust sensitivity than men and a more dramatic decrease in disgust sensitivity over time (Egolf et al., 2018; Haidt et al., 1994; Quigley et al., 1997). Imperatively, contamination disgust sensitivity can predict behavior when exposed to contaminated stimuli (Olatunji et al., 2014). Also, disgust sensitivity can vary greatly between individuals and is not fixed within the individual. Disgust sensitivity changes according to environmental demands - ultimately aiding in survival by serving as a defense mechanism from environmental threat (i.e. parasite theory; Curtis & Barra, 2018).

Summary

Though the likelihood that emotional reactivity could have a relationship with eating behavior is suggested by research (Dess & Chapman, 1990; Dess & Minor, 1996; Egolf et al., 2018; Herbert et al., 2014), disgust has yet to have been independently explored in relation to cardiovascular emotional dampening in general as well as related to eating. If emotional-dampeners have a reduced capacity to experience disgust, then they are more likely to engage in some form of risky behavior. While there have multiple proposed pathways that have linked emotional dampening to engagement in risky behavior (Loveless et al., 2018; McCubbin et al., 2018), the one most salient to the present discussion involves a failure to detect threat (McCubbin et al., 2018). Namely, if emotional-dampeners are less prone to experience disgust when exposed to contaminated stimuli, then they are less likely to engage in adaptive avoidance of said stimuli and are therefore at a greater risk for some form of negative consequence related to such.

Overview

The present study was a pilot project that explored the relationships between disgust sensitivity, emotional dampening, and adaptive avoidance among a sample of healthy young women. Consistent with previously used methods (Delgado et al., 2014), participants were divided into a high-emotionality group (i.e., non-emotional-dampeners) and low-emotionality group (i.e., emotional dampeners) using the Penn State Worry Questionnaire (Meyer et al., 1990). These groups were then compared on 1) their responses to a disgust-evoking paradigm where they were shown a mix of

neutral and disgusting images pulled from the International Affective Picture System (IAPS; Lang et al., 2008); 2) their self-reported likelihood of eating within the next hour; 3) their self-reported preference of portion size after being presented with pictures of cake slices that differ in size. Based on the reviewed research literature, it was hypothesized that:

1. The high emotionality group will, on average, report higher levels of disgust than the low emotionality group, even after controlling for trait disgust.
2. The high emotionality group will, on average, report being less likely to eat within the next hour after completing the disgust paradigm, even after controlling for self-reported pre-disgust levels of hunger.
3. The high emotionality group will, on average, select a smaller portion of cake following the disgust paradigm.

CHAPTER II

METHOD

Participants

Two-hundred and eighteen participants were recruited from the Middle Tennessee State University Department of Psychology research pool. Potential participants who indicated current psychiatric, endocrine, or cardiovascular diagnoses on the survey screening questions were excluded. Likewise, potential participants who reported taking depression/mood, anti-anxiety, attention, endocrine, and cardiac medications on the survey screening questions were excluded. Finally, participants were excluded if they indicated being assigned a male sex at birth, provided incomplete data, or failed the study's embedded validity questions. In total, 94 participants were excluded from the final analysis: 8 for incomplete responses; 1 for no documented consent; 54 for endorsing a history of psychiatric illness; 4 for endorsing a history of cardiovascular illness; 6 for medication exclusions; 9 for sex exclusion, and 8 for validity violations. One hundred and twenty-four participants remained in the final analysis. Sample Demographics can be found in Table 1. The survey took roughly 20 to 30 minutes to complete, and all participants who completed the study were compensated with research credit for the Introduction to Psychology course.

Psychometric Measures and Questionnaires

Penn State Worry Questionnaire (PSWQ)

The Penn State Worry Questionnaire was administered to create emotional dampening and non-emotional dampening comparison groups, as was done in a study

by Delgado and colleagues (2014). Developed by Meyer et al (1990), the PSWQ is a 16-item measure of trait worry with scores ranging from 16 to 80. The PSWQ utilizes a Likert scale ranging from 1 (*not at all typical*) to 5 (*very typical*). Higher scores on the PSWQ indicate higher trait worry. Eleven of the items are scored postively and 5 items are reverse scored.

Table 1

Demographic Information

	Variable	*n*	%
Age			
	18	60	48.4
	19	30	24.2
	20	19	15.3
	21	7	5.6
	22	3	2.4
	24	1	0.8
	29	1	0.8
	31	1	0.8
	53	1	0.8
	71	1	0.8
Race			
	White	72	58.1
	Black	29	23.4
	Asian	5	4
	Hispanic	9	7.3
	Mixed	3	2.4
	Other	4	3.2
	Prefer Not to Answer	2	1.6

N = 124

The PSWQ has good validity, good internal consistency, and good test-retest reliability. The PSWQ is also a good screener for GAD (Generalized Anxiety Disorder) and is sensitive to symptom-changes after anxiety-treatment (Behar et al., 2003; Stöber et al., 1998). In samples of older adults with GAD, community samples, and undergraduates, Cronbach's alphas spanned from .88 to .95 (Borkovec, 1993; Brown et al., 1992; Davey, 1993; Di Nardo & Barlow, 1988; van Rijsoort et al., 1999). Good test-retest reliability was shown in a sample of college students over a period of 8 to 10 weeks (r = 0.92) (Meyer et al., 1990). In clinical and community samples, moderate convergent validity has been shown when compared with other worry questionnaires such as The Worry Domains Questionnaire (r = .67) (Tallis et al., 1992) and the Student Worry Scale (r = .59) (Davey et al., 1992). Moderate discriminant validity has been shown for anxiety and depression in the State Trait Anxiety Inventory (trait r = .64–.79, state r = .49) (Meyer et al., 1990; Spielberger et al., 1983) and the Beck Depression Inventory (r = .36 – .62) (Beck et al., 1961; Meyer et al., 1990).

To define emotional dampening and non-emotional dampening groups, scores on the PSWQ were split into quintiles similar to the method used by Delgado et al (2014). Specifically, those considered to be emotional dampeners obtained scores within the bottom quintile of scores on the PSWQ from this sample, indicating low worry status. Conversely, those considered to be non-emotional dampeners obtained scores in the top quintile of scores on the PSWQ from this sample, indicating high worry status.

Three Domains of Disgust Scale (TDDS)

The Three Domains of Disgust Scale was administered to control for trait Pathogen Disgust (Tybur et al., 2009). Developed by Tybur and colleagues, the TDDS is a 21-item measure of Pathogen, Sexual, and Moral Disgust. Scores range from 0 to 126. The TDDS utilizes a Likert scale ranging from 0 (*not at all disgusting*) to 6 (*extremely disgusting*). Higher scores on the TDDS indicate higher disgust.

