Emotional Plasticity Theory: Preliminary Evaluation of Changes in Stress-related Variables in Obese Adults

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Abstract

Emotional Plasticity Theory (EPT) postulates that training individuals on brain-based self-regulatory techniques improves stress-related outcomes. The overarching approach of EPT has not been formally studied, and the purpose of the sequential mixed methods study was to provide an initial evaluation of EPT mediators to determine how a theory-based intervention impacts self-regulation and stress-related variable in obese adults. First, archival quantitative data (N=33) based on a random assignment, wait list controlled clinical trial were analyzed. Second, primary qualitative data using an open-ended survey of intervention facilitators were analyzed. Participation in the intervention was associated with improvements in all stress-related all stress-related: perceived stress (p=.0005), depression (p=.0005), positive affect (p=.003), negative affect (p=.004), self-efficacy (p=.019) and food dependence (p=.012); BMI improved significantly (p=.012), and blood pressure changes were not significant, but trends were consistent with theory. In contrast, changes in self-regulation were not significant. Qualitative themes confirmed changes in stress-related variables, but suggested that changes in self-regulation were associated with participation in the intervention, however, current constructs of adaptive self-regulation may not be consistent with emerging understandings of emotional plasticity. Participation in the theory-based intervention was associated with a broad range of adaptive changed in stress-related variables, consistent with EPT. The established measures of self-regulation not provide sufficient construct validity to assess self-regulation based on the neuroscience concepts and tools of the intervention. Development of n theory-based measure of self-regulation is warranted, and further research, to replicate these findings is indicated.

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Chapter 1: Introduction

Failure of self-regulation contributes significantly to most stress-related health problems in humans (Baumeister, Vohs, DeWall, & Zhang, 2007). Emotional Plasticity Theory (EPT) postulates that all creatures have survival drives that are encoded in emotional memory to promote adaptive self-regulation and survival (Mitrovic, Fish dePena, Frassetto, & Mellin, 2011; Mitrovic, Mellin, & Fish dePena, 2008). That circuitry may be effective, promoting self-regulatory success or ineffective, causing self-regulatory failure. Applying interventions that are directed at encoding adaptive neuroplasticity of these self-regulatory circuits may offer a promising approach for prevention and treatment of stress-related health conditions.

EPT emerged from an integration of theories, that although diverse share core concepts. These theories are evolutionary biology (Darwin & Huxley, 2003), allostatic load (Juster, McEwen, & Lupien, 2010; McEwen, 1998; Seeman, Epel, Gruenewald, Karlamangla, & McEwen, 2010; Seeman, McEwen, Rowe, & Singer, 2001), affective neuroscience (Davidson, 2003; Garland et al., 2010; Gross, 2009), and attachment (Bowlby, 1988; Calkins, 2010). EPT represents a new paradigm in health care in which there is less emphasis on the stress-related symptoms associated with the failure of self-regulation (Djuric et al., 2008; Hampson, Goldberg, Vogt, Hillier, & Dubanoski, 2009; Juster et al., 2010) and more attention to self-directed positive emotional plasticity of neuronal circuitry. By intervening to rewire the stress response for adaptive self-regulation, the frequency and duration of the allostasis (Juster et al., 2010; Koob, 2009; Koob & Volkow, 2010; Seeman et al., 2010) and stress-related increase in allostatic load (Danese & McEwen, 2012; Juster et al., 2011; McEwen & Gianaros, 2011; McEwen & Tucker, 2011; Seeman et al., 2010), the cumulative effect of episodes of stress on the

body, the root cause of many health problems could be beneficially impacted. By addressing the root cause, vulnerability to the onset, exacerbation, or prolongation of biological and psychological pathologies could decrease (Karatsoreos & McEwen, 2011; McEwen & Gianaros, 2011).

This chapter introduces a sequential mixed methods study that is an initial evaluation of the mediators of EPT to influence symptoms of the failure of self-regulation, specifically, stress-related psychological and physiological measures in a sample of obese adults. The chapter begins with an overview of the core concepts of EPT and the history of the development of an intervention that is based on this theory. The research problem is identified as the need for an initial formal study of the overarching foundation of EPT, that adaptive neuroplasticity of the self-regulatory circuitry that constitutes the basis for the emotional, cognitive, and behavioral responses of the individual to the psychological, metabolic, and physical stressors of daily life results in broad-spectrum changes in psychological constructs and biomarkers. The purpose, design, theory, and significance of the study are then reviewed; then, the research questions, the hypotheses of the quantitative component of the research, and the research strategy of the qualitative component of the study are presented. Finally, the chapter concludes with definitions of key terms, and a summary of the investigation.

Background

Self-regulation is the conscious and nonconscious control of behavioral and physiological mechanisms of the individual (Baumeister et al., 2007) to increase the frequency and duration of homeostasis. Homeostatic states are associated with optimal health and happiness (Damasio, 2003; McEwen & Wingfield, 2010). Nearly every major

personal and social problem affecting large numbers of modern citizens involves some kind of failure of self-regulation (Baumeister et al., 2007). The stressors that challenge self-regulatory process may be primarily psychological, the brain's response to the perception that the environmental demands tax or exceed the ability to cope (Cohen, Janicki-Deverts, & Miller, 2007). Episodes of stress that are repeated or prolonged strain most physiological systems, resulting in increased risk for physical and psychiatric disorders (Cohen et al., 2007; Cohen, Kessler, & Gordon, 1995; Kalia, 2002; Lecrubier, 2001; Murray & Lopez, 1996).

Stress has been shown to be a contributory cause of many health problems (Del Giudice, Ellis, & Shirtcliff, 2010; Fehm, Kern, & Peters, 2006; Ganzel, Morris, & Wethington, 2010; Kopp, 1989; Kopp & Rethelyi, 2004; McEwen, 2000; Romero, Dickens, & Cyr, 2009; Selye, 1976; Sterling & Eyer, 1988). Depression (Risch et al., 2009), anxiety (Britton, Lissek, Grillon, Norcross, & Pine, 2011; McEwen, Eiland, Hunter, & Miller, 2012), heart disease (Grant, Hamer, & Steptoe, 2009; Hamer & Malan, 2010), addictions (Edwards & Koob, 2010; Koob & Kreek, 2007; Koob, 2008; Lenoir, Guillem, Koob, & Ahmed, 2011; Uhart & Wand, 2009), and obesity (Allison et al., 2009; Dallman, 2010; Dong et al., 2004; Francis & Susman, 2009; Kivimaki et al., 2006; Krantz & McCeney, 2002; Li, Hansen, Mortensen, & Olsen, 2002; Mietus-Snyder & Lustig, 2008; Rozanski, Blumenthal, & Kaplan, 1999; Whitaker & Gooze, 2009) are all stress-related. Stress-related problems account for as much as 75–90% of primary care office visits (Stress in America, 2004).

When considering approaches to stress-related health problems, increasingly, attention has turned to the brain, the chief organ of stress and adaptation to stress, and the

potential to change the self-regulatory circuitry (Davidson, 2005; Koob & Volkow, 2010; McEwen, 2009; McEwen et al., 2011; Pittenger & Duman, 2008; Schiller, Cain et al., 2008; Schiller et al., 2010; Schiller & Phelps, 2011). Emotional Plasticity Theory (EPT) is based on this emerging appreciation of emotional plasticity, integrating evidence in the fields of evolutionary biology, stress physiology, affective neuroscience, attachment theory, and neuroplasticity (Mitrovic et al., 2011; Mitrovic et al., 2008), and will serve as the theoretical framework for the study.

The postulates of EBT involve interventions of change circuitry, including the circuits encoded in the least plastic areas of the brain early in life and during trauma later in life. The claim is that these circuits are modifiable by the use of mental techniques that mirror the convergence of these bodies of literature in evolutionary biology (Darwin & Huxley, 2003), stress physiology (Juster et al., 2010; McEwen, 1998; Seeman et al., 2010; Seeman et al., 2001), affective neuroscience (Davidson, 2003; Garland et al., 2010; Gross, 2009), attachment (Bowlby, 1988; Calkins, 2010) and neuroplasticity (Davidson, 2005; Davidson & McEwen, 2012; Pittenger & Duman, 2008). Evolution provides a unifying biological rationale for self-regulatory processes that are central to survival of the species, including the dyadic-regulation associated with secure attachment (Coan, 2008; Sbarra & Hazan, 2008; Silva, Soares, & Esteves, 2012), the neurophysiology of self-regulatory processing (Anda et al., 2006; Heatherton & Wagner, 2011; Perry & Hambrick, 2008), the complex relationship between stress and reward (Koob, 2009; Garland et al., 2010), and the salience of stress on low plastic circuits encoded early in life and during trauma (Anda, 2006; LeDoux, 2012b). The innately encoded survival memories (LeDoux, 2012b), which are expressed involuntarily, could be recruited by the

use-dependent brain (Anda et al., 2006; Perry & Azad, 1999; Schwarz & Perry, 1994) that changes in response to experience, to promote maladaptive stress responses that may contribute to the development, exacerbation, or prolongation of symptoms of dysregulation (Mitrovic et al., 2011; Mitrovic et al., 2008).

EPT was focused on changes to the self-regulatory circuits that constituted the basis for individual self-control, the prospect of increasing strength and dominance of adaptive circuits, and decreasing the strength and dominance of maladaptive states (Mitrovic et al., 2011; Mitrovic et al., 2008). Sustained physiologic state changes promote adaptive psychological, social, behavioral, cognitive, and physiological outcomes and thereby, improve stress-related morbidities (Mitrovic et al., 2011; Mitrovic et al., 2008).

Emotional Brain Training. An application of EPT, known as emotional brain training (EBT), which was developed at the University of California, San Francisco School of Medicine over the last 30 years, has been a widely used intervention (Mellin, 2011a). This theory-based intervention is a treatment for stress-related conditions via treatment of the self-regulatory neuronal circuitry through self-directed neuroplasticity (Mitrovic et al., 2011), which has been shown to improve stress-related outcomes (Mellin, Croughan, & Dickey, 1997; Mellin, Slinkard, & Irwin, 1987; Simon, Duncan, Huggins, Solkowitz, & Carmody, 2009). The EBT intervention has differed from other self-regulatory theories (Carver & Scheier, 1998; Kopp, 1989; Rasmussen, Wrosch, Scheier, & Carver, 2006; Williams et al., 2008) in that the tools were hypothesized to mirror the dyadic attunement of secure attachment (Ainsworth, 1974; Bowlby, 1988; Calkins, 2010; Schore, 2000) and evolutionarily-based brain physiology (Anda et al.,

2006; Perry & Azad, 1999; Schwarz & Perry, 1994) to promote the active change of brain state from the range of physiologic states of stress and affect to a state of low stress arousal and positive affect.

EBT differs from other contextual methods, such as mindfulness therapies (Kabat-Zinn, 1994; Segal, Williams, & Teasdale, 2002; Witkiewitz & Bowen, 2010) and dialectic behavior therapy (Linehan, 1993), as it involves adaptive use of adventitious episodes of stress and intentionally activated incidents to reconsolidate memories from trauma (Mitrovic et al., 2011; Mitrovic et al., 2008). This difference may have been particularly salient, as researchers have shown that neural reconsolidation of maladaptive circuits only occurs during episodes of intense emotion (Butler et al., 2007; Delgado, Jou, Ledoux, & Phelps, 2009; Schiller et al., 2010; Schwartz, Stoessel, Baxter, Martin, & Phelps, 1996). Researchers have shown that this maladaptive circuitry to promote chronic stress and addiction (Edwards & Koob, 2010; Ganzel et al., 2010; Koob & Volkow, 2010). If self-directed plasticity of these maladaptive circuits occurs as postulated in EPT, participation in a theory-related intervention would be expected to effect adaptive change in both psychological constructs and biomarkers associated with stress.

Adaptive changes in these maladaptive circuits that promote chronic stress and stress-related maladaptive emotions, thoughts and behaviors would be expected to adaptively modify stress-related biomarkers and psychological constructs. Specific mediators associated with adaptive physiologic state and effective self-regulation have included: (a) mindfulness, the observing, describing, acting with awareness, nonjudging of inner experience and nonreactivity to inner experience (Baer, Smith, Hopkins,

Kristemeyer, & Toney, 2006); (b) emotion regulation, the conscious and nonconscious use of strategies to regulate emotions in order to decrease negative emotions and increase positive emotions (Gross & Thompson, 2007); (c) depression, the most common psychological problem worldwide (Sartorius, Ustun, Lecrubier, & Wittchen, 1996); (d) positive and negative effects, which are two primary facets of mood, explaining much of the variance in specific types of affects, such as depression (McDowell, 2006); and (e) self-efficacy, beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands (Gist & Mitchell, 1992; Lee & Bobko, 1994; Wood & Bandura, 1989) that are associated with successful self-regulation.

Some preliminary studies of stress-related outcomes associated with participation in this intervention have been promising (Mellin et al., 1997; Mellin et al., 1987a). Despite the promising outcomes demonstrated in these intervention studies, there has been no formal evaluation of this theory. Evaluation of the mechanisms of action of the theory-based intervention related to the convergence of trends in changes of stress-related biomarkers and psychological toward decreased stress arousal and positive affect has not previously been reported (Mellin et al., 1997; Mellin et al., 1987a).

Problem Statement

The problem is that the overarching approach of EPT, changing the self-regulatory circuits that constitute the basis for individual self-control to mediate improvements in stress-related psychological and physiologic measures, has not been formally studied (Fernandes, Mellin, Fish-DePena, & Mitrovic, 2011; Mitrovic et al., 2011; Mitrovic et al., 2008). Over the past decade, structuring interventions to treat

specific behaviors that were diagnosis-specific and physiologically-motivated have focused on modifying psychological events associated with physiological change that promoted transdiagnostic outcomes (Hayes, Villatte, Levin, & Hildebrandt, 2011). The trend in scientific inquiry to apply physiologically-impactful treatments regardless of diagnosis has been consistent with EPT in an intervention of EBT that has operationalized this theory (Mitrovic et al., 2011). The intervention has been applied to children and adults for the treatment of stress-related conditions via interventions on self-regulatory neuronal circuitry through self-directed neuroplasticity (Mellin, 2011a; Mitrovic et al., 2012). Preliminary research in the EBT intervention has been limited to evaluation based on diagnosis-specific outcome variables, including several reports on the treatment of the obese (Mellin et al., 1997, Fernandes, 2011; Mellin et al., 1987a; Mitrovic et al., 2011) and one report of intervention outcomes in smokers (Simon et al., 2009). Increasingly, obesity is seen as a stress symptom (Bondia-Pons, Ryan, & Martinez, 2012; de Heredia, Gomez-Martinez, & Marcos, 2012; Moore & Cunningham, 2012; Tamashiro, Sakai, Shively, Karatsoreos, & Reagan, 2011), and stress-related variables, including addictive behaviors (Edwards & Koob, 2010; Koob, 2009; Koob & Volkow, 2010) such as food dependency (Adam & Epel, 2007; Mietus-Snyder & Lustig, 2008), body mass index (BMI), blood pressure (Juster et al., 2010), and psychological constructs reflect increased risk for physical and psychiatric disorders and other stress symptoms may cause or exacerbate weight gain (Dallman, Warne, Foster, & Pecoraro, 2007; Mietus-Snyder & Lustig, 2008). Finally, obesity has become a serious public health threat, with the rates of obesity increasing rapidly in the U.S. (Flegal, Carroll, Ogden, & Curtin, 2010). Interventions have shown poor long-term weight maintenance

(Brownell, 1998; National Heart, Blood, and Lung Institute, 1998), suggesting that new models and novel interventions to obese individuals (U.S. Department of Health and Human Services, 2001) may be useful.

Purpose

The purpose of the sequential mixed methods study is to provide an initial evaluation of mediators of EPT by determining the influence of the EBT intervention on stress-related psychological and physiologic measures in a sample of obese adults. The study of obese adults was made due to the preponderance of salient previous research on this intervention with respect to obese subjects (Fernandes, Mitrovic, Fish de Peña, & Mellin, 2011; Mellin et al., 1997; Mellin et al., 1987a), and obesity is increasingly seen as an intractable and refractory public health problem. Obesity can be viewed in part as a symptom of stress or at least stress-related (Bondia-Pons et al., 2012; de Heredia et al., 2012; Moore & Cunningham, 2012; Tamashiro et al., 2011). Stress has been shown to increase the risk of nonhomeostatic eating (Adam & Epel, 2007; Epel, Lapidus, McEwen, & Brownell, 2001), and increase the risk for physical and psychiatric disorders and other stress symptoms, which may cause or exacerbate weight gain (Dallman et al., 2007; Mietus-Snyder & Lustig, 2008).

The study will use an archival data set from a convenience sample of 36 obese adults. A convenience sample was used to increase external validity, making the results as similar to real life as possible (Jackson, 2009; Trochim & Donnelly, 2008). The participants were randomly assigned to a 7-week introductory intervention based on EPT, immediately or delayed, which was conducted by health professionals at the Washington County Health Department (WCHD) in Maryland. Primary qualitative data will be

gathered using an open-ended survey from five EBT Providers, the health professionals who facilitated or supported the EBT intervention and quantitative data collection. A criterion purposeful sample will be used for the study qualitative component (Patton, 2001) to include the five EBT Providers who facilitated or supported the facilitation of the intervention (Creswell, Klassen, Plano Clark, & Clegg Smith, 2011; Mertens, 2010).

The independent variable is the EBT intervention, and the nine dependent variables include (a) two measures of self-regulation (mindfulness and emotion regulation), (b) five psychological variables (perceived stress, depression, positive and negative affect, self-efficacy, and food dependence), and (c) two measures of physiologic stress (Body Mass Index and blood pressure). The perceptions of change of the EBT Providers who facilitated the intervention in the constructs of self-regulation and psychological variables will be assessed in the qualitative component.

The confluence of sequential quantitative and qualitative data will provide an evaluation of the mechanisms of action of EPT (Mitrovic et al., 2011; Mitrovic et al., 2008). In the proposed study, trends in both quantitative and qualititative data in the direction that is consistent with theory may be sufficient to reject the null hypothesis and offer qualitative information to enhance future EBT training.

Theoretical Framework

The study's objective is to provide an initial report of mediators of EPT to determine the influence of the theory-based intervention on stress-related psychological and physiologic measures in a sample of obese adults. Intervention to promote adaptive emotional plasticity of self-regulatory circuitry decreases the strength and dominance of maladaptive self-regulatory circuitry, and increases the strength and dominance of

adaptive self-regulatory circuitry (Mitrovic et al., 2011; Mitrovic et al., 2008), resulting in broad-spectrum improvements in health indices. The inspiration for the theory was the convergence of scholarship in the development of an intervention that was initially inspired by family systems theory (Bruch & Touraine, 1940), and over the span of more than 30 years, modified and validated (Mellin et al., 1997; Mellin, 2002; Mellin, 2010, 2011; Mellin et al., 1987; Mitrovic et al., 2011) to reflect emerging research based on the postulates upon which EPT is based. These four EPT postulates include: (a) all living beings have survival drives, (b) emotional memory evolved to improve survival, (c) emotional memories can be adaptive or maladaptive, and (d) positive plasticity of emotional memories improves health (Mitrovic, 2011). The theory integrates concepts from evolutionary biology (Darwin & Huxley, 2003), stress physiology (Juster et al., 2010; McEwen, 1998; Seeman et al., 2010; Seeman et al., 2001), affective neuroscience (Davidson, 2003; Garland et al., 2010; Gross, 2009), attachment (Bowlby, 1988; Calkins, 2010) and neuroplasticity (Davidson, 2005; Davidson & McEwen, 2012; Pittenger & Duman, 2008).

All psychotherapeutic interventions have as their direct or indirect goal, the promotion of self-regulation of emotions, cognitions, or behavior (Cozolino, 2010). The self-regulatory processes that support adaptive social and nonsocial responses to life are embedded in the genome as the basis for survival of the species. Early experiences encode self-regulatory circuitry early in life (Calkins, 2010). This circuitry is stored in the least plastic brain areas (Perry, Pollard, Blakley, & Vigilante, 1995).

A cluster of therapies has recently emerged with an explicit clinical goal of modifying the context or response to daily life (Hayes et al., 2011), which is consistent

with EPT. These therapies have their origins in behavioral therapy (Bandura, 1969; Watson, 1924), which was established more than 50 years ago, and involved two strands, (a) stimulus-response (S-R) learning theory, and (b) functional operant psychology, which drew upon the manipulation of the environmental contingencies. Cognitive meditational concepts were integrated into behavior therapy as a broadening of S-R learning theory (Beck, 1993; Beck, Rush, Shaw, & Emery, 1979). The behavioral tradition evolved to emphasize the structuring treatments for specific diagnostic categories, rather than focusing on fundamental human issues or underlying change models based on physiology.

Recently, a "third wave" of behaviorism (Hayes et al., 2011) has explored psychological processes that are strongly linked to physiology, fundamental human issues, and transdiagnostic outcomes. These contextual approaches share the incorporation of broad, flexible repertoires of responses. Many clinicians integrate behavioral and cognitive therapy, with a focus on deeper human issues and often the clinician engages as a practitioner of the techniques. Despite their similarities, their theories and practices vary. Mindfulness-based therapies (Kabat-Zinn, 1990, 1994) are based on increasingly focused, purposeful awareness, in an open, nonjudgmental, and accepting manner (Baer et al., 2006) to enhance self-management and effective coping. Attentional control therapies, such as learning to be aware of one's breath, focus on metacognitive therapy (Wells, 2000), which at the theoretical level are grounded in the Self-regulatory Executive Function (SEF) model (Wells & Matthews, 1994).

According to the SEF model, a specific cognitive process, cognitive attentional syndrome, involving worrying and ruminating, threat monitoring and ineffective coping

strategies, is the cause of most psychological problems (Wells, 2008). Among the contextual therapies is an integrative approach that includes mindfulness techniques of self-regulation with a therapeutic relationship and behavioral control (Linehan, 1993; Lynch, Trost, Salsman, & Linehan, 2007), and Acceptance and Commitment Therapy (Hayes, Strosahl, & Wilson, 1999), which integrates mindfulness and acceptance techniques with behavioral activation techniques. However, among these therapies, there is none that is consistent with EPT that focuses on adaptive plasticity of self-regulatory circuitry through the full range of physiologic states for the goal of promoting persistent posttreatment improvements in a broad range of stress-related psychological and biomedical variables (Mitrovic et al., 2011; Mitrovic, Frassetto, Fish dePena, & Mellin, 2013).

Allostatic load theory. The scientific basis for the possibility of promoting persistent health-related effects through adaptive plasticity of self-regulatory circuitry consistent with EPT is allostatic load theory. This theory was first described by McEwen and Stellar (McEwen & Stellar, 1993) as the cumulative effect of repeated activations of stress upon the brain and body, and has been developed by others to include neuronal stress circuitry and psychological and biological markers. This literature forms the basis for the current investigation because allostatic load is an integrative measure that includes both psychological and biological markers that are stress-related (Juster, McEwen, & Lupien, 2009; Juster et al., 2010). Researchers have only recently made recommendations about preventive and therapeutic strategies to change allostatic load (Danese & McEwen, 2012; Karatsoreos & McEwen, 2011; McEwen, Eiland, Hunter, & Miller, 2012; McEwen & Gianaros, 2011; McEwen & Tucker, 2011). EPT builds on this

allostatic load theory to address its prevention and treatment through reconsolidation of self-regulatory circuitry with the goal of promoting change from an allostatic state to a homeostatic state.

The strategy of intervening for the prevention or treatment of psychological and biomedical problems at the neurophysiologic level is predicated on the plasticity of self-regulatory circuitry. Scientific inquiry into the plasticity of self-regulatory circuitry (Davidson, 2005; Fumagalli, Molteni, Racagni, & Riva, 2007; Garland & Howard, 2009; LeDoux, 2012b; Pittenger & Duman, 2008) has increased in the last decade. A research protocol for the reconsolidation hypothesis was established in the late 1960s (Lewis, 1969; Misanin, Miller, & Lewis, 1968), even though it was burdened by significant methodological criticism which slowed discovery of laboratory findings that has application to the treatment of clinical problems (Schiller & Phelps, 2011). Only recently were methods established that overcame these concerns and was the reconsolidation of allostatic circuits documented in humans (Schiller et al., 2010; Schiller & Phelps, 2011); however, additional research is needed to increase the generalizability of findings to diverse populations and in non-laboratory settings.

The application of adaptive plasticity of self-regulatory circuits requires experiential learning of implicit memory systems, as changes in the emotional brain are "use dependent" (Perry & Pollard, 1998). The intervention that is based on EPT uses techniques for experiential learning that mirror the evolutionarily-based optimal, self-regulatory practices associated with dyadic attunement of secure attachment (Schore, 2005, 2009) to change physiologic states from maladaptive to adaptive and are hypothesized to switch the state, both to decrease stress arousal and negative affect, and

increase reward circuitry activation and positive affect. The goal of the use of self-regulatory practices is a state of low stress arousal and positive affect, which is consistent with Damasio's observation that the goal of homeostasis and the sign of optimal physiological functioning are joyous states of well-being (Damasio, 2003). As that state integrates affect and stress arousal systems, that biological observation suggesting the potential utility of integrating concepts based on affective neuroscience into the intervention (Davidson, Jackson, & Kalin, 2000; Garland et al., 2010). The theory postulates that harnessing the power of neuroplasticity to change primitive emotional circuitry (LeDoux, 2012b) that promotes stress, which is the cause of most health problems, promotes broad-spectrum adaptive changes in psychological constructs and biomarkers, and ultimately, improved health and happiness.

Research Questions

Using a mixed methods design may determine whether changes in nine dependent variables of self-regulatory processing, stress-related psychological variables, and measures of physiologic stress were related to participation in an EBT intervention aimed at decreasing the frequency and duration of the stress response. The goal of the study is to determine if this intervention based on EPT causes a convergence of adaptive trends in stress-related psychological constructs and biomarkers (Mitrovic et al., 2011; Mitrovic et al., 2008). The guiding research questions are:

Q1. Does the EBT intervention cause improvements in self-regulatory processing (mindfulness and emotion regulation)?

Q2. Does the EBT intervention cause improvements in stress-related psychological variables (perceived stress, depression, positive and negative affect, self-

efficacy, and food dependence)?

Q3. Does the EBT intervention cause improvements in measures of stress-related physiological and anthropometric variables (Body Mass Index and blood pressure)?

Q4. Do the subjective responses of the EBT Providers confirm the findings from the qualitative component of the study for self-regulatory and psychological variables?

Hypotheses (Quantitative/Mixed Studies Only)

$H1_0$: There is no significant difference in changes in self-regulation based on the Emotional Regulation Questionnaire (ERQ) in obese adults who participate in EBT and waitlist control subjects.

$H1_a$: Obese adult participants in the EBT intervention demonstrate statistically significant improvements in self-regulation as measured by the ERQ compared waitlist control subjects.

$H2_0$: There is no significant difference in changes in mindfulness as measured by the Five Facet Mindfulness Questionnaire (FFMQ) in obese adults who participate in the EBT intervention compared to waitlist control subjects.

$H2_a$: Obese adult participants in the EBT intervention demonstrate statistically significant improvements in mindfulness based on the FFMQ compared to waitlist control subjects.

$H3_0$: There is no significant difference in perceived stress as measured by the Perceived Stress Scale (PSS) in obese adults treated with the EBT intervention and waitlist control subjects.

$H3_a$: Obese adult participants in the EBT intervention demonstrate statistically significant decreases in perceived stress as measured by the PSS compared to waitlist control subjects.

$H4_0$: There is no significant difference in depressive symptoms as measured by the Center for Epidemiologic Studies Depression Scale (CESD) in obese adults who participate in the EBT intervention and waitlist control subjects.

$H4_a$: Obese adult participants in the EBT intervention demonstrate statistically significant decreases in depression as measured by the CESD compared to waitlist control subjects.

$H5_0$: There is no significant difference in changes in positive and negative affect as measured by the Positive and Negative Affect Scale (PANAS) in obese adults who participate in the EBT intervention and waitlist controls.

$H5_a$: Obese adult participants in the EBT intervention demonstrate statistically significant increases in positive affect and decreases in negative affect as measured by the PANAS compared to waitlist control subjects.

$H6_0$: There is no significant difference in changes in self-efficacy as measured by the General Self-efficacy Scale (GSE) in obese adults who participate in the EBT intervention compared to waitlist control subjects.

$H6_a$: Obese adult participants in the EBT intervention demonstrate statistically significant improvements in self-efficacy as measured by the GSE compared to waitlist control subjects.

$H7_0$: There is no significant difference in changes in food dependence as measured by the Yale Food Addiction Scale (YFAS) between obese adults who participate in the EBT intervention and waitlist control subjects.

$H7_a$: Obese adult participants in the EBT intervention demonstrate statistically significant decreases in food dependence as measured by the YFAS compared to waitlist control subjects.

$H8_0$: There is no significant difference in change in blood pressure in those who participate in the EBT intervention and waitlist control subjects.

$H8_a$: Obese adult participants in the EBT intervention demonstrate statistically significant improvements in blood pressure compared to waitlist control subjects.

$H9_0$: There is no significant difference in change in obesity in obese adults as measured by Body Mass Index in obese adults treated with the EBT intervention and waitlist control subjects.

$H9_a$: Obese adult participants in the EBT intervention demonstrate statistically significant decreases in obesity as measured by Body Mass Index compared to waitlist control subjects.

Nature of the Study

The purpose of the sequential mixed methods study is to provide an initial evaluation of mediators of EPT to determine the influence of the intervention based on this theory on stress-related psychological and physiologic measures in a sample of obese adults. This investigation offers a preliminary response to the first three research questions regarding the impact of the independent variable on the 9 psychological, anthropometric and psychological variables. The design of the quantitative arm of the

study best approximates the "gold standard," randomized, double blind, placebo controlled clinical trial for evaluation of clinical interventions (Spodick, 1982), randomizing participants to treatment versus control groups, but the cross design rules out double blind procedures. The investigation includes a confirmatory qualitative component based on a survey completed by intervention-related providers, which provides a subjective assessment of changes in the psychological variables, that is, do the subjective responses of the EBT Providers confirm the findings from the qualitative component of the study for self-regulatory and psychological variables? This mixed method approach was selected, as use of two methodological paradigms can provide greater confidence in the accuracy of the results, and when findings are contradictory, lead to the development of new research questions to examine (Tashakkori & Teddlie, 2010). As a first study of EPT, the priority is to demonstrate feasibility and proof of concept as the priorities, rather than a controlled clinical trial, which is premature before such foundational research has been conducted (Jackson, 2009; Trochim & Donnelly, 2008).

An archival data set from a sample of 36 obese adults will be used in this study, as feasibility of delivering this intervention in public health settings had previously been established (Mertens, 2010; Tashakkori and Teddlie, 2010) by research (Mellin et al., 1997; Mellin et al., 1987a) and informal evaluation at the study site, the Washington County Health Department (see Appendix C) for the quantitative component of the study. A convenience sample of 36 participants was stratified to allow those with more extreme obesity to be comparable between conditions. In designing this study, this subject number was determined to be sufficient, based on power analysis of .83 to detect the

treatment effects studied. Inclusion criteria included a Body Mass Index of 25 to 40, and stratification was based on weight category (obesity vs. extreme obesity). Participants were randomly assigned to a test group to receive a 7-week intervention of EBT based on EPT (immediate intervention) or to a (delayed intervention) control group (Mellin, 2010a).

Nine baseline and posttreatment measures were collected including measures of physiologic stress (Body Mass Index and blood pressure) and seven measures of psychological constructs: (a) mindfulness with The Five Facet Mindfulness Questionnaire (Baer, Smith, & Allen, 2004), (b) emotional regulation with The Emotional Regulation Questionnaire (Gross & John, 2003), (c) perceived stress with Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983), (d) depression, by the Center for Epidemiologic Studies Depression Scale (Radloff, 1977), (e) affect, by the Positive and Negative Affect Scale (Watson & Clark, 1999), (f) self-efficacy, by The General Self-Efficacy Scale (Sherer et al., 1982), and (g) food dependence, by the Yale Food Addiction Scale (Gearhardt, Corbin, & Brownell, 2008).

The retrospective qualitative component of the proposed study will involve original data collected by the researcher based on a 21-item survey, to probe perceptions of the WCHD Providers (N=5), EBT Providers who delivered the intervention or supported its delivery. This investigation offers a preliminary response to the fourth research question either confirming or failing to confirm the findings of the quantitative component of the study related to research questions 1 and 2. Use of a survey for data collection was chosen because a face-to-face interview is not feasible given geographical distance between the researcher and participants, and is appropriate for historical

observations to provide indirect information that is processed through the perceptions of observers of the obese adults who participated in the intervention (Tashakkori & Teddlie, 2010; Mertens, 2010). The survey will probe EBT Provider perceptions of intervention-related changes in study participants in the psychological constructs measured by and program components related to changes in the constructs measured.

The proposed analyses are a series 3 (measures at baseline, 8 weeks, and end of study, repeated measures) x 2 (test vs. control, between) univariate ANCOVAs for each dependent variable (see Table 4). Although the use of conducting multiple univariate tests may inflate Type 1 error, as this is a preliminary study that will be replicated, the purpose of the analysis is to show trends, which later investigations will confirm or disconfirm (Thabane et al., 2010). Participants were blocked on baseline BMI prior to random assignment, and pretest BMI will be used as a covariate (Cohen et al., 1995; Subak et al., 2005). The qualitative data will be prepared for analysis, with data coding and categorization of the data done via Atlas.ti software to identify trends as themes from the educator-reported aspects of the intervention associated with changes perceived in each of the seven constructs. The analysis will generally follow the precepts phase in the sequential design to assess EBT Provider perceptions on participant empirical measures and posttreatment perceptions of change in relationship to program components using the qualitative survey data. The qualitative analysis, based on data collection from the 21-item survey (EBT Provider Survey), will probe provider perceptions of change in the seven constructs measuring self-regulatory processing and stress-related psychological variables, as well as information on the relationship between these variables and intervention components.

Significance of the Study

Models that have attempted to explain the onset, exacerbation or prolongation of stress-related diseases are important, as stress is the root cause of the preponderance of human morbidity (Del Giudice et al., 2010; Fehm et al., 2006; Ganzel et al., 2010; Kopp, 1989; Kopp & Rethelyi, 2004; McEwen, 2000; Romero et al., 2009; Selye, 1976; Sterling & Eyer, 1988). Each of the 10 top causes of death in the United States is caused by or exacerbated by stress (Heron et al., 2009), and stress-related problems account for as much as 75–90% of primary care office visits (Stress in America, 2004).

Stress-related issues have contributed to the onset or exacerbation of numerous health problems including depression (Risch et al., 2009), anxiety (Britton et al., 2011; McEwen et al., 2011), heart disease (Grant et al., 2009; Hamer & Malan, 2010), addictions (Edwards & Koob, 2010; Koob & Kreek, 2007; Koob, 2008; Lenoir et al., 2011; Uhart & Wand, 2009), and obesity (Allison et al., 2009; Dallman, 2010; Dong et al., 2004; Francis & Susman, 2009; Kivimaki et al., 2006; Krantz & McCeney, 2002; Li et al., 2002; Mietus-Snyder & Lustig, 2008; Rozanski et al., 1999; Whitaker & Gooze, 2009).

The study is important because the postulates of the theory build on research ranging from axiomatic physiology to emerging neuroscience, yet the theory has never been formally studied. Early in the emergence of neuroplasticity research (Lewis, Amini, & Lannon, 1999), UCSF psychiatrist Fari Amini reviewed research and explanatory documents on a previous iteration of the EBT intervention and told the author that EBT represents a new modality in public health that can “revise” the limbic brain (personal communication, April 17, 2000). Since then, emerging research has provided guidance

regarding changes in the method, which were hypothesized to more accurately reflect brain physiology and neuroplasticity research. The initial formal study of EPT as a contribution to the field of study is small but important. Should the initial studies of this theory reject the null hypothesis, it will inform concurrent research on EPT that is being conducted by researchers in integrative medicine at Weill-Cornell Medical College (Peterson et al., 2010) and planned research by University of California, San Francisco researchers (Frassetto, Schloetter, Mietus-Synder, Morris, & Sebastian, 2009) on changes in biomarkers associated with interventions that target maladaptive neuronal stress circuitry.

Additional research following this study would contribute to understanding the nature of intervening to reverse allostatic load (Juster et al., 2010; McEwen & Gianaros, 2010, 2011), methods of contextual therapy (Hayes et al., 2011) that integrate allostatic circuitry reconsolidation (Schiller et al., 2010; Schiller & Phelps, 2011), and reflect on the nature of survival responses and the plasticity of innate and experienced-based mechanisms of response patterns (Hartley & Phelps, 2010; LeDoux, 2012b) that have been coupled to novel intervention through experience and learning.

Definitions

Homestasis. The term *homeostasis* was coined by physiologist Walter B. Cannon at the beginning of the 20th century. It is derived from the Greek *homeo*, meaning "same," and the Greek *stasis*, meaning "stable"; thus, homeostasis means "remaining stable by staying the same." Recently, Damasio (2003) defined the goal of homeostasis as joyous states, not just states of the absence of stress. The response is a negative feedback loop, and thus tends to be persistent. Homeostasis is adaptive and decreases or

reverses the cumulative wear and tear and adaptation on the body and brain to decrease risk of pathology (Fernandes, Mitrovic, & Mellin, 2010; Fish-De-Pena, Mellin, & Mitrovic, 2007).

Allostasis. The term *allostasis* was derived from the Greek *allo*, which means "variable," and *stasis*, and describes the ability to respond to distress by changing activity level and maintaining it at the new level as long as necessary. It is the process of achieving stability through physiologic or behavioral change (Sterling & Eyer, 1988). The response is a positive feedback loop, and thus tends to be persistent. Although allostasis has been adaptive in the short term, when prolonged becomes maladaptive, increasing wear and tear, and adaptation on the body and brain that increases risk of pathology (McEwen & Wingfield, 2003).

Neural stress circuits. All *neural stress circuits* respond to stimuli from the external environment and internal milieu with (a) a subcortical emotional processing phase, followed by (b) a cortical processing phase, and (c) concluding with a corrective response (Fish-De-Pena et al., 2007; Mitrovic et al., 2011). These neuronal stress circuits are the basis for the regulatory processing of life, and are either adaptive or maladaptive. The term is important in the clinical application of this method because the objective is to increase the strength and dominance of the adaptive circuits and reconsolidate the maladaptive neuronal stress circuits (Fish-De-Pena et al., 2007; Mitrovic et al., 2011).

Homeostatic neural circuit. *Homeostatic neural circuit* is defined as an adaptive circuit with a positive feedback loop of homeostasis (Fish-De-Pena et al., 2007; Mitrovic et al., 2011). All three phases of the neural stress circuit are adaptive, and the stress response is brief, avoiding or reversing pathology-related increases in allostatic load.

Allostatic neural circuit. *Allostatic neural circuit* is defined as a maladaptive circuit with a positive feedback loop of homeostasis (Fish-De-Pena et al., 2007; Mitrovic et al., 2011). All three phases of the neural stress circuit are maladaptive, and the stress response is prolonged, exacerbating pathology-related increases in allostatic load.

Brain state. *Brain state* is a physiologic state in which the dominant brain area varies based on perceived stress and the self-regulatory circuit that is activated (Fish-De-Pena et al., 2007; Mitrovic et al., 2011). These activations of neural stress circuits contribute to a brain state from states of balance and positive emotion, the physiological goal of homeostasis, to an activated state in which the emotional response is extreme, ranging from dissociation to hyperarousal (Perry et al., 1995). Although the number of brain states is not yet known, both EBT theorists and Perry have adopted the use of five brain states for education (Mitrovic et al., 2011; Perry et al., 1995).

Homeostatic state. *Homeostatic states* are axiomatic in physiology, triggered by effective conscious and nonconscious self-regulation, and with negative feedback loops they tend to flicker. These states are adaptive and they are complementary to allostatic states (Goldstein & McEwen, 2002).

Allostatic state. *Allostatic states* occur when the allostatic response is persistent to the extent that the state becomes a trait (Perry et al., 1995). The allostatic circuits are positive feedback loops, which favor persistence, causing the dsyregulation of both stress and reward systems (Goldstein, 2011; Goldstein & McEwen, 2002; Koob, 2008; Koob & Le Moal, 2001) to a state in which emotions, thoughts, behaviors, sensations, and physiologic states are maladaptive and persistent.

Allostatic load. *Allostatic load* is defined as a "cumulative measure of physiological dysregulation over multiple systems," the wear and tear along with adaptations to repeated episodes of allostasis that the brain and body experience (McEwen, 1998).

Self-regulation. *Self-regulation* is defined as the conscious and nonconscious regulation of emotions, thoughts and behaviors to increase the frequency and duration of homeostasis and decrease the frequency and duration of allostasis, and their attendant adaptive or maladaptive emotional states and responses. However, the definitions of self-regulation are diverse (Carver & Scheier, 1981; Carver & Scheier, 1998).

Emotional memory. *Emotional memory* is defined as the nonconscious memory underlying self-regulatory neural systems, which evolved to promote behavioral solutions to perceived threats to survival, causing the body to respond in a particular way that is consistent with past experiences (Koob, 2009; Schiller et al., 2010).

Emotional Plasticity Theory. *Emotional Plasticity Theory* or *EPT* focuses on the plasticity of the explicit memory systems of the executive brain (Barkley, 2001; Baumeister, 1998) to actively change brain states and re-encode maladaptive self-regulatory circuitry, which is stored in implicit memory systems of the subcortical brain. This definition incorporates the automatic model of self-regulation, with unconscious processing and automatic activation (Hull, 1931; Kruglanski, 1996) and early dyadic experiences that contribute to the attachment schema (Schore, 2000, 2005), and are influenced by trauma (Anda et al., 2006).

Emotional Brain Training. *Emotional brain training* or *EBT* is an intervention program that is based on EPT (Fish-De-Pena et al., 2007; Mitrovic et al., 2011). The

intervention is facilitated by licensed health professionals who have completed certification training through 160 hours of continuing education and provide short- and long-term progressive training to individuals and small groups based on manualized courses (Fernandes et al., 2010; Mellin, 2011b). The goal of the program is to ameliorate or prevent the stress-related development or exacerbation of an allostatic state and to promote the development of a homeostatic state (Cannon, 1929).