Pathogen (r = .86), Sexual (r = .91), and Moral (r = .81) disgust have been shown to have excellent internal consistency as well as moderate test-retest reliability (r = .64) when testing over a span of 12 weeks (Olatunji et al., 2012). Supportive evidence shows validity for Pathogen and Sexual Disgust subscales. These subscales showed strong associations with disgust/contamination and weak associations with negative affect. The validity of the Moral Disgust subscale was found to be limited. Limitations of the Moral Disgust subscale were revealed such as responses on this subscale being stronger when associated with anger. The TDDS subscales were differentially related to Big 5 personality traits. Validity of the TDDS was shown in the subscales in relation to multiple indices of disgust/contamination-aversion in a select sample.

Study Stimuli, Tasks, and other Materials

Qualtrics

Qualtrics software (Qualtrics, 2019) was used as the platform for administration of the stimuli, tasks, and materials.

Screening

Participants were asked to report if they have ever been diagnosed with a psychiatric issue by a licensed health care professional. Participants were then asked if they have ever been diagnosed with an endocrine issue by a licensed health care professional. Then, participants were asked if they have ever been diagnosed with a cardiovascular issue by a licensed health care professional. Participants were then asked to report if they are taking any depression/mood, anti-anxiety, attention, endocrine, or heart medications.

Demographics

Participants were asked to report their biological sex at birth. Participants were then asked their age. Participants were then asked to choose the race they consider themselves to be. Then, participants were asked if they were currently using any tobacco or nicotine products. If participants indicated tobacco and/or nicotine product use, they were then asked to indicate how many hours ago they last used a tobacco or nicotine product.

Pre- Exposure Hunger Rating

Before exposure to neutral and disgust stimuli, participants self-rated their current experience of hunger on a 7-point Likert scale ranging from 1 (*not hungry*) to 7 (*very hungry*). This rating was used to control for the effect of hunger.

Hours Since Last Eaten

Participants indicated how long it had been since they last ate on a scale of 1 to 24 hours. If the last time a participant ate exeeded 24 hours, they were asked to report 25.

International Affective Picture System (IAPS)

Published in 2005, the International Affective Picture System (IAPS; Lang et al., 2008) was developed as a resource to study emotion and attention and is widely used in psychologic research. Pictures from the IAPS were used for the contamination stimulus in order to elicit disgust. The IAPS was developed to provide standardized emotionally evocative images for emotion-research purposes with norms from 16 studies. The version of the IAPS used for this study has roughly 940 images rated on valence, arousal, and dominance with a 9-point Likert scale.

Ten disgusting and 10 neutral valenced pictures were selected from the IAPS for the emotion-related tasks. Pictures were selected from the contamination category, excluding gore, for disgust and pictures with neutral ratings (values of 5) were selected for the neutral category. Pictures with valence ratings greater than 5 were considered positive, while pictures with valence ratings less than 5 were considered negative. All 20 pictures were presented in randomized order.

Disgust Rating

Participants were shown both neutral- and contamination-image stimuli from the IAPS (Lang et al., 2008) and self-rated their experience of disgust on a 7-point Likert

scale ranging from 1 (*not disgusted*) to 7 (*very disgusted*). It is supported in the literature that self-rating for disgust on a Likert scale is a reliable and valid measure (Rolls, 2015).

Likelihood of Eating

Following the post-exposure hunger rating, participants self-rated their likelihood of eating in the next hour on a 7-point Likert scale ranging from 1 (*not at all likely*) to 7 (*very likely*). This measure was used in the current study to examine self ratings for likelihood of eating within the next hour after exposure to a soiled stimulus.

Food Stimulus

The participants were shown seven pictures of different-sized slices of cake to represent varied portion sizes of cake. The first picture was a 7-inch slice of cake, the second picture was a 6-inch slice of cake, the third picture was a 5-inch slice of cake, the fourth picture was a 4-inch slice of cake, the fifth picture was a 3-inch slice of cake, the sixth picture was a 2-inch slice of cake, and the seventh picture was a 1-inch slice of cake. The participants were asked to choose which portion of cake they would prefer. This measure was used in the current study to examine self ratings for portion preference after exposure to a soiled stimulus.

Procedures

During the online prescreening procedures, potential particpants answered screening questions (see Appendix C) and then reviewed and electronically signed the informed-consent document (see Appendix A). After signing the informed consent, those who indicated current psychiatric, endocrine, and cardiovascular diagnoses were screened out of the study. Likewise, those taking depression/mood, anti-anxiety,

attention, endocrine, and heart medications were excluded. Eligible consenting participants then answered demographic questions (see Appendix D) and then completed the PSWQ and the TDDS. Additionally, participants with incorrect validity question responses were excluded (see Appendix E). The participants then gave a Likert scale pre-exposure hunger rating. Following this, the participants were shown both neutral and disgust stimuli in randomized order. While viewing the stimuli, participants provided a 7-point Likert scale disgust rating for each photo. Subsequently, participants were asked to self-rate, on a Likert scale, post-exposure hunger rating and their likelihood of eating within the next hour. The participants then were asked to choose what size food stimulus they preferred at that time. Participants then were debriefed and were given 1 research credit in their psychology course, in line with the procedures at Middle Tennessee State Universty.

CHAPTER III

RESULTS

Hypothesis Testing

The statistical software SPSS (version 26) was used to perform statistical analysis on all hypotheses. In addition, the statistical software SAS Studio (version 3.8) was used to perform Johnsen Neymen Confidence Intervals for the second and third hypotheses. Descriptive statistics can be found in Table 2 for pre-hunger ratings, disgust ratings, neutral ratings, trait disgust, and PSWQ score.