Summary

EPT (Mitrovic et al., 2011) is based on four postulates: (a) all creatures have survival drives, (b) emotional memories are encoded to promote self-regulation, (c) memories can be either adaptive or maladaptive, and d) adaptive plasticity of emotional memories improves health. Most problems are symptoms of the failure of self-regulation (Baumeister et al., 2007), suggesting that intervening to promote adaptive changes in self-regulatory wiring could impact the frequency and duration of adaptive states of arousal and affect, promoting a broad range of beneficial effects on stress-related problems.

EPT and related theory-based interventions such as emotional brain training (EBT) suggest a new paradigm in health care in which there is less emphasis on treating the symptoms of stress in favor of treating the neural circuitry of the stress response (Mitrovic et al., 2011; Mitrovic et al., 2008). The problem addressed by the proposed study is that the overarching theory of EPT has never been formally studied. This preliminary report, a sequential mixed methods study, is a controlled clinical study of immediate treatment versus delayed treatment of a 7-week intervention, based on EPT on obese adults conducted by health professionals associated with the Washington County Health Department (WCHD) in Maryland. Data include an archival quantitative data set

and primary qualitative data from a 21-item survey of health professionals who conducted the intervention.

The independent variable in this study will be participation in the intervention, and the dependent variables will be nine measures of stress-related psychological and biological measures. A convergence of change in these measures consistent with a decrease in stress would build theory of EPT at this initial state of investigation. The study begins the process of building a novel theory that is consistent with five areas of neuroscience, and will contribute to the development of a body of research that will enhance understanding of allostatic load (McEwen, 1998; Juster et al., 2010; Seeman et al., 2010; Seeman et al., 2001), contextual behavioral methods (Hayes et al., 2011), self-directed adaptive plasticity of emotional memories (Hartley & Phelps, 2010; LeDoux, 2012b; Schiller et al., 2010; Schiller & Phelps, 2011), and the possibility of developing a new paradigm in health care (Mitrovic et al., 2011): addressing failure of self-regulation, the root cause of most human suffering (Baumeister et al., 2007).

Chapter 2: Literature Review

The purpose of the sequential mixed methods study is to provide an initial evaluation of changes in stress-related variables relative to Emotional Plasticity Theory. The study will analyze the relationship between participation in training in self-regulation based on EPT on a broad range of stress-related psychological constructs and biological markers.

EPT is an integrative theory that draws upon research ranging from axiomatic stress physiology to emerging understandings of positive emotional neuroplasticity (Mitrovic, Fish dePena, Frassetto, & Mellin, 2011, 2013; Mitrovic, Mellin, & Fish dePena, 2008). The inspiration for the theory was the convergence of these literatures in the development of an intervention that was initially informed by family systems theory (Bruch & Touraine, 1940). Over the span of more than 30 years, the intervention has been modified and validated (Mellin et al., 1997; Mellin, 2002; Mellin, 2010, 2011b; Mellin et al., 1987; Mitrovic et al., 2011) to reflect salient classic and emerging research in theories of evolution (Darwin & Huxley, 2003), allostatic load (Juster et al., 2010; McEwen, 1998; Seeman et al., 2010; Seeman et al., 2001), affective neuroscience (Davidson, 2003; Garland et al., 2010; Gross, 2009), attachment (Bowlby, 1988; Calkins, 2010) and neuroplasticity (Davidson, 2005; Davidson & McEwen, 2012; Pittenger & Duman, 2008).

The literature review emphasized the research on self-regulation, that is, the nonconscious and conscious processing of daily life to a state of low stress arousal (Koob & Le Moal, 2001) and positive affect (Davidson et al., 2000), thus integrating the stress response system and reward circuitry while emphasizing subcortical implicit learning and

the neocortical, explicit memory systems that orchestrate self-directed neuroplasticity (Davidson, 2005; Pittenger & Duman, 2008).

EPT includes four progressive postulates that propose a new paradigm in health care for the prevention and treatment of stress (Mitrovic et al., 2011), with the novel strategy of self-directed adaptive plasticity of the emotional memories that comprise stress circuitry. Failure of self-regulation is the cause of most psychological and biomedical problems, and the literature that bears directly or indirectly on it is exceedingly vast. A more extensive review of the literature and explication of theory will be the subject of a forthcoming collaborative work with my colleagues (Mitrovic et al., 2013). In order to appropriately limit this review, it was based on online databases for relevant research, theory, and reviews through searches of key words related to these literatures, and historical books and articles published in peer-reviewed journals. Research reported as dissertations and papers, which receive less rigorous review and scientific scrutiny and rigor, were not included in this review.

The review begins with a brief description to each of the five bodies of literature that influenced the development of EBT, continues with a review of the literature for each of the four postulates of EPT and concludes with a description of the components of the EBT intervention, which will be the dependent variable in this study.

Core Literatures

What follows are brief descriptions of each of the literatures that most strongly influenced the development of EPT. For each of the four postulates of this theory, multiple strands of research and theory will be integrated to explicate and substantiate the theory.

Evolutionary Biology

Evolutionary biology is a subfield of biology concerned with the origin and descent of species, as well as their change, multiplication, and diversity over time (Barkow, Cosmides, & Tooby, 1992; Tooby & Cosmides, 1990) to favor survival of the species. The response of an organism to threat is evolutionarily based and highly conserved across species (LeDoux, 2012a; Oler et al., 2012). Evolutionary biology is salient to EPT because the structures and functions that promote survival of the species are thought to have evolved over the millennia. Brain structures are hierarchical (Anda et al., 2006; Perry & Pollard, 1998), with the major self-regulatory functions, such as heart rate, blood pressure, and body temperature mediated by the lower areas and the more complex functions, such as language and abstract cognitions mediated by the higher areas.

The stress response and neural circuitry linking brain structures were also influenced by evolutionary factors (Korte, Prins, Vinkers, & Olivier, 2009; LeDoux, 2012a; Schulkin, 2011). Adaptive self-regulatory processing and the plasticity of that circuitry are thought to be related to survival of the species (Silva et al., 2012). Evolutionary biology is observed in brain structures and neurophysiologic processes in that the survival of our hunter-gatherer ancestors was dependent upon effective responses when faced with primarily physical threats. That same chemical and electrical cascade is now activated in modern life in response not only to episodic physical threat, but also to sensory, emotional, or cognitive representations (Olsson & Phelps, 2007). The episodic response adaptively activated periodically is now maladaptively activated chronically.

Plasticity of the neuronal circuitry that influences physiologic states, promoting

either self-regulatory failure or success and related mental and physical health, provides an overarching theory of EPT.

Stress Physiology

EPT integrates stress physiology (Juster et al., 2009; McEwen, 1998, 2006; McEwen & Wingfield, 2003) into the postulates as maladaptive self-regulatory circuitry, activated by stimuli from the external environment and internal milieu. The stress response evolved to orchestrate physiology to favor survival as homeostatic or, if the stressor overwhelmed homeostatic processes, favoring a prolonged and maladaptive response to a stressor. Two endocrine systems, the hypothalamic-pituitary-adrenocortical axis (HPA) (Selye, 1985) and the sympathetic-adrenal-medullary (SAM) system (Cannon, 1929) are activated in response to a stressor.

Recently, polyvagal theory (Porges & Furman, 2011) has been forwarded, which suggests that the SAM system demonstrates a phylogenic shift among three distinct processes and physiologic brain states, with adaptive processes organized around effective social engagement. Concepts of stress have evolved (Goldstein & Kopin, 2007; McEwen & Gianaros, 2010) to encompass the cumulative effect of exposure to repeated or chronic heightened activations of neural or neuroendocrine responses to stress or allostatic load. Prolonged or repeated activation interferes both with physiological systems and causes detrimental effects on brain regions that influence self-regulation (Arnsten, 2009; Heatherton & Wagner, 2011).

Various theories have extended allostatic load theory, which are consistent with the importance of the allostatic response in promoting dysregulation. The Adaptive Calibration Model (Del Giudice et al., 2010) proposes an evolutionary-developmental

perspective of individual differences that promotes variation based on early experiences to calibrate biological sensitivity to environmental demands. The Reactive Scope Model (Romero et al., 2009) differentiates reactive homeostasis from homeostatic overload and identifies a range of state-related biomarkers.

The neural circuits of fear are emotional circuits of implicit memory systems, as survival is predicated on nonconscious adaptive survival responses. These allostatic circuits are activated as innate survival functions or they can be recruited by experiences that may be adaptive or maladaptive in response to stress (LeDoux, 2012a; LeDoux, 2012b; Rodrigues, LeDoux, & Sapolsky, 2009). The evolution of the stress response conceptualization to circuitry is consistent with EPT (Mitrovic et al., 2011).

Affective Neuroscience

Affect has become more prominent in the thinking of bio-behavioral researchers. Antonio Damasio identified the goal of homeostasis not as a mediocre mood, but joyous states, signifying optimal physiological orchestration (Damasio, 2003). Psychological scientists have increasingly focused on the intersection of affect and neuroscience, and the role of emotion in self-regulation and its influence on survival (Davidson, 2005; Gross & Barrett, 2011; Immordino-Yang, McColl, Damasio, & Damasio, 2009). These advancements are consistent with the emergence of positive psychology (Seligman & Csikszentmihalyi, 2000) and the role of positive emotions in improving physiologic indices of stress, such as heart rate, blood glucose, and immune function (Blum, Liu, Shriner, & Gold, 2011; Edwards & Koob, 2010).

Mirroring the relationship between the stress response system and reward center circuitry, the Broaden and Build Theory (Fredrickson, 2004) postulated that positive

emotions expand awareness and creativity, facilitating the development of a larger repertoire of capacities and greater access to resources. Others have proposed the importance of pro-social emotions in promoting health and well-being (Davidson, 2008; Davidson & McEwen, 2012; Folkman, 2010; Haidt & Morris, 2009; Impett et al., 2012; Kogan et al., 2011; Seligman, Steen, Park, & Peterson, 2005; Vaillant, 2009).

Common symptoms of self-regulatory failure have been associated with negative affect, including depression as a symptom of stress (Risch et al., 2009), left prefrontal cortex laterality, positive affect insufficiency (Johnstone, van Reekum, Urry, Kalin, & Davidson, 2007), and substance abuse (Edwards & Koob, 2010; Koob & Le Moal, 2008). The complex relationship between stress, reward systems, and positive emotional states as markers of optimal physiology, and the role of emotional circuitry in self-regulation (LeDoux, 2012a) suggest the importance of affective neuroscience to EPT.

Attachment Theory

EPT integrates attachment theory (Bowlby, 1988; Dykas & Cassidy, 2011; Schore, 2000), which explains how the primary caregiver encodes the infant's brain with self-regulatory circuitry (Calkins, 2010). The dyadic relationship between caregiver and offspring leads to the development of patterns of attachment and internal working models or neuronal stress circuits that influence perceptions, emotions, thoughts, and behaviors (Calkins, 2010; Mikulincer & Shaver, 2012; Ponizovsky, Levov, Schultz, & Radomislensky, 2011; Quirin, Gillath, Pruessner, & Eggert, 2010; Warren et al., 2010). Attachment insecurity is associated with psychopathology (Crawford, Livesley, & Jang, 2007; Garrison, Kahn, Sauer, & Florczak, 2011; Schindler, Thomasius, Petersen, & Sack, 2009; Sharpley, 2010; Surcinelli, Rossi, Montebarocci, & Baldaro, 2010), and recent

research focuses on the goal of psychotherapeutic interventions in adaptive plasticity of self-regulatory circuitry as acquired secure attachment (Badenoch & Cox, 2010; Flores, 2010; Siegel, 2010).

This science is of importance to EPT in informing the self-regulatory processes of the method. Consistent with physiology evolving to favor survival of the species, the dyadic self-regulation in a secure attachment (Bowlby, 1988; Dykas & Cassidy, 2011; Schore, 2000) and the parenting style that is associated with adaptive self-regulation, authoritative parenting style (Baumrind, 1991), should be in harmony. The EBT intervention trains individuals in the use of tools that are hypothesized to operationalize this state-based dyadic regulation and adaptive parenting styles to promote effective self-regulation.

Neuroplasticity

EPT proposes treatment through the consolidation and reconsolidation of neuronal stress circuitry, predicated on findings from neuroplasticity research (Davidson, 2005; Koob & Volkow, 2010; Schiller et al., 2010), which demonstrated the capacity of the brain and nervous system to change in structure and function from experience. Neuroplasticity is important to self-regulatory intervention because the vast majority of brain development and organization takes place during the first 3 years of life (Perry, 1999) in areas of low plasticity. More recent reports of plasticity in self-regulatory neural circuitry in adults (Delgado et al., 2009; Schwartz et al., 1996) were integral to EPT.

When a maladaptive self-regulatory circuit is activated, during the reconsolidation window when synapses are fluid, providing an adaptive processing experience may depotentiate the maladaptive circuit and potentiate an adaptive circuit (Schiller et al.,

2010). This use of adaptive self-directed neuroplasticity to improve the effectiveness of self-regulation includes: (a) behavioral self-regulation based on hunter-gatherer practices (e.g., primitive diets of fruits, vegetables, nuts, oils, poultry, fish, and lean meat; a physically active lifestyle; natural sources of pleasure for play; and long-duration, high-quality sleep); (b) decreasing exposure to environmental stressors; and (c) recommendations for the adaptive utilization of preventive (Preventive Services Task Force, 2010) and therapeutic health care (Roehr, 2008).

These five areas of research are integrated in the four postulates of EPT. The next section of this review will include explication of the theory and the relevant science and theory of each postulate.

Postulate 1: All living beings have survival drives. The first drive of all creatures is survival, followed by reproductive fitness (Darwin & Huxley, 2003). Physiology is designed by natural selection to adaptively solve the primitive challenges of our hunter-gatherer ancestors. Included in this endowment is a range of instinctual responses to challenges to safety and well-being. These survival drives involve the detection and response to stress and the orchestration of neurophysiologic processes that favor such survival drives as defense, energy, fluids, thermoregulation, and procreation.

The stress response evolved to ensure the survival of the species in the short-term, and includes the survival drive in humans that evolved over the millennia to ensure the survival of the species. The body can be in homeostasis when perceived threat is low or allostasis when the stressor overwhelms homeostatic processes and activates a more extreme response to respond to the threat. The term *homeostasis* was originated by Walter B. Cannon, derived from the Greek *homeo*, meaning “same,” and the Greek *stasis*,

meaning “stable;” thus, homeostasis means “remaining stable by staying the same” (Mitrovic et al., 2008). Recent research emphasizes the importance of these allostatic circuits in both EPT (Mitrovic et al., 2011) and emotion research (LeDoux, 2012b; McEwen, 2008). The response to distress, which results in allostasis, is then called the *allostatic response*.

Allostatic response is necessary and it is adaptive in the short term (McEwen & Wingfield, 2003). However, in the long term, allostatic response results in “wear and tear” on the body that results in damage. The concept of “allostatic load” was proposed as a “cumulative measure of physiological dysregulation over multiple systems” (McEwen & Stellar, 1993), that is, the accumulated wear and tear that the body experiences due to repeated cycles of allostasis as well as the adaptations to the stress response (McEwen, 1998). Allostatic load in the body (e.g., atherosclerosis) and in the brain (sensitization to the stress response) increases the frequency and duration of the stress response when the capacity to cope is overwhelmed by the combined load of internal and environmental stressors.

Postulate 2: Emotional memory systems evolved to improve survival. The brain brings elements of experience across time by transforming experiences into patterns of neuronal activity or circuitry, which form the basis for self-regulation (LeDoux, 2012a; LeDoux, 2012b). These emotional memories provide survival advantage because they are activated quickly and without conscious awareness to ensure that the living being repeats the corrective response, which was used previously with the presumption that it was adaptive, given that our ancestors responded primarily to physical threats and survived (Heatherton, 2011; McEwen & Gianaros, 2010).

Self-regulation

Consistent with all literatures, the body of knowledge pertaining to self-regulation is fraught with inconsistencies, discrepancies, diminutions, and extrapolations that are at the heart of a dynamic and thoughtful exploration of science and theory. However, there is general agreement about the importance of self-regulation failure or success as determinants of health and happiness. Baumeister and Vohs (2010) assert that self-regulation is a global concern in that "all cultures require self-regulation and punish its failures" (p. 3) and "every personal and social problem affecting large numbers of modern citizens involves some kind of failure of self-regulation" (p. 4). Adaptive self-regulation is the goal of psychotherapy, as evidenced by neural integration (Cozolino, 2010), thus it is core to understanding many diverse aspects of abnormal and normal psychological functioning. If self-regulation is so central to the health and happiness of human beings, as individuals and in their collective, then understanding self-regulation and drawing upon those theories to study their applications would be expected to be central to the health sciences. Yet the vigor of study of self-regulation is remarkably low. A search of PubMed citations for the previous decade yields just over 50 times more papers with the word "self-regulation" in the title than one of the primary symptoms of the failure of self-regulation, specifically, depression (Risch et al., 2009).

The concept of self-regulation is imbedded in ancient philosophy in reflective thought about the nature of life, and was forwarded by William James, who in 1890 wrote, "the looking into our own minds and reporting what we there discover" (James & Miller, 1983, p.185) and the role of self-acting to modify responses to the stressors of life (Gailliot, Baumeister et al., 2007). The term *self-regulation* was first described in the

writings of Thorne (1946) as an elaboration of the concept of self-regulation, based on Lecky's self-consistency theory in which the individual is seen as having sufficient resources for adaptive evaluation and modifying one's own behavior (Lecky, 1945). Bandura refers to self-regulation in the broadest possible terms, as the intentional or purposeful internal responses (Bandura, 1991). The work of Carver and Scheier (Carver & Scheier, 1982) described self-regulation within the conceptual framework of control theory, emphasizing self-awareness of feedback loops based on applications of cybernetic theory, followed by study of self-regulatory approaches including coping strategies (Carver, Scheier, & Weintraub, 1989; Folkman, 2010). There is no agreement on the precise definition of self-regulation. The tasks of self-regulation have been conceptualized as cognitive regulation, emotional and social regulation, and behavioral regulation (Nes, Roach, & Segerstronm, 2009), and synthesized as endorsed feelings, thoughts or behaviors, motivation to reduce discrepancies between the actual and the endorsed, and sufficient effectiveness in reducing that discrepancy (Hofmann, Schmeichel, & Baddeley, 2012). During the last 30 years, research has emphasized the conscious control of thoughts, emotions, behavior, and physiology in deliberate efforts to reach specific goals or standards (Baumeister et al., 2007, p. 2). Implicit in the concept of self-regulation is emotion regulation, which is the motivational aspect of cognition and the modulation of emotion and emotional responses (Damasio, 2003; Zelazo & Cunningham, 2009) with increased interest in the emotion regulation component of self-regulation (LeDoux, 2012b).

The study of self-regulation is broad, including developmental approaches (Calkins, 2010 ; Charles & Carstensen, 2009; Thompson & Meyer, 2009) and self-

regulation pertaining to cognitive and emotional control (Gross & Thompson, 2007; Hofmann et al., 2012; LeDoux, 2012b; McRae, Misra, Prasad, Pereira, & Gross, 2011; Sipe & Eisendrath, 2012; Slagter, Davidson, & Lutz, 2011), behavioral self-control (Browning, Wewers, Ferketich, Otterson, & Reynolds, 2009; Patrick & Canevello, 2011; Silva et al., 2010; Sniehotta, Presseau, Hobbs, & Araujo-Soares, 2012), self-regulatory strength (Gailliot, Plant, Butz, & Baumeister, 2007; Schmeichel & Baumeister, 2010), conscious and nonconscious regulation (Bargh & Williams, 2007; Dorris, 2009; Williams & Gordon, 2007), resilience (Everly, Smith, & Welzant, 2008; Karatsoreos & McEwen, 2011; Seligman, 2011), and self-regulatory failure (George & Koob, 2010; Johnstone et al., 2007; Heatherton, 2011). There is a growing appreciation in the health sciences of the need for integrative theory and practice based on psychophysiological mechanisms (Garland & Howard, 2009; Novack et al., 2007; Sauer, Burris, & Carlson, 2010). This approach acknowledges the complexity of self-regulation, integrating approaches to the physical, metabolic, and psychosocial approaches to maintenance of health and the treatment of pathology, and addresses the underlying physiological state. In recent years, advances in identifying the physiologic basis of disparate problems that influence and are influenced by failure of self-regulation and its consequence, the maladaptive activation of the hypothalamic-pituitary-adrenal (HPA) axis (Beauchaine, Neuhaus, Zalewski, Crowell, & Potapova, 2011; Buss, Davis, & Kiel, 2011; Esch & Stefano, 2010; Ganzel & Morris, 2011; Kidd, Hamer, & Steptoe, 2010; Loman & Gunnar, 2010; Tollenaar, Beijers, Jansen, Riksen-Walraven, & de Weerth, 2010), has strengthened the scientific basis for this trend. Behavioral therapy from stimulus-response learning theory to cognitive behavioral therapy unwittingly drifts from a basis in physiologic change in

favor of modification of specific cognitions and behaviors for narrow diagnostic categories. In concert with the integrative approach, behavioral therapy has transitioned into treatments that address psychological events related to self-regulation for the promotion of transdiagnostic outcomes (Hayes et al., 2011). Advances in neuroimaging have fueled the development of new perspectives on brain-body medicine (Lane, Waldstein, Chesney et al., 2009; Lane, Waldstein, Critchley et al., 2009), and the related understandings of the neuroscience of self-regulation serves to increase awareness of the potential mechanisms of adaptive processes through brain structure and functioning (Esch & Stefano, 2010; Heatherton, 2011; Hofmann et al., 2012; Johnstone et al., 2007; McEwen, 2009). Research on neuroscience and cognitive psychology, and on social and personality psychology have been disengaged (Hofmann et al., 2012), only recently beginning to integrate (Baddeley, 2007; Davidson, 2008; Heller et al., 2009; Light et al., 2009; Lutz, Brefczynski-Lewis, Johnstone, & Davidson, 2008; Rosenkranz & Davidson, 2009; Salomons, Johnstone, Backonja, Shackman, & Davidson, 2007).