Table 2

Descriptive Statistics

Worry Group	*n*	Pre-hunger Rating		Disgust Rating		Neutral Rating		Trait Disgust		PSWQ Score	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low	26	3.04	1.80	5.83	0.85	1.78	0.76	27.46	8.37	42.27	6.31
High	25	3.60	2.24	6.24	0.58	2.21	0.92	30.20	7.24	74.68	2.70

Hypothesis 1

A repeated measures analysis of covariance (ANCOVA) was conducted to examine if disgust ratings differed by worry group (high worry, low worry) and image type (disgusting image, neutral image) while controlling for trait disgust. There was not a significant interaction between image type and worry group when controlling for trait disgust, Wilk's $F(1, 48) = 0.211$, $p = .648$. Disgust ratings were higher for disgusting

images (*M* = 6.03) than for neutral images *(M* = 1.99) when controlling for trait disgust, Wilk's *F*(1, 48) = 20.143, *p* < .001, , $\omega_p^2 = .27, 95\%\ CI\ [.10, .46]$. Ignoring stimulus valence, disgust ratings were significantly lower for the low-worry group (*M* = 3.83) than for the high-worry group (*M* = 4.19) when controlling for trait disgust, *F*(1, 48) = 6.23, *p* = .016, , $\omega_p^2 = .09, 95\%\ CI\ [.003, .28]$.

Hypothesis 2

A one-way analysis of covariance (ANCOVA) was conducted to examine if high- and low-worry groups were more likely to consume food within the next hour while controlling for pre-exposure hunger ratings. The relationship between pre-hunger ratings and likelihood to consume food within the next hour differed between the worry groups, *F(1, 47) = 8.73, p = .005,* $\omega_p^2 = .13, 95\%\ CI\ [.02, .33]$. As a result, the ANCOVA model allowed for different slopes and Johnson and Neyman confidence regions were used to determine significant differences between the groups. As can be seen in Table 2 and Figure 1, likelihood to eat within the next hour ratings were higher for the low-worry group than for the low-worry group when pre-hunger ratings were 3.10 or greater.

Table 3

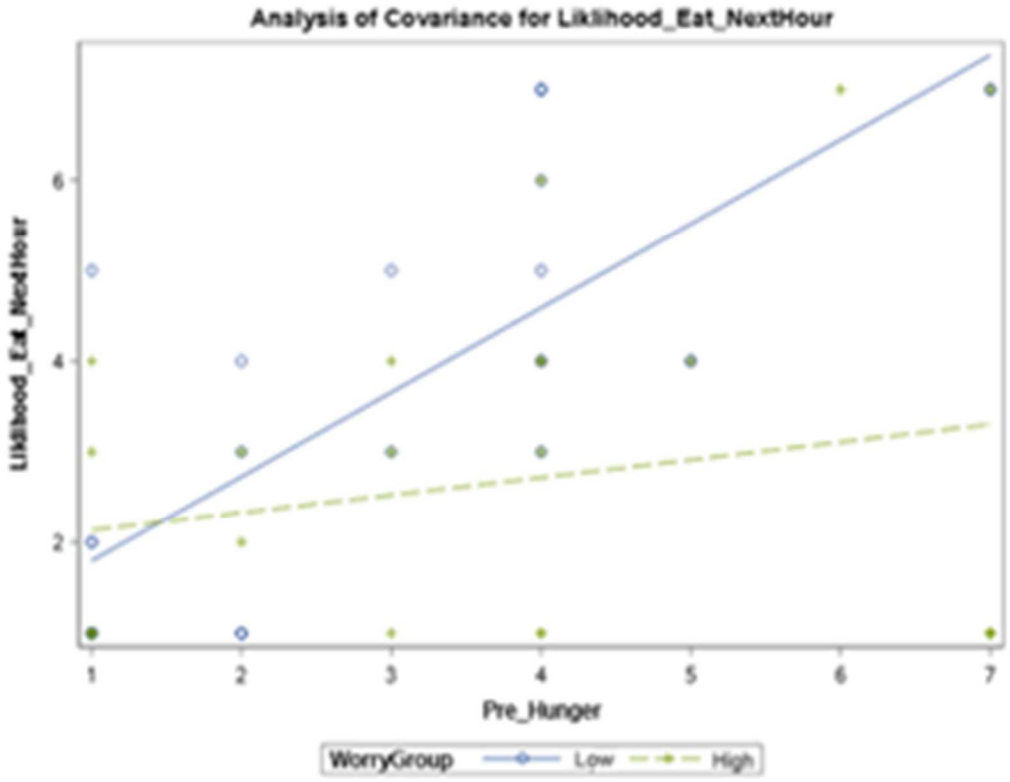
Likelihood to Eat Within the Next Hour with Confidence Intervals

PRE_HUNGER	Coeff	se	t	p	LLCI	ULCI
1.00	-0.34	0.75	-0.45	0.65	-1.84	1.16
1.30	-0.12	0.69	-0.17	0.87	-1.51	1.28
1.60	0.10	0.64	0.16	0.87	-1.19	1.39
1.90	0.32	0.60	0.55	0.59	-0.87	1.52
2.20	0.55	0.56	0.98	0.33	-0.57	1.67
2.50	0.77	0.53	1.46	0.15	-0.29	1.82
2.80	0.99	0.50	1.96	0.06	-0.03	2.00
2.83	1.01	0.50	2.01	0.05	0.00	2.02
3.10	1.21	0.49	2.46	0.02	**0.22**	**2.20**
3.40	1.43	0.49	2.91	0.01	**0.44**	**2.41**
3.70	1.65	0.50	3.29	0.00	**0.64**	**2.66**
4.00	1.87	0.52	3.58	0.00	**0.82**	**2.92**
4.30	2.09	0.55	3.78	0.00	**0.98**	**3.20**
4.60	2.31	0.59	3.90	0.00	**1.12**	**3.50**
4.90	2.53	0.64	3.98	0.00	**1.25**	**3.81**
5.20	2.75	0.69	4.01	0.00	**1.37**	**4.13**
5.50	2.97	0.74	4.01	0.00	**1.48**	**4.46**
5.80	3.19	0.80	4.00	0.00	**1.59**	**4.80**
6.10	3.41	0.86	3.97	0.00	**1.69**	**5.14**
6.40	3.63	0.92	3.94	0.00	**1.78**	**5.49**
6.70	3.85	0.99	3.91	0.00	**1.87**	**5.84**
7.00	4.07	1.05	3.88	0.00	**1.96**	**6.19**

Note. Bolded values illustrate significance.

Figure 1

Likelihood to Eat Within the Next Hour



Hypothesis 3

A one-way analysis of covariance (ANCOVA) was conducted to examine if high- and low-worry groups differed in portion preference while controlling for pre-exposure hunger ratings. The relationship between pre-hunger ratings and portion preference differed between the worry groups, *F(1, 47) = 8.24, p* = .006, $\omega_p^2 = .12, 95\%\ CI\ [.01, .32]$. As a result, the ANCOVA model allowed for different slopes and Johnson and Neyman confidence regions were used to determine significant differences between the groups. As can be seen in Table 3 and Figure 2, portion preference ratings were higher for the high-worry group than for the low-worry group when pre-hunger ratings were 1.60 or below. In contrast, when pre-hunger raters were 5.80 or higher, the portion preference ratings were higher for the low-worry group than for the high-worry group, See Table 3 and Figure 2.