Progress in self-regulation research may have been impacted by the immense scope of the area of study (Baumeister, Masicampo, & Vohs, 2011) of cognitions, emotions, behaviors, physiologic states, and environmental inputs, each of which influences the other, thereby becoming a study of processes within processes. Yet self-regulation has such a profound effect on all aspects of human functioning and failures of self-regulation are the cause of most human suffering and most health problems. This trend in the literatures may lead to the development of theories that integrate biology and psychology, such as EBT, with the potential for researchers to probe such fundamental questions such as, “What is optimal self-regulatory processing?”, “Can individuals learn

optimal self-regulatory processing?" and, "If that optimal self-regulatory processing becomes a trait, what biologic and psychological outcomes can be shown?" Implicit in EPT, which is based on the integration of the emerging mind-body medicine literature and processes, attempts to outline those processes document that individuals can learn them, and demonstrate trends toward improving their health and happiness.

Neural Basis of Self-regulation

All self-regulatory processing is carried out by the central nervous system, the chief organ of stress responsivity (McEwen & Gianaros, 2010). All thoughts, emotions, and behaviors are orchestrated by neural circuits, coactivations of neurons in patterns of synaptic connections, with nerve cells that are either afferent, transmitting information toward the central nervous systems, or efferent, carrying information away from the central nervous system (Purves, 2007). Circuits that transmit self-regulatory messages are both, and the encoding, activation, reconsolidation, and dominance of these circuits, and their related inputs from the internal milieu and external environment are the focus of EPT (Mitrovic et al., 2011).

The circuits that instantiate responses through detection and responding to stressors and rewards are self-regulatory circuits (LeDoux, 2012b). The activation of self-regulatory circuitry influences the whole brain and body; however, specific structures underlie various aspects of processing to appraise the threat or reward value of the stimulus and direct the corrective response. These regions of the brain that orchestrate self-regulation are highly interconnected (Pessoa, 2008) with other structures and regions. The neocortex, specifically, the prefrontal cortex, coordinates executive functions, including working memory operations, behavioral inhibition, and task-

switching for the modification of emotions, thoughts, behaviors and states (Hofmann et al., 2012; Krendl, Richeson, Kelley, & Heatherton, 2008). The medial and ventromedical prefrontal cortices are thought to be instrumental in the representation and appraisal of emotional stimuli and the anterior cingulate cortex, which is associated with regulation of emotional response (Bush, Luu, & Posner, 2000; Posner, Rothbart, Sheese, & Tang, 2007). Projections from the anterior cingulate cortex closely connect other structures, specifically, the ventromedial prefrontal cortex, insula, amygdala, hippocampus, and basal ganglia. The insula is thought to be involved in interoception (awareness of body states) and experience of emotions, along with self-regulatory functions and motor control.

The amygdala is activated by sensory input through the thalamus, which responds to external threat or to cortical, emotional, or state activation, causing heightened functioning of perceptual centers, and if sufficient threat is perceived, activating the stress response through the lower brain regions. Although the amygdala memory systems encode and store memories of positive and negative emotions, more is known about negative emotional activations, particularly fear memories and survival drives. The hippocampus provides a context for the fear memory activation of the amygdala and associates fear memories with new stimuli (Phillips & LeDoux, 1992). The basal ganglia, including its core, the striatum, are the center of procedural memory or the habit center pertaining to routine processes, cognitions, and behavior.

The neocortical structures and hippocampus encode circuits of explicit memory (conscious), whereas the subcortical (emotional brain) other than the hippocampus consolidates circuitry of implicit unconscious memory. Of particular relevance to EPT is

that the prefrontal cortex (PFC), which enables introspection and reflection ((Bear, Heerey, Keltner, Scabini, & Knight, 2003; Wheeler, Stuss, & Tulving, 1997) and the hippocampus, provides contextual memory that enables an adaptive or maladaptive down regulation or up regulation of activations of the amygdala. There are pathways between the PFC and the amygdala, providing a mechanism for the PFC to downregulate fear memory activation by the amygdala; however, these pathways are not symmetrical. The neuronal connections from the PFC to the amygdala are markedly weaker than the pathways from the amygdala to the cortex and activated fear memories favor subcortical pathways (Johnson, Hou, Prager, & Ledoux, 2011). This facilitates the brain's bias toward stress, and prolonged stress deleteriously impacts the electrophysiological and morphological characteristics of neurons in the areas that influence self-regulation, specifically, the amygdala, hippocampus, and prefrontal cortex (Rodrigues et al., 2009).

Research on subcortical emotional circuits in animals has been conducted for over a century (Ochsner & Gross, 2007); research on human self-regulatory processing is more recent, and although reports initially emphasized neocortical processes, recent interest among researchers has turned to the fear memories encoded in subcortical regions, particularly the amygdala. LeDoux and colleagues (LeDoux, 2012b; Hartley & Phelps, 2010) recently proposed a new conceptualization of the emotional brain based on fear circuitry, with a focus on allostatic circuits that are anchored in survival processes. He raises questions regarding the learning and unlearning of these circuits, examining strategies for reconsolidating fear memories, and differentiating types of allostatic circuits, an area of study that is consistent with theory building in EPT.

Postulate 3. Emotional memories can be adaptive or maladaptive. This self-regulatory circuitry has not changed in over one million years, even though most stress is psychological now. The same response to a physical threat that may have been life threatening and adaptive is now activated in response to psychological threats. The circuits activated may be adaptive (homeostatic), with an effective response returning the organism rapidly to a state of low arousal and positive affect, or maladaptive (allostatic) (Mitrovic et al., 2011) with an ineffective response, prolonging and amplifying high arousal and negative affect.

These homeostatic emotional memories, according to LeDoux, are basic emotions in comparison to allostatic emotional memories, which recruit primitive survival drives in circuitry and function of emotion (LeDoux, 2012a). The allostatic circuits are pernicious in that they are positive feedback loops with no endogenous shut off process, activating prolonged ineffective stress responses, causing an increase in the frequency and duration of the stress response, and the further strengthening of circuitry that encodes maladaptive emotions, cognitions, behaviors, and states (Davidson, 2003, 2005; Davidson et al., 2000; Johnstone et al., 2007). With repeated episodes of stress, the brain develops an allostatic state (Goldstein, 2011; Koob & Kreek, 2007; McEwen, 2003b), a fixed state of stress, which it defends, and which causes or exacerbates most psychological and biomedical problems.

Postulate 4. Positive plasticity of emotional memories can improve health. The brain is plastic and changes in response to experience (Courchesne, Chisum, & Townsend, 1994; Schwarz & Perry, 1994). Changes in the structures of the prefrontal cortex have been shown to promote improved emotion regulation and changes in

subcortical structures, particularly the amygdala (Davidson, 2003, 2005; Davidson et al., 2000; Johnstone et al., 2007). Emotionally intense experiences have been shown to open emotional circuitry for reconsolidation during emotionally vibrant experiences (Schiller, Levy, Niv, LeDoux, & Phelps, 2008; Schiller et al., 2010). Decreasing the strength and dominance of allostatic circuits and increasing the strength and dominance of homeostatic circuits may prevent or treat the allostatic state to promote or establish a homeostatic state, which may have adaptive impacts on a range of psychological constructs and biological markers and, ultimately, on morbidity (Djuric et al., 2008; Hampson et al., 2009; Juster et al., 2010; Logan & Barksdale, 2008).

Implicit in this theory is the primacy of survival drives shared by living beings over the secondary vicissitudes of genetic, epigenetic, and acquired variables on capacity for neural integration and well-being. The circuits that amplify and exacerbate stress arousal and attendant negative affect, and left prefrontal cortex laterality, are the focus of this theory, largely due to brain laterality, favoring the dominance of the amydala-cortical loop in comparison to the cortical-amygdala circuitry and the positive feedback loop and pernicious nature of allostatic circuits.

Self-regulation Interventions

The theory is based on modifying self-regulation. All psychotherapeutic interventions have as their direct or indirect goal the promotion of self-regulation of emotions, cognitions, or behavior (Cozolino, 2010). The self-regulatory processes that support adaptive social and nonsocial responses to life are embedded in the genome as the basis for survival of the species. Early experiences encode self-regulatory circuitry early in life (Calkins, 2010). This circuitry is stored in the least plastic brain areas (Perry

et al., 1995).

Interventions that focus on self-regulation of states of emotion and arousal have been conceptualized as contextual methods (Hayes et al., 2011) of changing cognitive and emotive processing, through methods that enhance awareness, openness, and activity. These therapies have their origins in behavioral therapy (Bandura, 1969; Watson, 1924), which was established more than 50 years ago, and involved two strands, (a) stimulus-response (S-R) learning theory, and (b) functional operant psychology, which drew upon the manipulation of the environmental contingencies. Cognitive meditational concepts were integrated into behavior therapy as a broadening of S-R learning theory (Beck, 1993; Beck et al., 1979). The behavioral tradition evolved to emphasize the structuring treatments for specific diagnostic categories, rather than focusing on fundamental human issues or underlying change models based on physiology.

The contextual approaches share the incorporation of broad, flexible repertoires of responses. Despite their similarities, their theories and practices vary. Mindfulness-based therapies (Kabat-Zinn, 1990, 1994) are based on increasingly focused, purposeful awareness, an open, nonjudgmental, and accepting manner (Baer et al., 2006) to enhance self-management and effective coping. Attentional control therapies, such as learning to be aware of one's breath, focus on metacognitive therapy (Wells, 2000), which at the theoretical level are grounded in the Self-regulatory Executive Function model (Wells & Matthews, 1994). According to that model, a specific cognitive process, cognitive attentional syndrome, involving worrying and ruminating, threat monitoring and ineffective coping strategies, is the cause of most psychological problems (Wells, 2008). Among the contextual therapies is an integrative approach that includes mindfulness

techniques of self-regulation with a therapeutic relationship and behavioral control (Linehan, 1993; Lynch et al., 2007), and Acceptance and Commitment Therapy (Hayes et al., 1999), which integrates mindfulness and acceptance techniques with behavioral activation techniques.

Westen (Westen & Blagov, 2009) proposed a clinical model of regulation which classifies emotional regulation strategies as adaptive versus maladaptive, and explicit verusus implicit. Folkman (2010) describes the interplay between coping strategies and positive affect; whereas Lowewenstein (2009) categorizes intervention research as reappraisal, distraction, and suppression, and eliminating negative versus accentuating positive. Larsen and Prizmic (2009) review the range of strategies for negative affect regulation and positive affect regulation and differentiate state versus trait conceptions of self-regulation. Only Hartley and Phelps (2010) describe self-regulation interventions related to neuronal circuitry in relationship to current self-regulatory treatments, and that view is consistent with LeDoux's documentation of allostatic circuitry and relevant to EBT.

Extinction

Extinction strategies for promoting adaptive self-regulation (Ochsner & Gross, 2007) involve reversal learning through strategies such as distraction and desensitization (Linehan, Bohus, & Lynch, 2009; Ochsner & Gross, 2007). Extinction is based on Pavlovian conditioning in which a previously neutral stimulus is conditioned by experiences of fear, and subsequent exposure to the stimulus elicits a stress response. For example, the conditioned stimulus (CS) that was previously neutral is repeatedly paired with an aversive stimulus or unconditioned stimulus (US) such as shock, and a stimulus-

reinforcer association is encoded as the conditioned fear response (CR). The CS alone activates the CR to a range of symptoms of the activation of stress response systems.

Extinction signifies the decrease in activation of the CR in the presence of the CS. Maladaptive emotions, thoughts, and behaviors occur when the CR of activation of the stress response system persists in response to the CS that was previously neutral in the absence of the CS remains. This ineffective activation persists despite the absence of the contingency of the conditioned and unconditioned stimuli. Research in both humans and animals show that the amygdala serves a primary function in encoding of these associations, with interactions of the hippocampus, which supports encoding, storage, activation, and reinstatement of extinction of these memories, suggesting that extinction is dependent upon an integrated functioning of these brain structures.

Extinction-based interventions for anxiety (Barlow, 2002; Garakani, Mathew, & Charnes, 2006) and posttraumatic stress disorder (PTSD) (Rauch, Shin, & Phelps, 2006) have shown spontaneous or cue-induced recidivism that may be the result of failure to reconsolidate the allostatic circuit. During conditioning, CS-US memory is stored and with standard extinction training (without memory activation), it is thought that a second memory trace is formed, which the CS-US (Schiller & Phelps, 2011) forms, and competes for activation with the initial memory. According to Bouton, existence of the initial memory facilitates the activation of the fear memory with time passage (reinstatement), in response to a stressor (reinstatement) or in a different context, renewal. Bouton (2002) supports the salience to health outcomes of techniques that promote erasure.

Cognitive Regulation

Cognitive regulation strategies have only been studied in humans, as cognitive control of emotion (McClure, Botvinick, Yeung, Greene, & Cohen, 2009) including antecedent-focused strategies that are used prior to an anticipated emotional event and response-focused strategies that are used after emotional activation, including the behavioral and physiological responses (Loewenstein, 2009). The use of cognitive therapies to change emotional responses had its origins in behavioral therapy (Bandura, 1969; Watson, 1924), which was established more than 50 years ago. Initially, behavioral therapy involved two strands, (a) stimulus-response (S-R) learning theory, and (b) functional operant psychology, which drew upon the manipulation of the environmental contingencies.

Cognitive meditational concepts were integrated into behavior therapy as a broadening of S-R learning theory (Beck, 1993; Beck et al., 1979). The cognitive-behavioral tradition evolved to use cognitive strategies to modify behaviors for specific diagnostic categories, rather than focusing on fundamental human issues or underlying change models based on physiology and was followed by the "third wave" of behaviorism (Hayes et al., 2011), which has explored integrative psychological processes.

The cognitive regulation of emotion focuses on decreasing negative affect with recognition that appraisal or contextual interpretation of a stressor can modify the response (Ochsner & Gross, 2008). Investigation of cognitive processing of emotions has been associated with activation of the prefrontal cortex, the related self-regulatory areas, including the anterior cingulated, orbitofrontal cortex, and amygdala (Ochsner, Bunge, Gross, & Gabrieli, 2002). Cognitive reappraisal has been shown to be effective in

downregulating the fear response and changes in activation in these self-regulatory brain structures (Beauregard, 2007; Delgado, Nearing, Ledoux, & Phelps, 2008; Wagner, Davidson, Huges, Lindquist, & Oschsner, 2008), suggesting that executive control of subcortical mechanisms of emotional processing improves negative emotional states. Activation of these regions has been used in cognitive-behavioral therapy for obsessive-compulsive disorder (Schwartz et al., 1996) and PTSD (Bryant et al., 2007).

Active Coping

Active coping involves choosing to initiate strategies that result in decreasing negative emotions and increasing positive emotions; however, relatively little formal evaluation of such emotion and behavior links have been conducted (Hartley & Phelps, 2010). Active coping is linked to conditioning that enables appraisal of the stressor as negative and learning of actions that are adaptive in decreasing stress and increasing reward. This process may be both subcortical and automatic, and cortical and intentional, the latter reflecting the component of active coping (LeDoux & Gorman, 2001) and include both the same brain structures active in extinction interventions and the nucleus acumens associated with reward activation (Rangel, Carnerer, & Montague, 2008), and striatum, which is part of the basal gangla or habit center (Morgenson, Jones, & Yim, 1980). This pathway of projections into the reward and habit centers of the brain is thought to facilitate active self-regulation (LeDoux & Gorman, 2001) in combination with the Pavlovian conditioning associated with decrease in stress associated with the use of the active coping strategy (Cain & LeDoux, 2008). The proposed brain structures that are the sites of mechanisms of active coping during stressful events may be compromised

during arousal, the hyperarousal and dissociation associated with trauma (Anda et al., 2006; Schore, 2009).

Reconsolidation

The most recent technique for promoting adaptive self-regulatory processing is reconsolidation. Until recently, fear memories were thought to be relatively permanent. Experiences encoded in circuitry are consolidated as a neural circuit. Although during the consolidation window during and soon after the memory formation, the circuit is fragile and can be disrupted, after that consolidation period, the memory trace remains, and although open to changes in strength, cannot be erased (Mobbs et al., 2009; Monfils, Cowansage, Klann, & LeDoux, 2009). Recently, research has suggested that with each retrieval of a memory, the circuit is labile and, as the emotional arousal diminishes, the circuit is consolidated or reformed. Instead of weakening a maladaptive circuit or encoding a new adaptive circuit that competes for activation with the maladaptive circuit, the maladaptive circuit is re-encoded as an adaptive circuit, thereby erasing the maladaptive circuit. This reconsolidation of memories presents the potential therapeutic opportunity to unhook the association between the CS-US association and eliminate the conditioned fear response (Schiller & Phelps, 2011).

Animal studies of reconsolidation have shown that fear memories can be erased if reconsolidation is blocked. Research by Nader and colleagues (Nader, Schafe, & LeDoux, 2000) showed that in rats, the CS acquired emotional significance through pairing with an aversive stimulus or US and elicited a fear response or CR, and upon re-exposure to the CS, the fear memory trace was activated. The rats were injected with a protein inhibitor, which blocked reconsolidation, or saline solution, which did not block

reconsolidation. The observation that the rat that had received the reconsolidation blockage demonstrated an absence of conditioned fear in response to the CS, whereas the rate that had received saline solution showed a fear response to the CS, suggesting that fear memories are reconsolidated after activation, a process that can erase the fear memory.

Subsequent animal studies that investigated reconsolidation suggested that the reconsolidation of fear memories is specific and they do not return (Alberini, 2005; Dudai, 2006), lending additional support to the hypothesis that reactivation of fear memories can result in their erasure. The study of reconsolidation has been challenging because of the experimental methods used, involving the administration of a chemical blockage, which is not tenable in humans. The use of propranolol as the antagonist enabled a series of studies in humans (Debeic & LeDeua, 2004; Kindt, Soeter, & Vervliet, 2009), which confirmed the findings of the animal experiments and the erasure of fear memories (Schiller & Phelps, 2011). The use of pharmacologic manipulations evaluated the reconsolidation of fear memories but was not intended for use in treating failures of self-regulation or stress-related pathology. As reconsolidation is a neurophysiologic process of learning through change in neural circuitry in response to experience, the evaluation of the impact of nonpharmacologic experience on memory traces has been explored.

Donald Lewis and colleagues conducted research in the late 1960s (Lewis, 1969; Misanin et al., 1968) on cue-dependent amnesia, subsequently referred to as *reconsolidation*. In contrast to consolidation theory of memory (McGaugh, 1966), in which memories were only labile when initially consolidated, this theory postulated that

retrieval of memory initiates a reconsolidation process. They established research criteria for the demonstration of reconsolidation: (a) the reactivation of the memory by a reminder cue, (b) post-memory formation treatment to alter it, and (c) retest of memory retention after the immediate impacts of the retest have diminished and after closure of the reconsolidation window. Reconsolidation is supported if there is no evidence that the memory is activated outside of the reconsolidation window in comparison to control conditions in which there is no post-memory formation treatment and there is treatment without activation.

Subsequently, researchers hypothesized memory difference with exposure to stress (Lewis, 1969; Lewis & Bregman, 1973; Mactutus, Riccio, & Ferek, 1979), which led to a controversy about cue-dependent amnesia as a response to an arousal rather than a general memory process (Schneider & Sherman, 1968; Squire, 1973). Lewis and colleagues responded to this concern with additional studies, leading to a novel theory of memory forwarded by Lewis: the act of remembering re-opens the reconsolidation period. Instead of short-term memory leading to long-term, rather permanent memory, long-term memory traces upon reactivation again became labile (Lewis, 1979). Subsequent research (Rubin, 1976; Rubin, Fried, & Franks, 1969) involved participants who suffered obsessive compulsive disorder and hallucinations and were subjected to electroconvulsive shock (ECS) and instructed to think about their fear object. Symptoms were favorably altered, whereas when the ECS was administered under anesthesia, they were not, suggesting that stress is associated with rewriting memory. Squire and colleagues (Squire, 1973; Squire, Slater, & Chace, 1976) showed that administering ECS

to depressed participants after memory arousal did not result in amnesia, thus reconsolidation did not occur without concurrent stress.

Research on reconsolidation showed inconsistent results, which is theorized to be an artifact of the memory-system specific differences in learning, including fear memories, episodic memory, and procedural memory (Schiller & Phelps, 2011), with fear memories most salient to self-regulation, and as discussed in this review, heralded by the development of research methods based on behavioral, not pharmacologic manipulation (Monfils et al., 2009).

The research has been slow to emerge, as the techniques required the administration of a protein synthesis inhibitor, which is useful in animals, but not feasible in humans for the treatment of clinical disorders, which requires the activation of memories allowing older memories to transform to new memories, incorporating new information, rather than erasure. Blocking the memory is different from updating a memory to reflect adaptive processes. Using this protocol, rats were given exposure to extinction training during the reconsolidation window exposure to extinction learning 10 minutes after the stress activation. The timing of the reconsolidation process is thought to require 3 to 10 minutes after the memory is reactivated to begin and to last at least 1 hour (Monfils et al., 2009) but less than 6 hours (Duvarci & Nader, 2004; Nader, Schafe, & LeDoux, 2000). In two control conditions, fear memories not reactivated and whose fear memories were reactivated outside the reconsolidation window, fear memories persisted. Return of fear memory occurred in rats exposed to the control conditions, but fear memory did not return for rats that were exposed to extinction learning after stress

activation during the reconsolidation window. This suggested that fear memories were erased by this reconsolidation condition in rats.

This research led to additional studies, designed to begin to answer the question about the use of reconsolidation mechanisms to change the expression of fear memories in humans, including traumatic and emotional events outside the laboratory setting (Schiller, Levy et al., 2008; Schiller & Phelps, 2011). Although there have been recent reports of the reconsolidation of fear memories in humans, two studies used post-reactivation blocker methods consistent with reconsolidation research criteria in PTSD patients (Brunet et al., 2008) using a protein antagonist blocker and behavioral interference (Schiller et al., 2010). Both studies demonstrated erasure of fear memories based on skin conductance tests. In the behavioral interference study, maintenance of the erasure was shown at 1 year.

In contrast to extinction training, which results in the existence of two competing circuits, the reconsolidation of fear memories may have applications in the onset, exacerbation and treatment of stress-symptoms. Schiller and Phelps (2011) commented that when fear-eliciting cues through naturalistic behavioral interference that elicits reward, the fear-eliciting cue may be slower to reconsolidate, as it represents safety. Such exploration may be of particular salience in understanding the prevention and treatment of substance abuse (Koob & Volkow, 2010).

Research on the neurocircuitry of self-regulation, with emphasis on stress arousal and negative affect associated with threat appears to involve a network of brain regions (Hartley & Phelps, 2010; Heatherton, 2011; Hofmann et al., 2012). Self-regulatory interventions on a neuronal level include extinction, cognitive regulation strategies, active

coping and reconsolidation, with only reconsolidation demonstrating erasure of memory, which may decrease risk of spontaneous recovery, reinstatement or renewal (Bouton, 2004; Schiller & Phelps, 2011), a hypothesis that is consistent with EPT.

Emotional Plasticity Theory

Emotional Plasticity Theory, or EPT (Mitrovic et al., 2011; Mitrovic et al., 2008) is based on three postulates: (a) all living beings are driven by survival drives, (b) emotional memory systems evolved to promote survival, and (c) these memory systems can change. The theory integrates models from evolutionary biology, attachment theory, stress physiology, and neuroplasticity.

Stressors

Metabolic stress, physical stress, and psychological stress are moderated by the brain, so that stressors from a range of sources (genetic, epigenetic, environmental) are processed by the central nervous system through self-regulatory circuitry, with the goal of survival of the individual, which favors survival of the species. In any given moment, the complexity and interactivity of stressors are regulated by the brain in an attempt to respond effectively to the perceived level of stress.

As the most fundamental aspect of the homeostatic process, the brain compares the current stimuli or stressor to past experiences to increase chances of an effective response. The brain encodes past experiences in patterns of potentiation of neural circuits. When an emotionally salient stressor arrives in the brain, it is compared to past representations of experience, and the most dominant and similar circuit is aroused. That circuit is activated in time measured in 10,000ths of a second, with an emotional processing (subcortical) phase, a cognitive phase (cortical), and a corrective response,

with the goal of returning to the goal of homeostasis, positive affective states with low arousal. The circuit that fires becomes stronger and more dominant, and more likely to be activated in response to experiences in the future. Competing circuits, which were not aroused, become weaker, less dominant, and less likely to be activated in response to future experience. This dynamic process of plasticity is fundamental to survival of the species and the human capacity to adapt to varying conditions, and to survive.

Self-regulatory Neural Circuitry

The self-regulatory circuitry in humans is so fundamental to survival that it is encoded in the implicit memory (Fitzsimons & Bargh, 2004), not left to chance that explicit memory, which is slower to activate, would not respond effectively. That circuitry is encoded in the subcortical brain, the limbic system and brain stem (emotional brain) during the last trimester of pregnancy and the first few years of life (Calkins, 2010). The in utero environment and the early experiences associated with attachment are thought to encode in the offspring's brain the fundamental neuronal circuit that is the substrate for self-regulation. Those experiences of the parent attuning to the infant and regulating physiological processes of arousal and affect from the whole range of states back to the optimal state for homeostasis of positive emotion and low arousal form the seeds of development, and are predictive of health and happiness (Ainsworth, Bell, & Stayton, 1974; Bowlby, 1973; Schore, 2001).

These circuits may be effective (homeostatic) or ineffective (allostatic) (McEwen, 2007; Mitrovic et al., 2011). Homeostasis is the self-regulation involving change of various parameters by staying the same, the subtle shifting in internal regulatory processing to maintain relative balance. When the stressor has exceeded the homeostatic

threshold, then another process is initiated: allostasis. The body and brain alter a range of response mechanisms in ways that are ineffective and often deleterious. Both responses are encoded in neuronal stress circuits early in life, then triggered repeatedly, becoming more and more dominant, with allostatic circuits offering a positive feedback loop with sustained and amplified stress responses.

Once formed, these circuits tend to persist, as they are stored in implicit memory systems (Perry & Pollard, 1998), and are not conscious and have no source attribution. Current stimuli activate these circuits that encode memories from past experiences, and the individual responds based on that encoded response, even though that circuit may trigger maladaptive extremes in all domains of life.

The brain is anxious, and in an attempt to ensure survival, responds to stimuli preferentially with an allostatic response, so without the capacity to reconsolidate these circuits, which are primarily formed early in life or later during traumatic experiences, these circuits become more and more dominant, and more and more easily triggered (Bargh & Williams, 2007; Johnstone et al., 2007).

Physiological Brain States

Based on axiomatic physiology, the dominant area of the brain in response to a stressor changes as a function of perceived stress. The lability of physiologic brain state is thought to promote the survival of the species. In response to a stressor, a circuit initiates a quick, simple regulatory functioning of the reptilian brain, the emotional arousal and fear-generating response from the limbic brain and the slower, more complex and analytical neocortical brain (Cloninger, 2009; Manna et al., 2010). In response to the activation of this self-regulatory response, the brain determines a state that is

commensurate with that level of perceived threat and the brain area prone to the rapidity of the response that is required becomes dominant. Although the actual number of brain states has not been formally studied, based on observed phenomena in EBT as consistent with the work of Perry investigating the effects of trauma (Perry, 1999), the minimal number of distinct brain states is at least five. Figure 1 depicts the five brain states and the modification in dominant brain area relative to perceived stress.

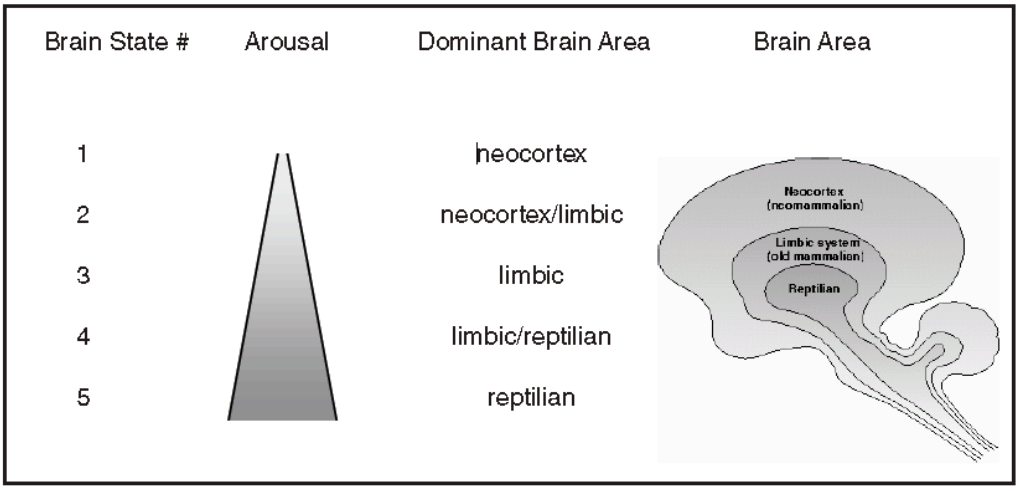


Figure 1. For each Physiologic Brain State, a Different Brain Area is Dominant.

Note. Adapted from: Stress and Dominant Brain Areas: Representation of 5 Brain States, their level of arousal and dominant brain area. In Mitrovic, Frassetto, Fish dePeña, and Mellin (2011), "Rewiring the Stress Response: A New Paradigm in Health Care," *Hypothesis, 9*:1-7 Copyright 2011 by Laurel Mellin.

The allostatic brain states are prolonged and amplified due to the activation and dominance of allostatic circuits, which are positive feedback loops. The brain's protective architecture atrophy, primarily the prefrontal cortex and hippocampus, making the brain more vulnerable to the deleterious effects of stress. The emotional set point of the brain, which it defends due to homeostatic tendencies, may deteriorate and change from the homeostatic range to the allostatic range. A fixed state in allostasis may ensue, in which dominance shifts to more primitive areas of the brain. With limbic and reptilian brain dominance, functions are primarily survival-driven (Perry & Pollard, 1998).

The stress-brain area dominance relationship impacts all domains of life, as the organization of the brain to facilitate survival that is beyond the homeostatic process, and instead, draws upon all systems (Chrousos & Gold, 1992). The brain areas that are dominant determine the extent of deviation from homeostatic states, with the various precise symptoms consistent with the same extent of deviation from homeostatic states, which are associated with less wear and tear, and improved health and happiness. For example, an individual in brain state 4 may have one of various maladaptive emotional symptoms associated with stress, such as depression, anxiety, hostility, dysphoria, or mania.

Although awareness of the specific symptom presented by an individual is an important part of the diagnosis to determine the most effective pharmacologic treatment, in this paradigm, the most important diagnostic criterion is the individual's brain stress area dominance. The problem is the allostatic circuitry, not the presenting symptom; if that circuitry is not modified, the onset of another maladaptive stress symptom, different from the original, may occur. Identifying the problem as a brain state of stress reframes

the treatment plan to promote addressing the root cause, the underlying brain state, and potentially decreasing the risk of symptom substitution. With regard to the above described brain states, there are brain state-related characteristics in the areas of cognition, emotion, relation, and behavior (Anda et al., 2006; Mitrovic et al., 2011). Table 1 depicts the cognitive, emotional, relational, and behavioral characteristics associated with each brain state, which are related to the level of stress arousal and affect consistent with the dominant brain area relative to perceived stress.

Table 1

Physiologic Brain State Characteristics

State (#)	Cognitive	Emotional	Relational	Behavior
1	Abstract	Joyous	Intimate	Optimal
2	Concrete	Balanced	Companionable	Healthy
3	Rigid	Mixed	Social	Moderate
4	Reactive	Unbalanced	Needy/Distant	Unhealthy
5	Irration	Terrified	Merged/Disengaged	Destructive

Note: Each state impacts cognitive, emotional, relations and behaviors, suggesting that therapeutic progress for any specific stress symptom may be impacted by other characteristics of that state. Adapted from: Brain State-related Characteristics. A summary of the cognitive, emotional, relational and behavioral characteristics for each of the 5 brain states. In Mitrovic, Frassetto, Fish dePeña, and Mellin (2011), "Rewiring the Stress Response: A New Paradigm in Health Care," *Hypothesis 9*: 1-7.

Brain Set Point

Although any given episode of stress may not have lasting impacts on the brain, if the self-regulatory dominance is ineffective and environmental stressors are high, they can impact brain structures and functioning. With each episode of allostasis, there is wear and tear and adaptations in the brain and body, and this "allostatic load" contributes to chronic stress (Juster et al., 2010; Koob & Le Moal, 2001; Logan & Barksdale, 2008; McEwen, 2007).

The brain establishes a set point, based on the myriad of factors that impact allostatic load. The emotional brain prefers sameness to a positive state, and if repeated episodes of stress have encoded the brain with a dominance of allostatic circuits, the default state begins to change from homeostatic states to allostatic states. A brain in a fixed state of stress may be the primary cause of most problems, as chronic stress causes a range of morbidities and maladaptive responses, each of which may influence the others (Juster et al., 2009; McEwen & Gianaros, 2010; McFarlane, 2010).

Stress-related Biomarkers and Behaviors

The identification of markers of allostatic load has been the subject of study by many investigators (Djuric et al., 2008; McEwen, 2003a, 2004a). Although there remains controversy regarding many of these markers, others are well-established, and if a brain-based paradigm in health care were to emerge, then medical care may focus on modifying these biomarkers and behaviors with the goal of preventing or treating the allostatic set point of the brain (Mitrovic et al., 2011).

Stress-related Conditions

Biomarkers of allostatic load, if not changed, put the individual at risk of

development pathological conditions. The medications, procedures, and devices used to treat these conditions are expensive and some may alleviate the stress symptom, yet increase overall allostatic load. Emotional plasticity theory (EPT) has described the hypothesized etiology of stress-related conditions, and related treatment. That treatment is emotional brain training (EBT), developed at the University of California, San Francisco (Mellin, 2010; Mitrovic et al., 2011). Recently, there has been more interest in EBT, and scientific research on brain plasticity and related areas has in turn increased interest in the formal evaluation of this method's effectiveness (Epel, Laraia, & Adler, 2010).

Stressors from the internal milieu and external environment activate adaptive or maladaptive self-regulatory circuits, activating arousal of physiologic states and theory psychological mediators, with dominance of circuits promoting changes in allostatic load or set point, which impact stress-related biomarkers and risk of morbidity. The theory-based intervention is directed at changing the self-regulatory circuits with a four-component intervention of self-regulation, allostatic circuitry reconsolidation, a brain fitness lifestyle program and preventive and therapeutic health care.

Recently, there has been more interest in EBT, and scientific research on brain plasticity and related areas has in turn increased interest in the formal evaluation of this method's effectiveness (Epel, Laraia, & Adler, 2010). Figure 2 is a depiction of the theory as outlined above.

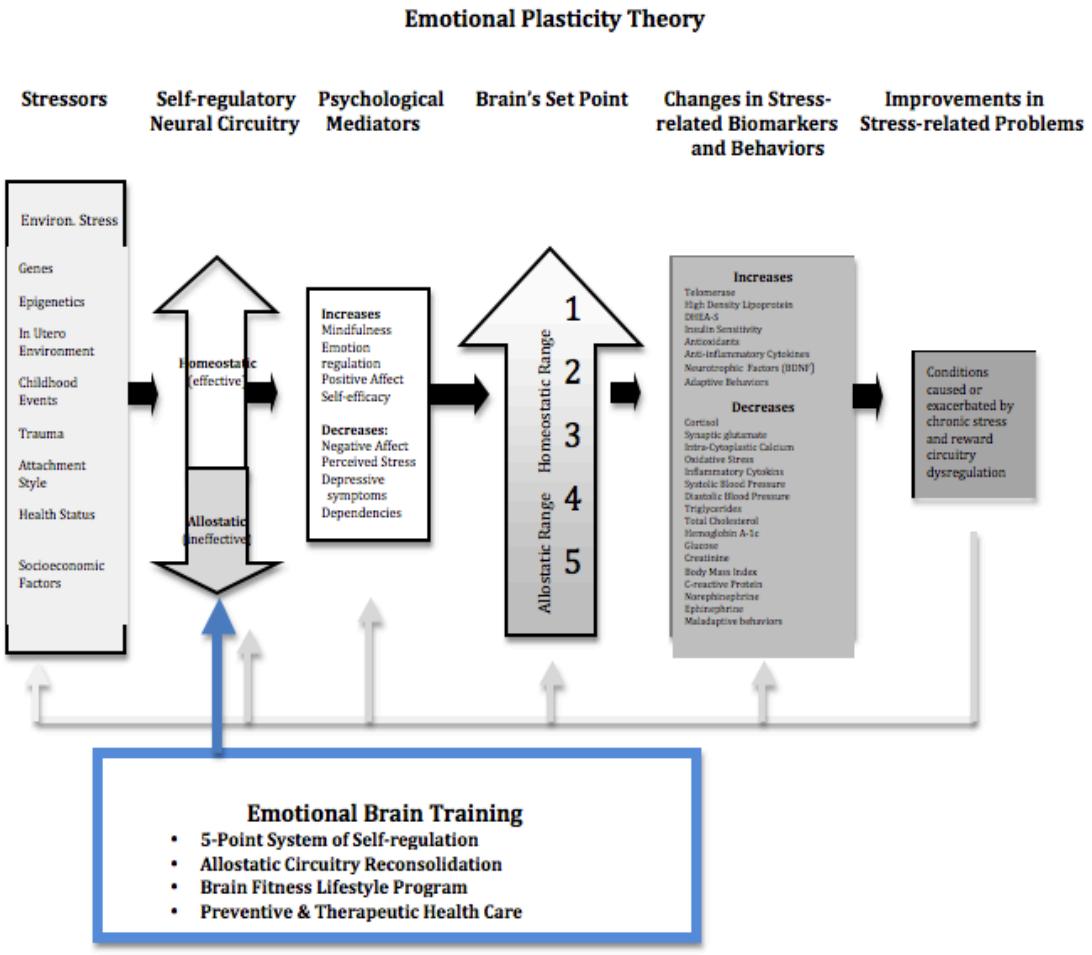


Figure 2. Emotional Plasticity Theory

Note. A visual representation of Emotional Plasticity theory, illustrating the stressors, with the theory-based intervention promoting adaptive plasticity of neural circuitry, psychological mediators, the brain's set point, which influences changes in stress-related biomarkers and problems, thereby promoting and activating self-regulatory neural circuitry.

Emotional Brain Training

The EBT intervention that is delivered by health professionals who are trained in the method, provide weekly group and individual sessions, with support from web-based

educational tools and a manualized program (Mellin, 2011b). It includes an introductory course, which can be implemented for preventive education or as an introduction to the method, preparing individuals with fundamental knowledge and skills in preparation for six progressively advanced courses, which are implemented in small group training by a health professional who is trained in EBT techniques. The goal of the advanced courses is to modify the brain's emotional set point through repeated experiences of active and passive changes in brain state. Integrated into the training are lifestyle changes and health care (Mitrovic et al., 2011).

The proposed study will be based on a 7-week, introductory biweekly program in EBT for stress management and the treatment of the strong emotional drives that promote maladaptive and addictive behaviors (Mitrovic et al., 2011).

The 5-Point System of Emotional and Behavioral Regulation

The investigation will attempt to build on EPT by demonstrating that participation in the introductory training is associated in variables that measure homeostasis. The intervention is based on a self-regulatory procedure, the 5-Point System of Emotional and Behavioral Regulation, which is theorized to increase the frequency and duration of homeostasis (Mellin, 2010; Mitrovic et al., 2011; Mitrovic et al., 2008). The techniques of this system have been designed to mirror the parental responses associated with an authoritative parenting style (Cozolino, 2010) and secure attachment (Ainsworth, Bell, & Stayton, 1974; Bowlby, 1988; Mikulincer & Florian, 2001; Sbarra & Hazan, 2008; Schore, 2000, 2005).

The master technique of EBT is The Check In Tool. It is a process that is hypothesized to engender the experience of feeling seen, heard, and felt, the interaction

that has been theorized to promote a secure attachment (Schore, 2000, 2005) and includes three steps: (a) mindfulness, (b) brain state appraisal, and (c) reappraisal of options of coping.

Check In Tool: Step 1. Mindfulness. The initial elements of the central tool of the method involve a series of processes of focused mindfulness on the internal world (Siegel, 2007) which have been associated with adaptive changes in arousal and affect. These include: diaphragmatic breathing (Gevirtz & Schwartz, 2005; Lum, 1981; Peper & Tibbets, 1994); abdominal breathing awareness, which has been shown to decrease stress (Czapszys, McBride, Ozawa, Gibney, & Peper, 2000; Peper & Tibbets, 1994); postural and facial changes, adopting the posture and facial expression associated with low arousal and positive affect (Brinol, Petty, & Wagner, 2009; Strack, Martin, & Stepper, 1988); decentering (Segal, Williams, & Teasdale, 2002; Teasdale et al., 2000), which integrates the attachment schema triad: feeling seen through the use of decentering or stepping outside the experience and observing it (Safran & Segal, 1990); feeling felt through emotional self-awareness; feeling heard by intentional use of a nurturing inner voice; and appraisal (Folkman, Lazarua, Gruen, & DeLongis, 1986; Lazarus, 1984). It reflects mindfulness, the observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience (Baer et al., 2006).

Individuals are trained to pause for 2 minutes hourly and to be curious, open, accepting, and loving (Siegel, 2007), using these techniques in this order: (a) diaphragmatic breathing (Gevirtz & Schwartz, 2005), or abdominal breathing awareness, which has been shown to decrease stress (Czapszys et al., 2000; Peper & Tibbets, 1994); (b) propioceptive posture, adopting the posture and facial expression associated with low

arousal and positive affect; and (c) the attachment schema triad: feeling seen through the use of decentering or stepping outside the experience and observing it (Safran & Segal, 1990), feeling felt through emotional self-awareness, and feeling heard by intentional use of a nurturing inner voice.

Check In Tool: Step 2. Brain State Appraisal. The second step in The Check In Tools is brain state appraisal and reappraisal of options based on problem-focused and emotion-focused coping and appraisal (Folkman et al., 1986; Lazarus, 1984). Options include compassionate acceptance of brain state or use of tools to attempt active revision of that brain state. The state appraisal is based on the EBT 5-Point System of Emotional and Behavioral Regulation. In this system, the brain state is assessed based on cognitive, emotional, behavioral, and sensory awareness.