Table 4

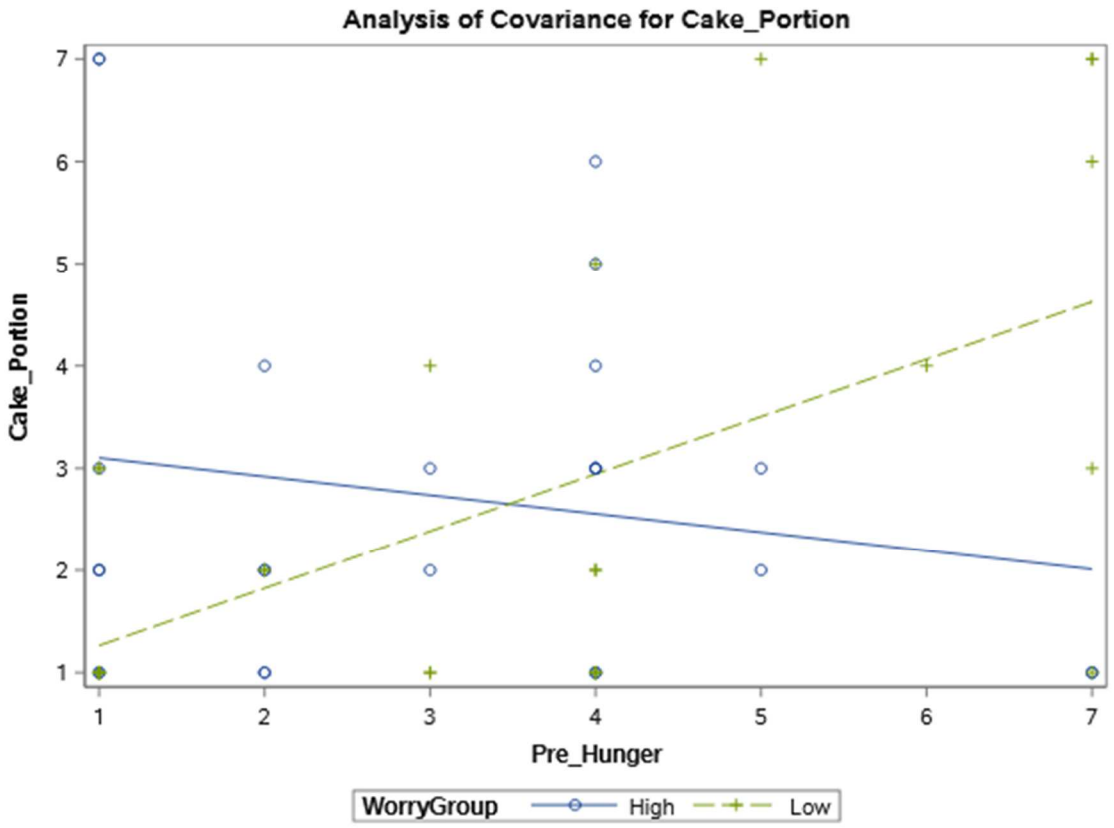
Portion Preference with Confidence Intervals

PRE_HUNGER	Coeff	se	t	p	LLCI	ULCI
1.00	1.84	0.78	2.37	0.02	**0.28**	**3.40**
1.30	1.62	0.72	2.25	0.03	**0.17**	**3.06**
1.60	1.39	0.67	2.09	0.04	**0.05**	**2.73**
1.73	1.30	0.65	2.01	0.05	0.00	2.60
1.90	1.17	0.62	1.89	0.06	-0.08	2.41
2.20	0.95	0.58	1.64	0.11	-0.22	2.11
2.50	0.72	0.55	1.33	0.19	-0.37	1.82
2.80	0.50	0.52	0.96	0.34	-0.55	1.55
3.10	0.28	0.51	0.55	0.59	-0.75	1.31
3.40	0.06	0.51	0.11	0.91	-0.97	1.08
3.70	-0.17	0.52	-0.32	0.75	-1.21	0.88
4.00	-0.39	0.54	-0.72	0.48	-1.48	0.70
4.30	-0.61	0.57	-1.06	0.29	-1.77	0.55
4.60	-0.83	0.61	-1.36	0.18	-2.07	0.40
4.90	-1.06	0.66	-1.60	0.12	-2.39	0.27
5.20	-1.28	0.71	-1.79	0.08	-2.71	0.16
5.50	-1.50	0.77	-1.95	0.06	-3.05	0.05
5.64	-1.60	0.80	-2.01	0.05	-3.21	0.00
5.80	-1.72	0.83	-2.08	0.04	**-3.39**	**-0.05**
6.10	-1.95	0.89	-2.18	0.03	**-3.74**	**-0.15**
6.40	-2.17	0.96	-2.27	0.03	**-4.09**	**-0.24**
6.70	-2.39	1.02	-2.34	0.02	**-4.45**	**-0.33**
7.00	-2.61	1.09	-2.40	0.02	**-4.81**	**-0.42**

Note. Bolded values illustrate significance.

Figure 2

Portion Preference



CHAPTER IV

DISCUSSION

Before this study, disgust and its behavioral consequences had not been studied in the emotional dampening literature in general or as related to eating. Generally, it was expected that emotional dampeners would be less sensitive to threat in the environment, therefore increasing engagement in approach behavior when presented with a threatening environment (McCubbin et al., 2020). This project explored differences between emotional dampeners and non-emotional dampeners in degree of contamination disgust following soiled stimulus exposure as well as differences between the groups in adaptive avoidance following soiled stimulus exposure. Specifically, this project addressed these two main intentions by exploring three hypotheses. First, the high emotionality group would, on average, report higher levels of disgust than the low-emotionality group, even after controlling for trait disgust. Second, the high emotionality group would, on average, report being less likely to eat within the next hour after completing the disgust paradigm, even after controlling for self-reported pre-disgust levels of hunger. Third, the high emotionality group would, on average, select a smaller portion of cake following the disgust paradigm, even after controlling for self-reported pre-disgust levels of hunger.