The perceived states are numeric, ranging from 1 (low arousal and positive affect) to 5 (high arousal and negative affect). After appraising the state, with the previously mentioned approach of curiosity, openness, and compassion, the individual chooses either to accept their state or use the state-based technique, which is hypothesized to provide optimal self-regulation, based on mirroring the attunement and resiliency of an authoritative parent who provides a secure base and attunes to the infant through the range of states, coregulating to a state of adaptive arousal and reward circuitry activation. Table 2 compares dyadic regulation associated with an authoritative parenting style and secure attachment with the theory-based intervention tools for self-regulation pertaining to each brain state.

Table 2

Comparison of Dyadic Regulation and Self-regulation (EBT tools)

State (#)	Dyadic Regulation	Self-regulation
1	Dyadic amplification of positive affect	Self-amplification of positive affect
2	Parental awareness of feelings and needs and appraisal of need for support	Self-awareness of feelings and needs and self-appraisal of need for
3	Elicit expression of negative feelings	Self-expression of negative feelings
	Negative affect and arousal decrease decrease	Negative affect and arousal decrease
	Elicit expression of positive feelings	Self-expression of positive feelings
4	Narrative of stressor	Narrative of stressor
	Elicit negative feelings	Self-expression of negative feelings
	Identify and modify maladaptive maladaptive expectations	Self-identify and modify maladaptive expectations
5	Distraction, redirection reassurance	Distraction, redirection, reassurance

Note: Comparison of hypothesized brain-state specific processes of self-regulation associated with secure attachment and brain-state specific self-regulatory tools of emotional brain training.

Shown in Table 3 are brain-state based neurophysiologic processes and the corresponding processes promoted by EBT Tools, suggesting coherence of state-based neurophysiologic processes and the cognitive and emotional processes specific to each

state-based tool.

Table 3

Comparison of Neurophysiologic Processes and Processes Promoted by EBT Tools

State (#)	Neurophysiologic Processes	EBT Tools
1	Very low arousal facilitates flexible abstract thoughts of compassion, which activate reward circuitry.	Abstract thoughts of compassion, which activate reward circuitry.
2	Low arousal facilitates awareness of dominant feeling and corresponding needs.	Identify dominant feeling, and corresponding needs.
3	Moderate arousal causes slight dysregulation of emotions: Express negative emotions. Arousal decreases. Express positive emotions.	Express negative emotions. Arousal decreases. Express positive emotions.
4	High arousal causes dysregulation, hyperarousal or dissociation and activation of implicit memory encoded during stress. Identify and revise maladaptive expectations.	Narrative of stressor Express negative emotions. Identify and revise maladaptive expectation.
5	Very high arousal causes full-blown stress response, cognitive rigidity, redirect, reassure or distract.	Repetitive brief phases to redirect, reassure or distract.

Note. Comparison of brain-state specific neurophysiology and brain-state specific emotional brain training processes to improve self-regulation.

The rationale for brain state appraisal is based on the observation that high levels of arousal may cause prefrontal cortex functioning to be so rigid and emotional brain reactivity so extreme, that the effectiveness of self-regulatory processing by mindfulness may be limited. In addition, self-reflections based on the range of symptoms of each of the five brain states may enhance self-acceptance and improve the effectiveness of strategies to facilitate self-regulation. This identification of brain states is based on axiomatic physiology and evolutionary biology. To promote the survival of the species, the brain has evolved into an organized hierarchy, which includes the simple, quick, regulatory functioning of the reptilian brain, the emotional arousal and fear-generating limbic brain, and the slower, complex and analytical neocortical brain (Cantor, 2009; Cloninger, 2009). In response to the activation of self-regulatory circuitry, the brain establishes a state in which a specific brain area becomes dominant (Manna et al., 2010).

Check In Tool Step 3. Reappraisal of Options for Coping. In EBT, after mindfully attuning to the state and appraising state, the individual reappraises coping options, choosing either to compassionately accept the state, or to actively change it using brain-state based techniques.

Acceptance of State

Acceptance of state in EBT is a compassion-focused technique thought to generate emotions associated with secure attachment (Schore, 2005). This process involves the individual observing their own brain state with curiosity and without judgment, accepting their state as coherent and reasonable based on their external and internal environments. This may increase positive affect, which may broaden attention and behavioral and cognitive repertoires and flexibility (Fredrickson, 2004; Garland et

al., 2010).

Active Change of State

In states of arousal, prefrontal cortex functioning is more rigid and less effective, making acceptance of state more challenging. In addition, use of the coping strategy of active change of state may decrease the duration and extent of allostasis. Allostatic states are positive feedback loops, which are prone to persistence or amelioration by external coping mechanisms, such as overeating. Providing participants with the option of using tools to actively modify their state may improve psychological and physiological mediators and biopsychosocial outcomes. The neuroscience concepts of EBT postulate that intentional change of brain state is facilitated by the use of brain-state specific techniques. Based on axiomatic physiology, the dominant brain area changes with level of arousal, suggesting that self-regulatory processes may vary based on state.

The EBT techniques are hypothesized to facilitate self-regulation based on the processes of dyadic regulation, which are associated with secure attachment. With each episode of awareness, attunement, and state appraisal, EBT practitioners may choose to accept their state with compassion; this may reduce arousal and improve affect. Alternatively, they may use the brain-state based technique, which mirrors secure attachment for each state of arousal and affect to actively change their brain state. This practice is hypothesized to improve self-regulation, particularly in states of extremes of arousal and affect.

The brain state-specific tools are hypothesized to mirror the authoritative parenting style (Baumrind, 1991) that has been associated with secure attachment (Ainsworth et al., 1974; Bowlby, 1988; Schore, 2000) and may internalize the structures

of a secure attachment style (Frick-Horbury, 2001) related to self-regulation, and the ability to maintain flexibly organized behavior in the face of high levels of stress (Schore, 2005, 2009; Siegel, 1999). These cognitive and emotional processes are consistent with neurophysiology and the association of extremes of emotions and cognitions and arousal (see Table 1).

Reconsolidation of Allostatic Circuits

Neural circuits of self-regulation are stored in a state-specific memory, so that memories cannot be reconsolidated unless one is in the approximate level of stress in which it was encoded (Anda et al., 2006; Perry, 1999). In stressed states, self-directed neuroplasticity is more challenging because it is the prefrontal cortex's focused and flexible attention and use of the tools, which rewires those circuits (Heatherton & Wagner, 2011).

During stress, the prefrontal cortex is less effective in self-directed neuroplasticity, and without effective tools, the brain states of stress activate the circuits; arousal can be so intense that the individual's attention to reconsolidation is decreased (Delgado et al., 2008; Hartley, Fischl, & Phelps, 2011; Phelps & Sharot, 2008; Schiller & Phelps, 2011). Techniques in EBT provide methods that are hypothesized to reconsolidate circuits stored during stress, including those that promote false associations and false generalizations. The circuitry stored in these brain areas was thought to be immutable after childhood (Perry, 2008; Schore, 2009), discouraging theorists from identifying modifications in that circuitry as the focus of intervention (Hartley & Phelps, 2010; Schiller & Phelps, 2011). Recently, emotional circuits have been shown to be modifiable in adults (Butler et al., 2007; Delgado et al., 2009; Schiller et al., 2010;

Schwartz et al., 1996).

Brain Fitness Lifestyle Program

Neuroplasticity is influenced by lifestyle factors, particularly exercise (Ding, Ying, & Gomez-Pinilla, 2011; Knaepen, Goekint, Heyman, & Meeusen, 2010; Lin et al., 2012), nutrition (DiLeone, 2011), and sleep (Havekes, Vecsey, & Abel, 2012; Shepherd, 2012). Some research suggests that these lifestyle factors impact emotional plasticity, particularly sleep (van der Helm, 2011). The EBT intervention includes a comprehensive program for lifestyle change that is modulated to brain state, in order to balance acceptance and change. The program does not separate brain and body, viewing inactivity, maladaptive nutritional behaviors, and poor sleep habits as sources of stress, comparable to situational stress or the arousal of memories of trauma. The program emphasizes natural sources of pleasure and lifestyle change that are consistent with evolutionary biology (Frassetto et al., 2009; Jonsson et al., 2009).

Preventive and Therapeutic Health Care

Health problems can increase metabolic stress, physical stress and emotional stress (Bondia-Pons et al., 2012; Hamer & Malan, 2010; Logan & Barksdale, 2008; McFarlane, 2010) and health care, including medication use (Ruiter et al., 2012; Slomski, 2012) are related. The inclusion of health care monitoring and referral in EBT is consistent with the emerging field of integrative medicine, treating the whole person (Maizes, Rakel, & Niemiec, 2009; Ullman, 2010). EBT intervention is delivered by health professionals who may or may not have medical training, so the program materials do not include specific information regarding preventive of therapeutic health care, but recommend that participants access health care and monitor biomarkers regularly (Djuric

et al., 2008; Juster et al., 2010; Lin et al., 2010).

Summary

EPT draws from emerging understandings that self-regulation has a neural basis (Beauregard, 2007), which suggests the efficacy of an integrated approach to adaptive neural plasticity (Ochsner et al., 2009; Stein, 2008) and the modifiability of this circuitry (Butler et al., 2007; Delgado et al., 2009; Schiller et al., 2010; Schwartz et al., 1996). An intervention that is based on EPT has shown some evidence of improved outcomes in stress-related biomarkers (Mellin et al., 1997; Mellin et al., 1987a). This will be the first report of psychological constructs that are potential moderators and mediators. This area of study will support researchers in understanding how the EBT intervention works, and the contributors to changes in these constructs, which may cause change. At the current time, EPT is a unique conceptualization of relationship between emotional memories and health, which describes the reconsolidation of the whole range of self-regulatory circuits from an integrated neuroscience perspective.

The EBT intervention has demonstrated improved stress-related health indices and maladaptive behaviors. An uncontrolled observational study of EBT on 22 adult overweight participants that worked at a medical center or lived in the surrounding community and participated in a mean of 18 two-hour weekly EBT sessions, was conducted at the University of California, San Francisco. Data were collected at baseline, 3, 6, 9 12, and 24 months, and showed significant improvements at 24 months for exercise, blood pressure, and Body Mass Index (Mellin et al., 1997). Measures of depression obtained by using the Beck Depression Inventory: Short Form (Beck & Beck, 1972) were available for 12 subjects, and although the trend observed was improvement

in depression, the sample size was too small for the change to reach statistical significance. Studies of nonsurgical weight management interventions have consistently shown regression to baseline weight levels within 1 to 2 years after treatment. The initial study had shown sustained decreases in Body Mass Index at 2-year follow-up. An analysis of 16 individuals for whom data were available at 6-year follow-up showed significant improvements in all constructs, including depression (Fernandes et al., 2010). Instead of regressing to pretreatment weight levels, mean sustained weight was significantly and meaningfully lower than baseline levels.

University of Illinois at Chicago researchers (Mitrovic et al., 2011) conducted a retrospective pretest design study, using a mailed survey sent to all subjects who had completed at least 1 year of EBT during the last 2 years. With an 86% response rate, 134 participants responded to the survey, and reported significant improvements in maladaptive behaviors (overeating, alcohol use, smoking, overspending, and overworking) and improvements in blood pressure, obesity, and physical activity. A clinical trial of 244 veterans enrolled in a smoking cessation program found that among 11 strategies studied, an EBT technique was the most positive, related to quitting smoking at 1 year, self-reported data that was validated by improvements in a nicotine biomarker (Duncan, Caramody, Hudes, & Simon, 2005). This EBT technique is one aspect of the 5-Point System of Emotional and Behavioral Regulation, and trains individuals to identify their feelings and their corresponding needs, and to check for their need to ask for support. This fundamental brain process associated with homeostatic circuitry activation was the only strategy evaluated that directly accessed emotional processing.

A gap exists within the literature, as the theory has not been formally studied. Mitrovic and associates (Mitrovic et al., 2011, 2013) have called for research on the association between participation in the theory-based intervention and trends in measures of biomarkers and psychological constructs. The proposed preliminary report on mechanisms of action the EBT intervention will provide initial data upon which to begin to build a conceptual framework of EPT.

Chapter 3: Research Method

The purpose of the sequential mixed methods study is to provide an initial evaluation of mediators of EPT by determining the influence of the EBT intervention on stress-related psychological and physiologic measures in a sample of obese adults. The study objective is to provide an initial investigation of the overarching theory of EPT, how self-directed plasticity of self-regulatory circuits mediates adaptive changes in stress-related psychological and physiologic measures and improves health (Mitrovic et al., 2011; Mitrovic et al., 2008). A mixed methods research design was chosen for this investigation because traditional quantitative methods are limited in their ability to evaluate the complexity of convergent trends in a confluence of psychological constructs and physiologic biomarkers (Tashakkori & Teddlie, 2010; Creswell, Klassen, Plano Clark, & Clegg Smith, 2011; Mertens, 2010). EPT is grounded in physiologic-based changes, however, not all physiologic changes that are salient to changes in stress-related biologic and psychological factors can be measured by quantitative methods (Djuric et al., 2008; Juster et al., 2010). This design is appropriate to the study purpose in providing an initial formal investigation of the overarching theory of EPT, changing emotional memories that constitute self-regulatory processing to decrease the frequency and duration of stress arousal to improve a broad range of stress-related biomarkers and psychological constructs and, ultimately, health status.

This design is consistent with fundamental aspects of research methods and design (Miles & Huberman, 1994; Saldana, 2009; Trochim & Donnelly, 2008) and best approximates the optimal design of a double-blind controlled clinical trial randomized, double blind, placebo controlled clinical trial for evaluation of clinical interventions

(Spodick, 1982). It minimizes risk to humans by providing preliminary data based on participation in the theory-based intervention only. The measures include both biological and psychological measures, consistent with allostatic load theory (Juster et al., 2010; Koob & Le Moal, 2001; Logan & Barksdale, 2008; McEwen, 2007).

Mixed methods research can assess the complexity of change, providing more insight into the psychological phenomena and exploring subtle but important concepts, which may enable researchers to gain deeper insight into intervention-associated changes. A sequential mixed methods approach that integrates qualitative and quantitative approaches in an integrated initial report (Mertens, 2010; Tashakkori & Teddlie, 2010) will increase confidence in the findings of the study, specific to the psychological constructs that are investigated, as a preliminary report of potential mediators of change and intervention practice.

The design is appropriate in that it is situational, in that the population studied is one in which the need for a treatment for stress had been identified by the health department and efficient, avoiding an unnecessarily high number of participants engaged in the evaluation, long-term treatment or data collection or extensive collection of biomarker data. The findings from both components of the investigation will be reported to determine trends in change of the variables consistent with adaptive self-regulation and decreases in stress arousal and negative affect. A confluence of findings from the qualitative and quantitative data would build theory and improve understanding of the intervention.

The quantitative component of the proposed study provides a preliminary report of mediators of EPT with the independent variable of a 7-week application of a theory-

based intervention that has demonstrated improvement in stress-related outcomes (Mellin et al., 1997; Mellin et al., 1987a; Simon et al., 2009) delivered to a convenience sample of 36 overweight and obese adults, which was sponsored by the Washington County Health Department (WCHD) in Maryland. The dependent variables are stress-related psychological constructs and biomarkers. The study will include a first sequence quantitative component based on archival data from this study and includes three observations, including baseline, posttreatment and follow-up of participants who were randomly assigned to treatment immediately or treatment delayed.

The variables and their directional trends that are consistent with theory are: improvements in mindfulness as measured by the Five Facet Mindfulness Questionnaire (FFMQ); improvements in emotion regulation as measured by the Emotion Regulation Questionnaire (ERQ); decreases in perceived stress as measured by the Perceived Stress Scale (PSS); decreases in depressive symptoms as measured by the Center for Epidemiologic Studies Depression Scale (CESD); increases in positive affect and decreases in negative affect as measured by the Positive and Negative Affect Scale (PANAS); improvements in self-efficacy as measured by the General Self-efficacy Scale (GSS); decreases in food dependence as measured by the Yale Food Addiction Scale (YFAS); and decreases in obesity as measured by Body Mass Index, and decreases in blood pressure.

The qualitative component of the study will provide the second sequence of analysis, based on a 21-item open-ended survey questions (see Appendix B) with response boxes completed by the EBT Providers who facilitate the theory-based intervention. The survey was developed by the researcher and will use an unstructured

response format (Tashakkori & Teddlie, 2010; Trochim & Donnelly, 2008) and probe participant perceptions of EBT intervention associated changes in the two self-regulatory constructs and the five stress-related psychological constructs assessed in the quantitative component of the study. The survey will be reviewed by an expert panel of researchers who study EPT for face validity and the instrument will be repeatedly revised until the panel determines that the instrument demonstrates sufficient face validity.

Participants will be a criterion purposeful sampling (Patton, 2001) of EBT Providers (*N*=5) who facilitated or supported the facilitation of the interventions upon which the archived quantitative data were collected. The participants will complete the 21-item EBT Provider Survey (see Appendix B) after executing a consent form (see Appendix D), which will be transmitted electronically to the participants, then returned to the researchers through de-identified transmission. Content analysis of responses will be analyzed (Miles & Huberman, 1994; Saldana, 2009) using Atlas.ti qualitative data analysis software, with codes for the constructs emerging inductively from the data and theme tables developed from these data.

The results of the qualitative analysis would vary based on the results of the quantitative component of the study, having a more important role if the data demonstrated that the intervention was not successful in promoting adaptive changes in stress-related constructs. Additional questionnaire items focus on the educator's perception of the usefulness of various aspects of the intervention.

The research questions for this study are: (a) does the theory-based intervention cause improvements in self-regulatory processing (mindfulness and emotion regulation)? (b) does this intervention cause improvements in stress-related psychological variables

(perceived stress, depression, positive and negative affect, self-efficacy, and food dependence)? (c) does it cause improvements in measures of stress-related physiological and anthropometric variables (Body Mass Index and blood pressure)? and d) do the subjective responses of the EBT Providers confirm the findings from the qualitative component of the study for self-regulatory and psychological variables?

Both the quantitative and qualitative components of the study will provide data to examine these questions. The first three hypotheses will be addressed by statistical tests to determine if the data support rejecting or not rejecting each hypothesis. Data on stress-related measures, specifically, that obese adult participants in the theory-based intervention will be evaluated compared to waitlist control subjects and demonstrate significant improvements in stress-related variables. The fourth hypothesis will be analyzed using qualitative analysis processes to demonstrate trends, which either support or fail to support the hypothesized intervention-associated changes based on the qualitative component of the study in self-regulatory and stress-related psychological variables. The convergence of quantitative and qualitative data with trends in the direction that is consistent with decreased stress may result in the rejection of the null hypotheses and provide qualitative information to reflect on potential improvements in the theory-based training program.

This chapter will begin with a description of the study design and justification for the design, including elaboration on the appropriateness of the design to accomplish the goals of the study. A review of the population, the definitions of the variables that will be studied and the instruments used, and a summary of the data collection, processing and analysis plan will be provided. The chapter will conclude with a discussion of the

methodological assumptions, limitations, and delimitations, a review of ethical considerations, compliance with standards for conducting research with human subjects, and a summary of the key concepts and relevant citations from the salient literatures upon which this study builds.

Research Method and Design

This study is a mixed methods design, including a dominant component of the study that is quantitative (Jackson, 2009; Trochim & Donnelly, 2008) and a confirmatory component of the study that is qualitative (Creswell et al., 2011; Mertens, 2010). Following are descriptions of the rationale for the selection and design of each study component.

Quantitative component. The quantitative component of the study will be based on the analysis of archival data of a waitlist controlled counterbalanced quantitative design study (Subak et al., 2005). After blocking for pretest BMI, EBT Providers randomly assigned 36 participants to treatment now (test group) versus delayed treatment (control group). Figure 3 is a display of the design of the quantitative component of the study, including the random assignment, condition applied to each group in Tx Phase 1 and Tx Phase 2 and observations collected at baseline, post-Tx Phase 1 and post-Tx Phase 2.

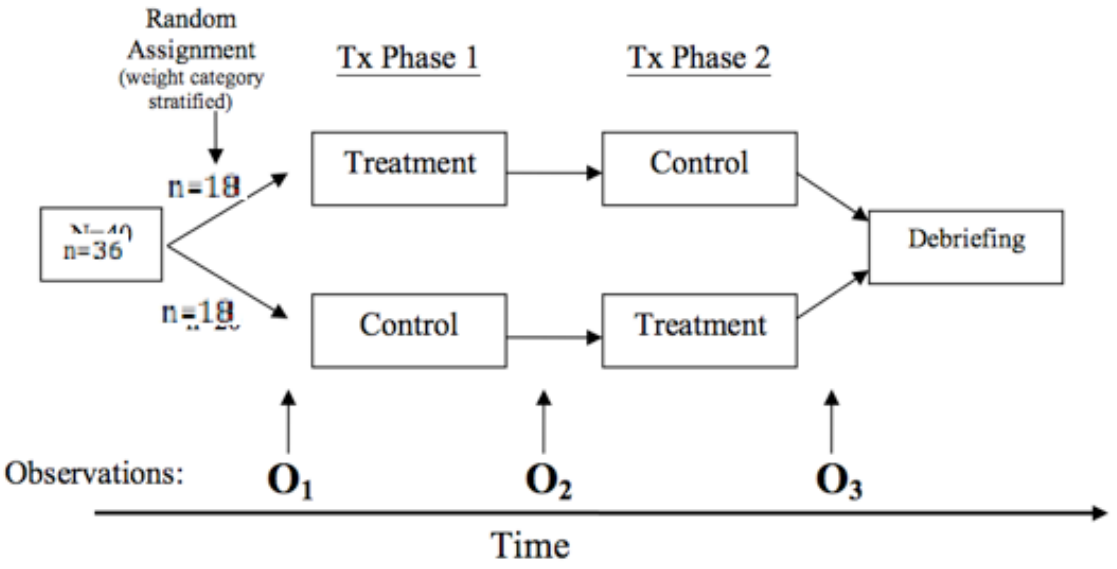


Figure 3. The Counterbalanced Design of the Quantitative Component of the Study

Note. The counterbalanced design begins with random assignment to treatment now or treatment in 8 weeks. Tx Phase 1 provides a control condition for the shared environment. Tx Phase 2 allows for observation of a second wave of treatment and monitoring of the post-treatment changes in the group that received immediate treatment.