First, it was hypothesized that the high emotionality group would, on average, report higher levels of disgust than the low-emotionality group, even after controlling for trait disgust. image ratings between groups were similar. Differences were not found between emotional dampeners and non-emotional dampeners in degree of

contamination disgust following soiled stimulus exposure. Therefore, support was not found for the first hypothesis of this study.

The findings associated with the first hypothesis suggest IAPS image ratings are similar regardless of emotionality group (IAPS; Lang et al., 2008). This study, therefore, provides support that IAPS image ratings in both neutral and contamination categories are similar regardless of emotionality group. Though support has been found in the literature for generalization inhibition effects (Nyklíček et al., 2001; McCubbin et al., 2011; Shukla, 2017; Shukla et al., 2018a; Shukla et al., 2020), the results of this suggest that limits do exist for said effects when in the context of visual appraisal of emotionally evocative stimuli (i.e., contamination stimulus rating).

Second, it was hypothesized that the high emotionality group would, on average, report being less likely to eat within the next hour after completing the disgust paradigm, even after controlling for self-reported pre-disgust levels of hunger. Support was found for this hypothesis as the groups differed in the predicted direction. Specifically, those who reported high levels of pre-hunger and were in the low-worry group reported higher likelihood to eat within the next hour after exposure to soiled stimulus. Therefore, a difference was found between emotional dampeners and non-emotional dampeners in adaptive avoidance following soiled stimulus exposure.

Third, it was hypothesized that the high emotionality group would, on average, select a smaller portion of cake they would like to eat following the disgust paradigm. Support was found for this hypothesis as the groups differed in the predicted direction. Specifically, those who reported high levels of pre-hunger and were in the low-worry

group selected significantly larger portions when presented with a food stimulus after exposure to soiled stimulus. Therefore, another difference was found between emotional dampeners and non-emotional dampeners in adaptive avoidance following soiled stimulus exposure.

The support found for the second and third hypothesis of this study reflect similar findings in the literature related to eating behavior, contamination disgust, and blunted emotional reactions, as well as behavioral consequences and risk engagement. The results of these hypotheses reflect that of related studies suggesting that emotional reactivity could have a relationship with eating behavior (Dess & Chapman, 1990; Dess & Minor, 1996; Egolf et al., 2018; Herbert et al., 2014). This study found similar results in that, emotional dampeners are more likely to consume when hungry after being exposed to a disgusting stimulus, suggesting that emotional reactivity does have a relationship with eating behavior. The suggested relationship with emotional reactivity and behavior reflects similar results from other contamination disgust studies (McCubbin et al., 2011; Olatunji et al., 2014; Curtis & Barra, 2018). Those belonging to the low-emotionality group who reported higher pre-hunger levels rated themselves as more likely to consume than other participants. This is consistent with research suggesting that contamination disgust sensitivity can predict behavior (Olatunji et al., 2014).

The results of these analyses also reflect findings that emotional dampeners are less sensitive to disgust (Shukla et al., 2020). Blunted responses to emotional cueing have been hypothesized to aid in controlling the effects of intense emotions, like

disgust, and could be a significant contributor in involuntary blood pressure elevation. The results of these hypothesis reflect this potential relationship in that when in a threatening environment, those in the low-emotionality group, if hungry, had higher consumption-likelihood ratings, supporting other studies suggesting that emotional dampeners are less sensitive to disgust (e.g., McCubbin et al., 2011; Shukla et al., 2020).

The results of these analyses also reflect predictions that cardiovascular emotional dampening has both short- and long-term implications for human functioning (McCubbin et al., 2020), and that emotional dampening can hold consequences for one's health from engaging in more extreme, risky behaviors (Loveless et al., 2018; McCubbin et al., 2018; McCubbin et al., 2020). Health and wellness implications of these individuals such as higher blood pressure are present as they might engage in more excessive or extreme appetitive behaviors to experience reinforcement, such as consuming sooner and consuming larger portion sizes. This study found that emotional dampeners reporting high pre-hunger levels are more likely to engage in risk via consumption when faced with a threatening environment. Reflecting earlier studies, the results of this hypothesis demonstrate cascading effects on blood pressure which reinforce the effects of emotional dampening via consumption likelihood.

In summary, differences were not found between emotional dampeners and non-emotional dampeners in degree of contamination disgust following soiled stimulus exposure, not supporting the first hypothesis. Support was not found for the first hypothesis of this study. However, support was found for the second and third hypotheses of the study in that a difference was found between emotional dampeners

and non-emotional dampeners in adaptive avoidance following soiled stimulus exposure. Additionally, support was found for the third hypothesis of this study in that a difference was found between emotional dampeners and non-emotional dampeners in adaptive avoidance following soiled stimulus exposure. In both instances, low- worriers with high levels of pre-hunger indicated higher engagement in approach behaviors compared to the other groups.

Limitations to this study include constraints in methods due to Covid-19 restrictions. Due to these restrictions, measurements requiring physical attendance could not be obtained. For example, physical foodstuffs could not be provided. Therefore, measurements of consumed foodstuffs could not be obtained. Additionally, psychophysiological measurements could not be obtained (i.e., blood pressure; heart rate variability), so physiologic confirmation of worry group status could not be provided.

Future studies could largely benefit from expanding in both physical and participant domains. Some suggestions for expanding in the physical domain include the addition of foodstuffs, psychophysiological measurements, and alternative disgusting stimuli (i.e., disgusting tactile, olfactory, or gustatory stimuli) as well as further exploring the degree to which these findings might generalize to other behaviors beyond eating (i.e., personal grooming, hand washing, etc.). In the participant domain, some suggestions for further research include collecting more information regarding participant environment such as hygiene, trauma, and food availability. Additionally,

suggestions for collecting participant information in the future include the addition of male participants, eating disorder questionnaires and measures of executive function.

After exposure to soiled food stimulus, different flavors and textures of foodstuff (ex. crunchy, soft, etc.) could be provided for consumption and measured (ex. weight, calories). Taste accuracy and preference could also be explored. Additionally, psychophysiological measurements such as heart-rate variability, blood pressure, and baroreflex could be collected. Including these measures would provide psychophysiological data related to cardiovascular emotional dampening, providing additional data to confirm worry group status. Additionally, a physical disgust stimulus is recommended for inclusion in future studies. Because the degree of disgust experienced has been proposed to be related to the intimacy of disgust stimuli (Angyal, 1941), it is recommended that future studies include physical disgust stimuli to further explore how disgust varies between individuals in a physical setting.

Another recommendation for future research is to further explore what degree generalization effects transfer to the other senses, such as taste, smell, and sight (Shukla, 2017; Shukla et al., 2018a). Future research could also explore differences in taste preference after being exposed to soiled stimuli, reflecting work done in previous studies (Herbert et al., 2014). Differences in taste accuracy could also be explored.

Further studies could also explore different aspects of participant environment such as trauma exposure, food availability, and hygiene. Because disgust responds accordingly to environmental demand, it is possible that participants who engage in risk taking behaviors could be exposed to threatening environments, decreasing both

disgust sensitivity and the ability to accurately assess risk (Borg & Jong, 2012; Fleischman et al., 2015; Hoefling et al., 2009; Lee et al., 2014; Curtis & Barra, 2018). Low food availability is a pertinent example of something that can decrease disgust sensitivity and the ability to accurately assess risk, potentially effecting consumption-likelihood and portion selection. Therefore, future studies could benefit from including measures of food availability since disgust sensitivity varies based on consequences in the environment (Borg & Jong, 2012; Fleischman et al., 2015; Goldenberg et al., 2001; Hoefling et al., 2009; Lee et al., 2014). Future studies could collect information on participant hygiene behaviors such as environmental hygiene, (ex. home cleanliness, non-contaminating cooking practices, cleaning frequency) personal hygiene (ex. bathing, teeth brushing, handwashing) and social hygiene (ex. mask wearing, vaccination status, covering a cough).

Further studies could also include the addition of male participants, eating disorder questionnaires, and measures of executive function. Because cardiovascular emotional dampening varies between men and woman and because there have been sex differences found in risk taking behaviors (McCubbin et al., 2020), data from male participants could be useful to further demonstrate individual differences in risk taking behaviors after exposure to soiled stimuli and the relationship to emotional dampening status. The addition of an eating disorder questionnaire could also benefit future studies by providing data to examination individual differences in disgust, emotional dampening, and consumption. Additionally, because higher levels of resting heart-rate variability are associated with higher performance on tasks utilizing executive functions

(Thayer et al., 2012; McCubbin et al., 2011), including measures of executive functions is recommended for inclusion in future studies.

Conclusions

Before this study, disgust and its behavioral consequences had not been studied in the emotional dampening literature in general as well as related to eating. From exploring this gap in the literature, it was found that low-worriers with high levels of pre-hunger indicated higher engagement in approach behaviors when compared to high worriers. From this conclusion, this study found support for differences between emotional dampeners and non-emotional dampeners in approach behaviors and adaptive avoidance, as well as support for the reinforcing effects of emotional dampening. This study supports that emotional dampeners are less sensitive to threat in the environment, therefore increasing engagement in approach behavior when presented with a threatening environment. Specifically, this study demonstrated differences between emotional dampeners and non-emotional dampeners in adaptive avoidance following soiled stimulus exposure in that low-worriers with high levels of pre-hunger indicated higher consumption likelihood when compared to the other groups. This also demonstrates one of the possible cascading effects that emotional dampening could have on blood pressure, which also reinforces effects of emotional dampening through consumption likelihood.

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APPENDICES

APPENDIX A: INFORMED CONSENT

Information and Disclosure Section

The following information is provided to inform you about the research project in which you have been invited to participate. Please read this disclosure and feel free to ask any questions. The investigators must answer all of your questions and please save this page as a PDF for future reference.

- Your participation in this research study is voluntary.
- You are also free to withdraw from this study at any time without loss of any benefits.

For additional information on your rights as a participant in this study, please contact the Middle Tennessee State University (MTSU) Office of Compliance (Tel 615-494-8918 or send your emails to irb_information@mtsu.edu. (URL: http://www.mtsu.edu/irb).

Please read the following and respond to the consent questions in the bottom if you wish to enroll in this study.

1. **Purpose**: The present study is an exploration of the influence of emotional awareness on projected future eating behavior.
.
2. **Description**: Participation is open to women who at least 18 years of age or older, are healthy, and have no history of cardiovascular, endocrinological, or psychiatric illness. Qualified and consenting participants will complete some surveys, and then undergo an emotion rating task wherein they will be shown a series of pictures and then will be asked self-rate their responses to said pictures. The study will then conclude with the answering of a few more questions followed by the presentation of a debriefing statement.

3. **IRB Approval Details**

Protocol Title: Cardiovascular Emotional Dampening, Disgust, and Consumption-Likelihood

- Primary Investigator: Katherine Hitchcock
- PI Department & College: Psychology; College of Behavioral and Health Sciences.
- Faculty Advisor (if PI is a student): Dr. James Loveless
- Protocol ID: 21-1175 2q_ Approval Date: 05/14/2021 Expiration Date: _06/30/2022___

4. **Duration**: This study is expected to take approximately 30 minutes to complete.

5. **Here are your rights as a participant:**

- Your participation in this research is voluntary.
- You may skip any item that you don't want to answer, and you may stop the experiment at any time.

- If an item has been left blank you will be notified. If you intend to leave your response blank, you may click past this reminder.

6. **Risks & Discomforts:** This study features images that may elicit negative emotional reactions from participants; however, it has been determined that the intensity of these reactions should be no greater than what is experienced in day-to-day life.

7. **Benefits:**
    a. Benefits to you that you: There are no direct benefits to you
    b. Benefits to the field of science or the community: Your participation will help contribute to a better understanding of the potential influence of emotional awareness on eating behavior.

8. **Identifiable Information**: You will NOT be asked to provide identifiable personal information

9. **Compensation: There is no cash compensation.** Nonetheless, the participants may enter into gift card raffles. The value of the gift cards are between $25(2) and $50(1). The eligibility criteria are given below:

    Compensation Requirements:
    a) The qualifications to participate in this research are: being at least 18 years of age, female, and free of current cardiovascular, endocrine, or psychiatric diagnosis. *If you do not meet these qualifications, you will not be included in the research and you will not be compensated.*
    b) After you complete this consent form you will answer screening questions. If you fail to qualify for the research based on these questions, the research will end and you will not be compensated.
    c) Please do not participate in this research more than once. Multiple attempts to participate will not be compensated.

10. **Confidentiality.** All efforts, within reason, will be made to keep your personal information private but total privacy cannot be promised. Your information may be shared with MTSU or the government, such as the Middle Tennessee State University Institutional Review Board, Federal Government Office for Human Research Protections, *if* you or someone else is in danger, or if we are required to do so by law.