The rationale for the design is that it is best approximates the "gold standard" randomized, double blind, placebo controlled clinical trial for evaluation of clinical interventions (Spodick, 1982). As a first report of EPT, it would be premature to randomly assign participants to the theory-based intervention and another stress management intervention, which would control for intervention exposure because feasibility and preliminary benefits had not been established (Cozby, 2009). The

proposed analyses are a series of 3 (measures at baseline, 8 weeks, and end of study, repeated measures) x 2 (test vs. control, between) with pretest BMI as a covariate univariate ANCOVAs for each dependent variable. This 2 x 3 design has six cells. Participants were blocked on baseline BMI prior to random assignment, and pretest BMI will be used as a covariate. The test group receives the EBT treatment between baseline and 8 weeks; the control group receives the EBT training between 8 weeks and end of study. Both groups are assessed at each of the three measurement times. Descriptive statistics will be provided for all 6 cells in design.

This 2 x 3 design an extended pretest/posttest design (Cohen et al., 1995; Subak et al., 2005; Trochim & Donnelly, 2008). The pretest/posttest between-group design using ANCOVA (Subak et al., 2005) is most appropriate as the study design and will provide the internal validity of a random assignment repeated measures design controls for the shared environment. Most initial studies are repeated measures waitlist control design, in which the second observations, followed by debriefing, would conclude the experiment. The present design is extended by treating the control group and adding a third measurement at the end of the study.

By comparing the test and waitlist controls at baseline, the researcher can ascertain the extent to which the groups are equivalent at baseline, confirming that the random assignment to the two groups was successful (Cozby, 2009; Trochim & Donnelly, 2008). This cross design rules out double blind procedures; however, the design of the quantitative study supports adequate internal validity because of the random assignment. The advantage of the quantitative design is to control for between-subject differences to increase power. Finally, the design is appropriate, based on the sample and

sampling method. Also, the postulates of EPT depict an approach to intervention of changing self-regulatory circuitry to modify allostatic load; research on allostatic load research has used quantitative approaches as most stress-related measures are biologic (McEwen & Gianaros, 2011).

The study protocol was approved by the Institutional Review Board, State of Maryland Department of Health and Mental Hygiene, and the cooperation of the Washington Country Health Department has been supported (see Appendix C). The intervention was conducted by health professionals who are EBT Providers and had completed one year or more of part-time training in the delivery of the theory-based intervention. They facilitated 14 semi-weekly 1.5 hour sessions based on the program, which is manualized (Mellin, 2011b, 2011c). The educators and other health professionals met weekly during the study period to discuss the protocols and participant responses to improve their fidelity to the protocols and their clinical skills in the EBT intervention. The content and process of the intervention sessions included: stress tools (60 minutes), stress management lifestyle change (20 minutes), and goal setting (10 minutes). Homework between sessions included: (a) monitoring progress in stress tools, (b) monitoring stress management lifestyle changes, (c) accessing social support by telephone with another program participant, and (d) using program materials involving a workbook and Internet-based videos. Both groups received the same intervention, with the test group receiving the treatment at baseline and the control group receiving the treatment 7 weeks later. All materials and services were provided without cost to participants and supplied by the WCHD.

The test group participated in the intervention during the first phase of the study and received no formal treatment by the staff during the second phase of the study. Data were collected at baseline, post-Phase 1 (week 7) and post-Phase 2 (week 14) on seven self-regulation and stress-related psychological constructs and biomarkers (blood pressure and Body Mass Index) and were archived. The archived data will be transmitted to the researcher electronically and analyzed. The de-identified archived data set will be transferred to the researcher, based on this quantitative pretest/posttest between-group design who will analyze the data from using ANCOVA (Subak et al., 2005) for measures of the psychological constructs and biomarkers. Findings will be reported to the EBT Providers and included in the dissertation.

Qualitative component. The qualitative arm of the study expands the scope of the report to include open-ended responses from facilitators of the theory-based intervention. The data collected will be used to document their perceptions of change in the stress-related psychological constructs and illuminate essential aspects of change in the self-regulatory process or stress-related psychological variables using established qualitative methods (Marshall & Rossman, 2010; Miles & Huberman, 1994; Saldana, 2009). The qualitative data will be based on a 21-item open-ended survey questions (see Appendix B) with response boxes completed by the EBT Providers who facilitate the theory-based intervention. The survey was developed by the researcher and uses an unstructured response format (Tashakkori & Teddlie, 2010; Trochim & Donnelly, 2008). This survey probes three aspects: (a) observation of participant change in each construct, (b) opinion of intervention aspect helpful in change in each construct, and (c) opinion of intervention aspect not helpful in change in construct for two constructs of self-regulatory

processing and five constructs of stress-related psychological variables. In addition, the survey includes items that probe perceptions of the usefulness of intervention aspects for each of the self-regulatory and psychological constructs evaluated in the quantitative component of the study. This survey will be validated by an expert panel of researchers who study EPT for face validity (Meltzoff, 1997) and the feedback will be used to refine the survey questions. Revisions in the survey questions will be reviewed by the expert panel and revised by the researcher until the panel concludes that the survey demonstrates sufficient face validity (Cozby, 2009). The qualitative data will be organized into theme tables and no statistical data will be used, however the data shown on these theme tables will tends to confirm or not confirm the hypotheses of the quantitative component of the study.

Participants

This study includes two samples, a public health population in Washington County, Maryland, and EBT Providers associated with the study that was sponsored by the WCHD. What follows are descriptions of the populations for both samples, including recruitment, sampling, and participant characteristics.

Quantitative component. For the quantitative component of the study, a nonprobability convenience sample of 36 participants within a public health population was used because the rigorous procedures for data collection provided an archival data set more reproducible than choosing a population from a bariatric physician practice, and may be more representative of the population (Martinez, Gonzalez, Vicente, van-der Hofstadt Roman, & Rodriguez-Marin, 2012). The subject number was determined by the researchers who designed the quantitative component of the study based on G*Power

analysis of .83, which suggested that this sample size would provide sufficient sensitivity to detect the treatment effects studied (Jackson, 2009; Trochim & Donnelly, 2008).

Adults were recruited through media outlets and flyers posted in the Hagerstown, MD area, which were similar and consistent with previous promotional efforts for this program in its delivery by WCHD. Recruitment was aimed at overweight and obese adults who were stressed and wanted to control the effects of stress on their weight and eating. Inclusion criteria were: (a) a Body Mass Index (BMI) of 25-40; (b) not pregnant; (c) 18 years of age or older; (d) available to participate in the intervention based on the schedule of both treatment offerings; (e) willingness to make lifestyle changes to manage stress; (f) be English literate; and (g) able to access communications through public or private telephones and the Internet.

The inclusion criteria of adults who were overweight or obese was determined as the theory-based intervention research had been conducted on this population (Mellin et al., 1997; Mellin et al., 1987a) and obesity is the most common stress-related problem in the US (Flegal et al., 2010). The relationship between stress and weight has been well-established (Dallman et al., 2007; Mietus-Snyder & Lustig, 2008). Medical treatment rather than education, including training in self-regulatory skills, is indicated for participants whose BMI is 40 or higher (extreme obesity) (National Institute of Health, 2011). The subjects were stratified in random assignment based on weight category (BMI > 26–35 and BMI > 35–40) as extent of deviation from a non-obese BMI is a marker for allostatic load (Djuric et al., 2008; Juster et al., 2010) and may be a confounding variable that would decrease validity of the findings.

Children and adolescents were excluded from participation in this study as the intervention was not designed to treat their developmental needs (Holterman, Le Holterman, & Browne, 2012; Washington, 2012) and pregnant women were excluded as the intervention does not integrate strategies based on the special needs of gestation (Hardt & Gold, 2011; Power & Schulkin, 2011). Other applications of the theory-based intervention have been developed for these populations (Mellin, 2008; Mellin & Testa, 2010). English speaking and access to telephone and Internet communication were inclusion criteria because the intervention includes transmission that is dependent upon these capacities.

These study selection criteria were imposed in addition to the standards of usual care based on the WCHD protocol for screening participants in all sponsored educational programs. This screening is implemented to decrease risk of participation, and it was conducted through interviews of the subjects by trained EBT Providers, and it included self-reported health-related problems. Disclosures of conditions were responded to by referral to health department services or private professional services for problems and the potential exclusion from the study if situational stress or serious mental or health problems were identified. Measurement of weight, height and blood pressure were conducted for screening purposes, and individuals who demonstrated blood pressure greater than 90 mmHg diastolic blood pressure and/or 140 mmHg systolic blood pressure were advised to follow up with their health care provider or given a list of providers for follow-up. Potential participants attended a 30-minute orientation session, which was delivered by EBT Providers and located at WCHD offices in which the intervention was described as a program to address stress, eating, and weight. Participants were not

blinded to study hypotheses. In order to obtain 36 participants for this report, 55 individuals were screened.

Qualitative component. Participants will be recruited to participate in the qualitative component of the investigation, with the inclusion criteria of educators who facilitated or supported the facilitation of the intervention (*N*=5) in affiliation with EBT Providers. A criterion purposeful sample will be used, with the criterion for inclusion being: (a) engagement in the professional support or delivery of the intervention in collection of the archived data set; (b) certification in the EBT intervention at minimum of introductory level; and (c) reside in Maryland. Certified EBT Providers are health professionals who complete 144 hours of continuing education courses in EBT, with introductory training requiring at least 24 hours of training (Mellin, 2011c). All participants in the qualitative component of the study are female residents of Maryland. Although all individuals from the sample have informally consented to participate in the study, they will be invited to participate via electronic communication, a recruitment method that uses nonprobability convenience sampling (Trochim & Donnelly, 2008).

Consistent with sampling methods for qualitative research (Marshall & Rossman, 2010; Miles & Huberman, 1994), this sample is purposeful rather than random, with the sampling parameters of geographical location (Maryland), intervention-specific training (Certified EBT Provider), and affiliation with the WCHD professional community. The sample size is adequate given that the role of the qualitative inquiry is confirmatory and the study, which is preliminary (Marshall & Rossman, 2010; Mertens, 2010).

Materials/Instruments

The materials and instruments for the study are surveys, questionnaires, anthropometric and physiologic measurement devices. What follows are descriptions of the instruments and materials for both components of the investigation.

Quantitative component. The quantitative component of the study included demographic questions and used seven questionnaires and two tests (Appendix A), which have demonstrated sufficient validity and reliability. The administration of these tests is consistent with the Golden Rule of survey research (Trochim & Donnelly, 2008), as they are as brief as possible and sensitive to the respondent's needs. The three areas probed by these measures are constructs specific to self-regulation, stress-related psychological variables, and conform to study questions.

The questionnaire for the quantitative component of the study includes measures of self-regulatory skills, including mindfulness and active change of brain state through adaptive emotion regulation. In addition, it includes measures of adaptive psychological functioning, including perceived stress, depression, positive and negative affect, self-efficacy, and addictive behavior. The demographic questions included four items, which used a nominal-level response format to probe marital status, race and ethnicity, and highest level of education completed. Data on date of birth and gender were collected by EBT Providers.

Center for Epidemiologic Studies Depression Scale. Depressive symptoms were measured by CES-D, the Center for Epidemiologic Studies Depression Scale, which is one of the most common tests for depression, with reliability and validity well-established (Radloff, 1977). The CES-D items were generated from validated depression

measures and based on components of depression that were evidence-based through factor analysis. These components include: (a) depressed mood, (b) feelings of guilty and worthlessness, (c) feelings of helplessness and hopelessness, (d) psychomotor retardation, (e) loss of appetite, and (f) sleep disturbance.

The internal consistency of the scale was about .85 for the general population and .90 for the patient population. Reliability of the measure based on test-retest correlations were adequate (r=.54). Validity of the CES-D has been studied in relation to clinical criteria of depression, self-reported criteria, need for services, and life events criteria. All were adequate. Change in CES-D scores for those who did or did not report stressful life events in the previous year supported the scale's validity, with more negative events associated with lower depression scores (Dohrenwend & Dohrenwend, 1974) and the average CES-D score significantly lower at posttreatment (Weissmam, Prusoff, & Newberry, 1975).

The 20-item instrument uses a 4-point ordinal scale referencing the frequency of depression during the previous week: Rarely or none of the time (less than 1 day); Some or little of the time (1-2 days); Occasionally or a moderate amount of the time (3-4 days); Most of the time (5-7 days). A summary score is calculated, with the range of scores being 0–60.

Positive and Negative Affect Scale. Positive and negative affect will be measured by the Positive and Negative Affect Scale (Watson & Clark, 1999). To measure how the intervention may change affect, the proposed study will use the Positive and Negative Affective Scale short form (PANAS), which is a brief assessment of two dimensions of mood, positive and negative. It offers an evaluation of mood based on a

nonspecific approach, using frequency ratings for experiencing 20 different emotions (Watson, Clark, & Tellegen, 1988). Rather than assessing specific types of affect, such as hostility, depression, or anxiety, this measure evaluated these hierarchical levels, as they account for most of the variance in specific types of affect. The measure has been extensively studied and has shown acceptable psychometric properties, with coefficient alpha values for the positive affective scale ranging from 0.83 to 0.90 and for the negative affective scale ranging from 0.84 to 0.93 (Watson et al., 1988). Intercorrelations between the scales were low. The evaluation of the timeframe used, from immediate to long-term showed a slight tendency for correlations to increase (Watson, 1988b). Validity of the measure has been assessed, including the correlation with health indices (Watson, 1988a). In general, studies of the PANAS have shown that these two scales are relatively independent, and correlations with other measures range from .50 to .68.

This instrument contains 10 positive affect items and 10 negative affect items, and probes frequency of experience of that affect by the respondent using a 5-point Likert-type scale based on various time periods. Scoring of the PANAS involved summing the scoring for the 10 items on the positive affect subscale (e.g., interested, excited, enthusiastic) and for the 10 items on the negative affect scale (e.g., upset, guilty, scared, hostile).

Emotion Regulation Questionnaire. The Emotion Regulation Questionnaire (ERQ) was designed to measure two strategies of emotion regulation: expressive suppression and cognitive reappraisal, with suppression negatively correlated with stress and cognitive reappraisal positively associated with stress (Gross & John, 2003). The 10-item questionnaire includes 6 reappraisal items and 4 suppression items. Each of the 10

items indicates clearly one emotional-regulatory process. A study of 1483 college students evaluated the instrument's validity and reliability (Gross & John, 2003). The correlation between the two subscales has been shown to be zero in multiple samples. The scores were not related to cognitive ability or social desirability.

The construct validity of the ERQ Suppression scale was supported by a .53 (p=.001) correlation with peer-related suppression index and the observation that high scorers demonstrated worse memory of social situation than lower scorers (Gross & John, 2003; Richards & Gross, 2000). The ERQ Reappraisal scale correlated only .24 (p=.05) with the peer-rated reappraisal index; however, the peer-rated index is based on single-item peer ratings with modest reliability, so these correlations may underestimate the real effect sizes. The alpha reliabilities averaged .79 for Reappraisal and .73 for Suppression. Test-retest reliability across 3 months was .69 for both scales. Men scored higher on Suppression than women on both scales and effect sizes were similar, averaging about one-half of a standard deviation, whereas for Reappraisal, there were no gender-related differences. The individual differences in emotion regulation are conceptualized as modifiable and sensitive to individual development (John & Gross, 2004).

Respondents are informed that the scale includes questions that involve two aspects of their emotional life: emotional experience and emotional expression, and are instructed to answer based on a 7-point Likert-type scale with responses ranging from 1 = strongly disagree to 7 = strongly agree. There is no reverse scoring and score is the sum of scores for the individual items. Currently, there is no established measure of emotional regulation that is consistent with the EPT and the tools of the theory-based intervention.

General Self-efficacy Scale. Self-efficacy is an individual's belief in their

capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational needs. Self-efficacy theory (Bandura, 1977) measured the activity people choose to engage in, the level of effort they spend, and their pattern of persevering in the face of challenges.

The General Self-Efficacy Scale (GSE) (Schwarzer & Jerusalem, 1995) was initially developed as a German instrument, then translated and adapted by others into 36 languages as a measure of general sense of perceived self-efficacy, specifically, coping with daily stressors and adaptation after stressful life events. The construct of perceived self-efficacy reflects an individual's perceptions that they can respond effectively to novel or difficult challenges and adverse situations (Schwarzer, 1992). The scale was designed for a general population, age 12 years or above.

The validity of the instrument as been evaluated in studies based on populations from 23 nations, with Cronbach's alphas mainly in the high .80s, and ranging from .76 to .90. Criterion-related validity is documented in numerous correlation studies with positive emotions, optimism, behavior change (Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, 2009; Lluszczynaska et al., 2010) and GSE scores demonstrating positive correlation coefficients and test scores have been shown to be negatively correlated with negative affective states, including depression, anxiety, stress, burnout (Schwarzer & Hallum, 2008) and post-surgical coping (Boehmer, Luszczynaska, & Schwarzer, 2007). This theory has favored domain specificity, suggesting the importance of measuring beliefs regarding a specific behavior and the performance of that behavior.

The general self-efficacy measure was selected as it was more consistent with the goals of the theory-based intervention as adaptive plasticity of allostatic circuits would be

expect to promote global changes (Perry & Hambrick, 2008).

The GSE is a 10-item scale with items that are scored on a 4-point Likert-type scale describing to what extent the respondent believes each statement is true, ranging from 1 = not at all true, to 4 = exactly true. All 10 items are positively scored items; the scale score is derived by summing all 10 items, with score ranging 0 to 40, and with higher scores indicating higher perceived self-efficacy.

Five Facet Mindfulness Questionnaire. The Five Facet Mindfulness Questionnaire (Baer et al., 2004) was developed from several mindfulness instruments with independent attempts to operationalize mindfulness, with an analysis showing five facets (Baer et al., 2006) that appeared to represent elements of mindfulness as it is currently conceptualized. The five facets were observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience. The instrument will be used to assess the general tendency to be mindful in daily life, as the first step in the process of using the self-regulatory tool of EBT is mindfulness. The measure has been shown to have convergent and discriminant validity in relation to other psychological constructs in mediating and nonmediation samples (Baer et al., 2006) and regression and mediation analyses showed independent contributions to the prediction of well-being. The alpha coefficients for all facets of mindfulness were .67 to .92 and intercorrelations of the five scales are low, with correlation coefficients ranging from .32 to .56 (all $p < .01$), suggesting that the facets are distinct constructs (Baer et al., 2008). The FFMQ is a 39-item scale with a Likert-type scale and factors include: observe, describe, act with awareness, nonjudgment, and nonreactive. There are 20 positively scored items and 19 negatively scored items, and the scale score is derived by reversing

the scores on the positive items (e.g., 0 = 5, 1 = 4, etc.), then summing all 39 items, with score ranging 0 to 195, with higher scores indicating greater perceived stress. Currently, there is no established instrument that measures EPT and the tools of the theory-based intervention.

Yale Food Addiction Scale. Food dependence will be based on the Yale Food Addiction Scale (YFAS) (Gearhardt et al., 2008). The YFAS quantifies the extent to which an individual is dependent on overeating as a coping mechanism. The scale is composed of items based on substance abuse criteria (American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, 2000, 4th ed., text rev.) and related scales that assess behavioral addictions. The items were organized to measure six core components of addiction: salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse, and has shown sufficient face and content validity.

Based on a survey of 353 respondents (Gearhardt et al., 2008), the YFAS exhibited adequate internal reliability with a Cronbach's alpha of .93 and showed good internal validity with an alpha of .86. Convergent validity of the measure was evaluated by assessing scores on the YFAS and other measures that tapped eating behaviors, with statistically significant relationships at p=.01, with correlation coefficients ranging from .46 to .61. This measure was chosen for the construct because improvements in food-related emotional drives in obese subjects are targeted in this intervention and decreasing those drives is consistent with the theory that the study is designed to test. The YFAS is a 27-time measure that uses both dichotomous and frequency scoring to capture the diagnostic criteria.

Perceived Stress Scale. Stress will be measured by the Perceived Stress Scale, or PSS (Cohen et al., 1983). The Perceived Stress Scale (Cohen, Tyrrell, & Smith, 1993) is the gold standard measure for perceptions of stress, and has been extensively validated (Cohen & Williamson, 1988). It is the only empirically established index of general perception of stress and was designed to assess the degree to which experience is unpredictable, uncontrollable, or overwhelming (Cohen et al., 1983). This 10-item self-report questionnaire measures an individual's evaluation of stress in the past month based on subjective evaluations or appraisals of stress, including the meaning of the experience and the interpretation of the adequacy of one's capacity to cope with that experience, and their relationship with their environment.