11. **Contact Information.** If you should have any questions or concerns about this research study, please feel free to contact Katherine Hitchcock by telephone 931-205-3530 or by email keh5m@mtmail.mtsu.edu OR my faculty advisor, Dr. James Loveless, by telephone at 615-898-5388 or by email at james.loveless@mtsu.edu. You may also contact the MTSU Office of compliance via telephone (615 494 8918) or by email (compliance@mtsu.edu). This contact information will be presented again at the end of the experiment.

You are not required to do anything further if you decide not to enroll in this study. Just quit your browser. Please complete the response section below if you wish to learn more or you wish to part take in this study.

Participant Response Section

☐No ☐Yes I have read this informed consent document pertaining to the above identified research
☐No ☐Yes The research procedures to be conducted are clear to me
☐No ☐Yes I confirm I am 18 years or older
☐No ☐Yes I am aware of the potential risks of the study

By clicking below, I affirm that I freely and voluntarily choose to participate in this study. I understand I can withdraw from this study at any time without facing any consequences.

☐ NO I do not consent
☐ Yes I consent

Information and Disclosure Section

The following information is provided to inform you about the research project in which you have been invited to participate. Please read this disclosure and feel free to ask any questions. The investigators must answer all of your questions and please save this page as a PDF for future reference.

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- You are also free to withdraw from this study at any time without loss of any benefits.

For additional information on your rights as a participant in this study, please contact the Middle Tennessee State University (MTSU) Office of Compliance (Tel 615-494-8918 or send your emails to irb_information@mtsu.edu. (URL: http://www.mtsu.edu/irb).

Please read the following and respond to the consent questions in the bottom if you wish to enroll in this study.

12. **Purpose**: The present study is an exploration of the influence of emotional awareness on projected future eating behavior.
    .
13. **Description**: Participation is open to women who at least 18 years of age or older, are healthy, and have no history of cardiovascular, endocrinological, or psychiatric illness. Qualified and consenting participants will complete some surveys, and then undergo an emotion rating task wherein they will be shown a series of pictures and then will be asked self-rate their responses to said pictures. The study will then conclude with the answering of a few more questions followed by the presentation of a debriefing statement.

14. **IRB Approval Details**
    Protocol Title: Cardiovascular Emotional Dampening, Disgust, and Consumption-Likelihood
    - Primary Investigator: Katherine Hitchcock
    - PI Department & College: Psychology; College of Behavioral and Health Sciences.
    - Faculty Advisor (if PI is a student): Dr. James Loveless
    - Protocol ID: 21-1175 2q_ Approval Date: 05/14/2021 Expiration Date: _06/30/2022___

15. **Duration**: This study is expected to take approximately 30 minutes to complete.

16. **Here are your rights as a participant:**

    - Your participation in this research is voluntary.
    - You may skip any item that you don't want to answer, and you may stop the experiment at any time.
    - If an item has been left blank you will be notified. If you intend to leave your response blank, you may click past this reminder.

17. **Risks & Discomforts:** This study features images that may elicit negative emotional reactions from participants; however, it has been determined that the intensity of these reactions should be no greater than what is experienced in day-to-day life.

18. **Benefits:**
    a. Benefits to you: here are no direct benefits to you
    b. Benefits to the field of science or the community: Your participation will help contribute to a better understanding of the potential influence of emotional awareness on eating behavior.

19. **Identifiable Information**: You will NOT be asked to provide identifiable personal information

20. **Compensation: There is no financial compensation. Nonetheless, students enrolled in the MTSU SONA system will receive course one (1) course credit per 30 minutes of participation. Refer below for eligibility requirements.**

    Compensation Requirements:
    d) The qualifications to participate in this research are: being at least 18 years of age, female, and free of current cardiovascular, endocrine, or psychiatric diagnosis. *If you do not meet these qualifications, you will not be included in the research and you will not be compensated.*
    e) After you complete this consent form you will answer screening questions. If you fail to qualify for the research based on these questions, the research will end and you will not be compensated.
    f) Please do not participate in this research more than once. Multiple attempts to participate will not be compensated.

21. **Confidentiality.** All efforts, within reason, will be made to keep your personal information private but total privacy cannot be promised. Your information may be shared with MTSU or the government, such as the Middle Tennessee State University Institutional Review Board, Federal Government Office for Human Research Protections, *if* you or someone else is in danger, or if we are required to do so by law.

22. **Contact Information.** If you should have any questions or concerns about this research study, please feel free to contact Katherine Hitchcock by telephone 931-205-3530 or by email keh5m@mtmail.mtsu.edu OR my faculty advisor, Dr. James Loveless, by telephone at 615-898-5388 or by email at james.loveless@mtsu.edu. You may also contact the MTSU Office of compliance via telephone (615 494 8918) or by email (compliance@mtsu.edu). This contact information will be presented again at the end of the experiment.

You are not required to do anything further if you decide not to enroll in this study. Just quit your browser. Please complete the response section below if you wish to learn more or you wish to part take in this study.

Participant Response Section

☐No ☐Yes I have read this informed consent document pertaining to the above identified research
☐No ☐Yes The research procedures to be conducted are clear to me
☐No ☐Yes I confirm I am 18 years or older
☐No ☐Yes I am aware of the potential risks of the study

By clicking below, I affirm that I freely and voluntarily choose to participate in this study. I understand I can withdraw from this study at any time without facing any consequences.

☐ NO I do not consent
☐ Yes I consent

APPENDIX B: IRB APPROVAL PAGE

IRB
INSTITUTIONAL REVIEW BOARD
Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129
FWA: 00005331/IRB Regn.: 0003571

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN007 – EXEMPTION DETERMINATION NOTICE

Friday, May 14, 2021

Protocol Title	***Cardiocascular Emotional-Dampening Disgust, and Consumption-Likelihood***
Protocol ID	**21-1175 2q**
Principal Investigator	**Katherine Hitchcock** (Student)
Faculty Advisor	James Loveless
Co-Investigators	NONE
Investigator Email(s)	*keh5m@mtmail.mtsu.edu; james.loveless@mtsu.edu*
Department/Affiliation	Psychology

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXEMPT** review mechanism under 45 CFR 46.101(b)(2) within the research category ***(2) Educational Tests, surveys, interviews or observations of public behavior*** *(Qualtrics Survey)*. A summary of the IRB action and other particulars of this protocol are shown below:

IRB Action	**EXEMPT from further IRB Review** Exempt from further continuing review but other oversight requirements apply		
Date of Expiration	6/30/2022	*Date of Approval:* **4/14/21**	*Recent Amendment:* NONE
Sample Size	One Hundred and Fifty (150)		
Participant Pool	**Healthy adults (18 or older) - (1) with current cardiovascular, endocrine, or psychiatric diagnoses; and (2) MTSU SONA**		
Exceptions	Online consent followed by internet-based survey using Qualtrics is permitted (Qualtrics links on file).		
Type of Interaction	☒ Non-interventional or Data Analysis ☐ Virtual/Remote/Online Interview/survey ☐ In person or physical– Mandatory COVID-19 Management (refer next page)		
Mandatory Restrictions	**1. All restrictions for exemption apply.** **2. The participants must be 18 years or older.** **3. Mandatory ACTIVE informed consent. Identifiable information including, names, addresses, voice/video data, must not be obtained.** **4. NOT approved for in-person data collection.**		
Approved IRB Templates	*IRB Templates:* Online Informed Consent and IRB Flyer *Non-MTSU Templates:* Recruitment Email		
Research Inducement	Course Credit (MTSU SONA) and Gift Raffle (others)		
Comments	NONE		

Summary of the Post-approval Requirements: The PI and FA must read and abide by the post-approval conditions (Refer "*Quick Links*" in the bottom):

- ***Final Report:*** The Faculty Advisor (FA) is responsible for submitting a final report to close-out this protocol before 6/30/2022; if more time is needed to complete the data collection, the FA must request an extension by email. REMINDERS WILL NOT BE SENT. **Failure to close-out (or request extension) may result in penalties** including cancellation of the data collected using this protocol or withholding student diploma.
- ***Protocol Amendments***: IRB approval must be obtained for all types of amendments, such as:
  - Addition/removal of subject population and sample size.
  - Change in investigators.
  - Changes to the research sites – appropriate permission letter(s) from may be needed.
  - Alternation to funding.
  - Amendments must be clearly described in an addendum request form submitted by the FA.
  - The proposed change must be consistent with the approved protocol and they must comply with exemption requirements.
- ***Reporting Adverse Events:*** Research-related injuries to the participants and other events , such as, deviations & misconduct, must be reported within 48 hours of such events to compliance@mtsu.edu.
- ***Research Participant Compensation:*** Compensation for research participation must be awarded as proposed in Chapter 6 of the Exempt protocol. The documentation of the monetary compensation must Appendix J and MUST NOT include protocol details when reporting to the MTSU Business Office.
- ***COVID-19:*** Regardless whether this study poses a threat to the participants or not, refer to the COVID-19 Management section for important information for the FA.

COVID-19 Management:
The FA must enforce social distancing guidelines and other practices to avoid viral exposure to the participants and other workers when physical contact with the subjects is made during the study.

- The study must be stopped if a participant or an investigator should test positive for COVID-19 within 14 days of the research interaction. This must be reported to the IRB as an "adverse event."
- The FA must enforce the MTSU's "Return-to-work" questionnaire found in Pipeline must be filled and signed by the investigators on the day of the research interaction prior to physical contact.
- PPE must be worn if the participant would be within 6 feet from the each other or with an investigator.
- Physical surfaces that will come in contact with the participants must be sanitized between use
- **FA's Responsibility:** The FA is given the administrative authority to make emergency changes to protect the wellbeing of the participants and student researchers during the COVID-19 pandemic. However, the FA must notify the IRB after such changes have been made. The IRB will audit the changes at a later date and the PI will be instructed to carryout remedial measures if needed.

Post-approval Protocol Amendments:
The current MTSU IRB policies allow the investigators to implement minor and significant amendments that would not result in the cancellation of the protocol's eligibility for exemption. ***Only THREE procedural amendments will be entertained per year*** *(changes like addition/removal of research personnel are not restricted by this rule).*

Date	Amendment(s)	IRB Comments
NONE	NONE.	NONE

Post-approval IRB Actions:
The following actions are done subsequent to the approval of this protocol on request by the PI or on recommendation by the IRB or by both.

Date	IRB Action(s)	IRB Comments
NONE	NONE.	NONE

Mandatory Data Storage Requirement:
All research-related records (signed consent forms, investigator training and etc.) must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data must be stored for at least three (3) years after the study is closed. Additionally, the Tennessee

State data retention requirement may apply (*refer "Quick Links" below for policy 129*). Subsequently, the data may be destroyed in a manner that maintains confidentiality and anonymity of the research subjects. **The IRB reserves the right to modify/update the approval criteria or change/cancel the terms listed in this notice**. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:

- Post-approval Responsibilities: http://www.mtsu.edu/irb/FAQ/PostApprovalResponsibilities.php
- Exemption Procedures: https://mtsu.edu/irb/ExemptPaperWork.php
- MTSU Policy 129: Records retention & Disposal: https://www.mtsu.edu/policies/general/129.php

APPENDIX C: SCREENING QUESTIONS

To your knowledge, have you ever been diagnosed with a psychiatric issue (e.g,, depression, anxiety, ADD, ADHD, etc.) by a licensed health care professional?

- Yes
- No

To your knowledge, have you ever been diagnosed with an endocrine issue (e.g., diabetes, thyroid disease, etc.) by a licensed health care professional?

- Yes
- No

To your knowledge, have you ever been diagnosed with a cardiovascular issue (e.g., high blood pressure, arrhythmia, or some other heart problem) by a licensed health care professional?

- Yes
- No

Are you **currently** taking any of these types of medications (select all that may apply):

- Depression/mood meds: Zoloft, Paxil, Celexa, etc.
- Anti-anxiety meds: Xanax, Ativan, Klonopin, etc.
- Attention meds: Adderall, Vyvanse, Ritalin, etc.
- Endocrine meds: Synthroid, Insulin, Metformin, etc.
- Heart meds: Lisinopril, Losartan, Metoprolol, etc.
- I am not currently taking any of these types of medications

APPENDIX D: DEMOGRAPHIC QUESTIONS

What was your biological sex at birth?

- Male
- Female
- Intersex

What is your age?

Choose the race that you consider yourself to be:

- White
- Black or African American
- Hispanic
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Pacific Islander
- Mixed race
- Other
- Prefer not to say

Do you **currently** use any of the tobacco or nicotine products list below (select all that may apply)?

- Cigarettes
- Chewing tobacco
- Cigars
- Vaping devices (e.g., Juul)
- I do not use any tobacco products

APPENDIX E: VALIDITY QUESTIONS

What is 4 x 7?

- 32
- 24
- 28
- 11

True of false: Trees are animals?

- True
- False