Psychological stress involves interpretation of the meaning of an event and perceptions of the adequacy of coping resources (McEwen, 2004). The instrument was designed not for diagnostic assessment, but for use comparisons. The internal reliability of the PSS resulted in a Cronbach's alpha of .78 (Cohen & Williamson, 1988). It was also evaluated for biological or verified disease outcomes, and suggested discriminant validity. In an examination of the common cold and negative life events (Cohen et al., 1993) greater perceived stress associated with greater risk of being infected, differentiating the life events from stress perception.

There are five positively scored items and five negatively scored items, and the scale score is derived by reversing the scores on the positive items (e.g., 0 = 4, 1 = 3, etc.), then summing all 10 items, with score ranging 0 to 40, with higher scores indicating greater perceived stress.

Blood pressure. Blood pressures were taken while the participant was seated. If the participant's arm circumference was 33 centimeters or more, a large cuff was used to obtain an accurate measurement.

Weight change and BMI. Body weight was measured using a Health-O-Meter balance beam scale and body height with a wall-mounted Stadiometer, and measured in duplicate. These data will be used to derive Body Mass Index (kg/meters^2).

Qualitative component. The qualitative component of the study will involve a survey of the perceptions of the educators who facilitate the intervention. The survey will include six demographic questions, which will use a nominal-level response format to probe marital status, race and ethnicity, highest level of education completed, health professional discipline and level of professional certification in the theory-based intervention. Additionally, it will include questions regarding construct-specific changes in participants who complete the theory-based intervention, and usefulness of the various aspects of the intervention in promoting adaptive changes in the self-regulatory, and stress-related psychological constructs.

EBT Provider Survey. The qualitative data will be based on open-ended survey questions with response boxes completed by the WCHD-affiliated EBT Providers who facilitate the theory-based intervention. The 21-item instrument, EBT Providers Survey (see Appendix B) was developed for the study by the researcher, after a review of developed surveys yielded none that probed the specific data needed to confirm perceptions of change in the constructs used in the qualitative component of the study. This instrument uses an unstructured response format (Tashakkori & Teddlie, 2010) to generate responses to three overarching questions probing: (a) perception of participant

change in construct, (b) perception of intervention aspects helpful in change in construct, and (c) perception of intervention aspects not helpful in change in construct for the two self-regulatory constructs and five constructs of stress-related psychological variables.

The survey will be validated by an expert panel of researchers who study EPT for face validity and the feedback will be used to refine the survey questions. Revisions in the survey questions will be reviewed by the expert panel and revised by the researcher until the panel concludes that the survey demonstrates sufficient face validity.

Operational Definitions of Variables

Mindfulness. Mindfulness is the observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience (Baer et al., 2006), which a meta-analysis has shown to improve stress related symptoms (Klainin-Yobas, Cho, & Creedy, 2011). Mindfulness is a dependent variable and will be measured by The Five Facet Mindfulness Questionnaire (Baer et al., 2004). This instrument is a 39-item questionnaire, which uses a 5-point Likert-type scale (1 = Never or very rarely true to 5 = Very often or always true) to measure respondent opinions of what is generally true for them. The items of this instrument are ordinal, and responses are calculated based on sum of numbers assigned to responses, with 19 of the 39 responses reverse scored. Range for each subscale is 0 to 8, except for the subscale of nonreact, in which the range of scores is 0 to 7.

Emotion Regulation. Emotion regulation is the conscious and nonconscious use of strategies to regulate emotions to decrease negative emotions and increase positive emotions (Gross & Thompson, 2007). Emotion regulation is a dependent variable and will be measured by the Emotional Regulation Questionnaire (ERQ) (Gross & John,

2003). This instrument is a 10-item questionnaire that uses an interval level Likert-type 7-point scale (1 = Strongly disagree to 7 = Strongly agree). It probes respondent agreement of their emotion regulation. The items of this instrument are interval, and responses are calculated based on sum of numbers assigned to responses, based on two subscales: expressive suppression and cognitive reappraisal, with 4 items probing emotional suppression and 6 items probing cognitive reappraisal. Range for the emotional suppression subscale is 0 to 28 and for the cognitive reappraisal subscale is 0 to 42, with higher scores indicating more emotional suppression (maladaptive) and more cognitive reappraisal (adaptive).

Depressive symptoms. Depressive symptoms are the behavioral and psychological symptoms associated with depression. Persistent nonhomeostatic states or stress has been identified as the primary cause of depression (Risch et al., 2009). Depression is a dependent variable and will be measured by CESD, the Center for Epidemiologic Studies Depression Scale ((Radloff, 1977). This instrument is a 20-item questionnaire, which uses an interval-level 4-point Likert-type scale (0 = Rarely or none of the time (less than 1 time per day in the past week) to 4 = Most or all of the time (5-7 days). It probes the respondent's self-report of frequency of depression-related feelings in the previous week. The items of this instrument are interval, and responses are calculated based on sum of numbers assigned to responses. Range for the responses for each item is 1 to 3, with 4 of the 20 items being reverse scored. The range for scores on the CES-D is 0 to 60.

Positive and negative affect. Positive and negative affect are emotions which are positive and negative, which explains most of the variance in mood (McDowell,

2006). Mood is stress-related with positive affect associated with states of low stress arousal and negative affect associated with high stress arousal (Folkman et al., 1986). Positive and negative affect is a dependent variable and measured by the Positive and Negative Affect Scale (Watson & Clark, 1999). This instrument is a 20-item questionnaire, which uses an interval-level Likert-type 5-point scale (1 = Very slightly or not at all to 5 = Extremely. This instrument measures the extent to which the respondent has experienced each valence of affect in the last few days and includes two subscales: positive affect and negative affect. The items of this instrument are interval, and responses are calculated based on sum of numbers assigned to responses, with 10 items related to each subscale. A sum of the responses each items within each subscale provides the score, with higher scores on the negative affect subscale indicating more negative affect and higher scores on the positive affect subscale indicated more positive affect. Range of scores for each subscale is 10 to 50.

Self-efficacy. Self-efficacy is defined as beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands (Gist & Mitchell, 1992; Lee & Bobko, 1994; Wood & Bandura, 1989) and influence to affect experience and behavioral outcomes (Bandura, 1977). Self-efficacy is a dependent variable and will be measured in the quantitative study by The General Self-Efficacy Scale (Sherer et al., 1982). This instrument is a 10-item questionnaire, which uses an interval-level 4-point scale (1 = Not at all true to 4 = Exactly true). The questionnaire probes respondent beliefs that one's actions are responsible for successful outcomes. The items of this instrument are interval, and

responses are calculated based on sum of numbers assigned to responses with range for the scale of 10 to 40 points.

Food dependence. Food dependence measures the extent to which an individual is dependent on overeating as a coping mechanisms and food dependency has been associated with stress (Adam & Epel, 2007; Mietus-Snyder & Lustig, 2008). Food dependency is a dependent variable and will be measured by the Yale Food Addiction Scale (Gearhardt et al., 2008). This instrument has been developed to identify those who are most likely to exhibit markers of substance dependency on high fat, high sugar foods. This instrument is a 25-item questionnaire, which includes 8 questions with yes/no dichotomous level responses and 16 questions with interval-level responses in a Likert-type 5-point scale (0 = Never to 5 = Always) and 1 question with interval-level responses using a 5-point scale (1 time to 5 or more times). This questionnaire includes additional items that are unscored to assess addiction-related behaviors. This instrument probes 7 aspects of dependency. The aspects of dependency and number of questionnaire items that assess it are: 1) substance taken in larger amount and for longer period than intended (3 items) persistent desire or repeated unsuccessful attempt to quit (4 items); 3) much time/ activity to obtain, use or recover (3 items); 4) important social, occupational, or recreational activitities given up or reduced (4 items); 5) use continues despite knowledge of adverse consequences (1 item); 6) tolerance based on marked increase in amount or marked decrease in effect (2 items); 7) characteristic withdrawal symptoms or use of substance to relieve withdrawal (3 items); and 8) use causes clinically significant impairment (2 items). In the use of the instrument that is not diagnostic, but instead resembles a symptom count, the 8th subscale is not used. The score for the Yale Food

Dependence Scale is 0 to 7, with higher scores indicating more symptoms of food dependence.

Perceived stress. Perceived stress is the general perception of stress and was designed to assess the degree to which experience is unpredictable, uncontrollable or overwhelming (Cohen et al., 1983). Perceived stress is a dependent variable and will be measured by The Perceived Stress Scale (PSS) (Cohen, 1983). This instrument is a 10-item questionnaire, which uses an interval-level, Likert-type 5-point scale (0 = Never to 5 = Often) to probe respondent frequency of stress-related thoughts and feelings in the last month. This instrument also probes frequency of high and low stress arousal perceptions in the previous week. PSS scores are obtained by reversing responses (e.g., 0 = 4, 1 = 3, 2 = 2, 3 = 1 & 4 = 0) to the four positively stated items (items 4, 5, 7, & 8) and then summing across all scale items. The range for the scale is 0 to 40, with higher scores indicating higher levels of perceived stress.

Body Mass Index. Body Mass Index is based on anthropometric data of height and weight applied to a formula (weight^2 / height, with weight expressed in Kg and height expressed in meter) (NIH, 2011). BMI is a biomarker for allostatic load (Djuric et al., 2008; Juster et al., 2009). This variable is only measured in the quantitative component of the study, and changes in weight are appropriate, useful, and consistent in addressing study questions.

Blood pressure. Blood pressure will be measured as systolic and diastolic blood pressure measures in mmHg, based on standard practices of measurement (NIH, 2011). Stress has been associated with hypertension (Juster et al., 2010; Spruill, 2010) and obesity (Bays, Chapman, & Grandy, 2007). Blood pressure is a quantitative dependent

variable and provides data on a biomarker associated with allostatic load (Djuric et al., 2008; Juster et al., 2009).

EBT Intervention. The independent variable in this report is the EBT intervention and it is delivered to all participants, either immediately or 7 weeks later. This intervention is a 7-week introduction to a long-term training program that provides introductory tools in self-regulation and has been manualized (Mellin, 2011d).

Data Collection, Processing, and Analysis

In this sequential, mixed methods design, the first sequence will involve the data collection, processing and analysis of the archived quantitative data. The second sequence will involve these processes for primary data collected from facilitators of the theory-based intervention. What follows are the descriptions of the first sequence quantitative process and the second sequence qualitative process including collection, processing, and analyses of the data.

Quantitative component. Participants who had provided informed consent and had been assigned to the test or control group attended three data collection visits at the clinical sites of the WCHD, including baseline data at Observation #1 (O_1), at Observation #2 (O_2) 7 weeks later, and at Observation #3 (0_3), 14 weeks later. A debriefing followed the last observation period to enhance safety and determine need for and make referrals. No study data from the debriefing were archived for inclusion in the study. Data collection was done by EBT Providers who were blind to participant condition. They performed assessments of weight and blood pressure at all data collection points and height at baseline assessment visit only. Participants were given options to complete questionnaires on the Internet or through paper and pencil tests. The

questionnaires had been programmed based on surveymonkey.com by EBT Providers. The WCHD staff were instructed by WCHD investigators on the administration of the questionnaires based on anonymous data collection.

Participants self-selected a name code, and the participant list of names and codes were kept in a locked file drawer in the principal investigator's office at the WCHD and destroyed at the conclusion of the study. Blood pressures were taken while the participant was seated. If the participant's arm circumference was 33 centimeters or more, a large cuff was used to obtain an accurate measurement. Participants with blood pressure greater than 140/90 were advised to follow up with their health care provider or given a list of providers for follow-up. Body weight was measured using a Health-O-Meter balance beam scale and body height with a wall-mounted Stadiometer, and measured in duplicate. These data were used to derive Body Mass Index (kg/meters$^{2)}$. The data were de-identified to minimize risk of breach of confidentiality and archived. After acceptance of the Dissertation Proposal and approval of the Northcentral University Institutional Review Board application for this study, this de-identified data will be electronically transferred to the researcher for analysis and reporting.

The demographic data will be analyzed for means and ranges. The initial analyses of the quantitative data will include descriptive statistics including the mean, standard deviation, and characteristics of the distribution for each of the measures at each of the three measurements. Most of the potential mediators are composed of several items, so distribution problems are not anticipated with these variables. Reliabilities and validities of the measures will be determined to see if they performed adequately.

Table 4 displays the six means (A- F) that will be available for each of the nine dependent variables: (a) mindfulness, (b) emotion regulation, (c) perceived stress, (d) depression, (e) positive and negative affect, (f) self-efficacy, (g) food dependence, (h) Body Mass Index, and (i) blood pressure.

Table 4

Quantitative Analysis: Means Available for 15 Dependent Variables

	Observation Times		
	01	02	03
Test (immediate intervention; between O_1 and O_2	A	B	C
Control (delayed intervention; between O_2 and O_3)	D	E	F

Note. Observation times based on test vs. control condition and observation at baseline, 8 and 16 weeks.

What follows is a description of 5 tests that will be performed on this cross design study. All tests will analyze all constructs and variables.

Research Question 1, "Does the theory-based intervention cause improvements in self-regulatory processing?" will be answered based on analyses of (a) five constructs of mindfulness, and (b) two constructs of emotion regulation. Research Question 2, **"**Does the theory-based intervention cause improvements in stress-related psychological variables?" will be answered based on analyses of (c) perceived stress, (d) depressive symptoms, (e) positive affect, (f) negative affect, (g) self-efficacy, and (h) food dependence. Research Question 3, "Does the theory-based intervention cause improvements in measures of stress-related physiological and anthropometric variables?"

will be answered by the analysis of (i) Body Mass Index, (i) systolic blood pressure, and (j) diastolic blood pressure. The analyses of the quantitative data will begin with a standard 2 (test vs. control, between) x 3 (observation times, repeated) ANCOVA. The following tests will be conducted to respond to these questions:

Test 1. Were the groups comparable, suggesting that the randomization was effective based on archived quantitative data? A contrast will be computed (ANCOVA) between Cell A and Cell D.

Test 2. Was the EBT intervention superior to the control group based on archived quantitative data? A contrast will be computed for the difference between A and B (B-A) compared to the difference between D and E (E-D). Although the pooled error term will be used, Test 2 amounts to testing the significance of the interaction in a 2 (between) x 2 (within) ANCOVA. G*Power 3.1.3 to was set to "ANCOVA, Repeated measures, within-between interaction, post hoc computed achieved power, effect size =.5, alpha = .05, total sample size = 36, number of groups = 2, nonsphericity correction = 1, and number of measures = 2." The post hoc computed power = .83 (this G*Power screen does not ask for the correlation between repeated measures).

Test 3. Was the delayed EBT intervention superior to the control group based on archived quantitative data? A contrast will be computed for the difference between C and B (C–B) compared to the difference between E and F (F–E). This is the best contrast available in the present design because there is no never-treated control available between 0_2 and 0_3.

Test 4. Did participation in the EBT intervention for the test group cause improvements at follow-up based on archived quantitative data? A contrast will be computed for the difference between A and C (C–A).

Test 5. Did participation in the EBT intervention for combined test and control groups, ignoring the control groups, show changes in the immediate pretest and the immediate posttest ANCOVA based on archived quantitative data? A contrast will be computed based on a combined test of A and B (B–A) and E and F (F–E).

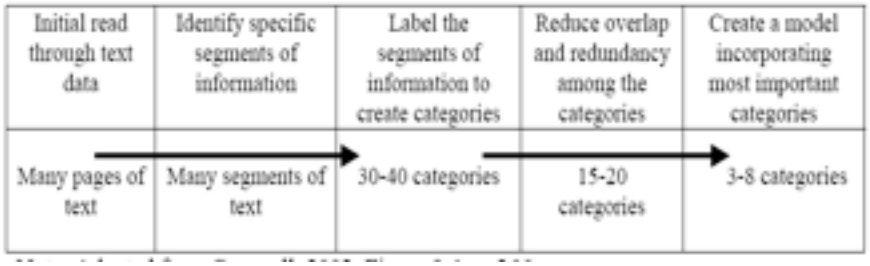
The pretest/posttest between-group design using ANCOVA (Subak et al., 2005) is most appropriate as the study design and will provide the internal validity of a random assignment repeated measures design for the first phase of the study, controlling for the shared environment and additional data during the second phase of the study. The use of multiple univariate tests greatly increases the probability of Type 1 errors. This problem was deemed acceptable in the context of the present pilot study status of the investigation (Thabane et al., 2010). The investigator acknowledges that replications of this study are necessary and they are planned in order to deal with the increased Type 1 errors. Moreover, given that this study evaluates a short-term application of a long-term intervention aimed at reconsolidation of maladaptive neuronal stress circuits stored in the low plastic area of the brain, it would be sufficient as a first report to show trends in dependent variables that were associated with homeostatic states and decreased frequency and duration of the allostatic response. The researcher will receive the transfer of data from the EBT Provider, prepare and analyze the data and report on the findings of the data.

Qualitative component. For the qualitative component of the study, EBT Providers will sign an informed consent form and complete the survey, which will be administered by the researcher (see Appendix D). The EBT Provider survey and the consent form will be transmitted electronically. The educators will receive instructions that include a list of the operational definitions of the two constructs that measure self-regulation and the five constructs that measure stress-related psychological variables. Information about individuals to contact with questions about human research or the study protocol will be provided. The respondents will be asked to complete the questionnaire without discussion or conference with other respondents of this survey, and to return the de-identified survey to the researcher within 2 weeks. Participants will be provided a de-identified envelope to use in returning the completed survey to the researcher.

The qualitative analyses will utilize thematic content analysis (Marshall & Rossman, 2010; Saldana, 2009; Stauss & Corgin, 2008) using Atlas.ti qualitative data analysis software. In particular, each of the measures of self-regulation (mindfulness and emotion regulation) and stress-related psychological constructs (perceived stress, depression, positive and negative affect, self-efficacy, and food dependence) that were measured as dependent variables in the quantitative portion of the research will constitute an initial list of a prior categories. These meaning units will then be assigned one or more codes from (a) the concepts in the a priori list of constructs associated with EPT, and (b) codes related to the intervention that emerge inductively from the survey data using an iterative process. Table 5 describes the coding process in inductive analysis that will be used by the researcher.

Table 5

The Coding Process in Inductive Analysis



Note. Adapted from Creswell, 2002, Figure 9.4, p. 266.

The inductive analysis of the qualitative data for the perception of change question for each self-regulatory processing construct and stress-related psychological construct will be predetermined based on theory, as associated with significant and meaningful improvements in stress-related variables, or not (Marshall & Rossman, 2010; Miles & Huberman, 1994; Saldana, 2009). The thematic coding analysis will display persons and themes for each of the seven constructs. In addition, the analysis of the data related to the perceptions of intervention aspects associated with changes in constructs will be allowed to emerge organically during the qualitative data analysis. The qualitative thematic findings will be presented in tabular form.

Methodological Assumptions, Limitations, and Delimitations

This preliminary report on the mediators of change of EPT evaluates trends in a broad range of stress-related indices in a short-term trial of an intervention designed to

decrease physiologic stress through changes in self-regulatory circuitry(Leedy & Ormrod, 2010; deVaus, 2001; Meltzoff, 1997). The methodological assumptions about the population in this study is that they will demonstrate a broad range of characteristics that are stress-related in biomarkers and psychological factors at baseline. No baseline determinations of psychological and biomarker variables other then BMI will be used as inclusion criteria. Instead the inclusion criteria of a BMI of 25 to 40 is used; elevated BMI is associated with stress arousal and dysregulation (Djuric et al., 2008; Juster et al., 2010). The researcher assumes that the stress-related constructs and variables will demonstrate levels associated with nonhomeostatic states.

Another study limitation is the pronounced dysregulation associated with higher levels of BMI (extreme obesity), as random assignment alone would not be expected to control for that. The step taken to mitigate this limitation was to use a process of random assignment in which participants whose BMI was >35–40, were blocked, with equal numbers of participants in that BMI category being assigned to both groups.

The researcher assumes that these constructs and variables are modifiable by a short-term application of the theory-based intervention. The theory-based intervention is a long-term program involving 7 courses that require 1 year to complete (Mellin, 2012), with the goal of modifying an allostatic state to a homeostatic state (Mitrovic et al., 2011). A preliminary step in evaluating changes associated with the theory-based intervention is assessment of changes in the short-term application of it. In addition, the current practices of health departments, as evidenced by the practices of the WCHD, is provision of short-term training in the intervention.

EBT Providers have introductory certification in the theory-based method, however, they had never facilitated treatment groups based on this application of the EBT intervention. Fidelity to program processes were not assured, however, steps taken to mitigate the limitations of the study included weekly telephone consultation of the researcher with the theory-based research intervention facilitators. During these consultations, the EBT Providers identified skill insufficiencies and program implementation difficulties and developed plans for responding to them. An assumption of the study is that these challenges were responded to effectively and did not compromise the fidelity of the study.

Another threat to internal validity (deVaus, 2001; Meltzoff, 1997) of the qualitative component of the study is that EBT Providers may have inconsistent or limited knowledge of the seven constructs examined in the EBT Providers survey. To minimize this threat to validity, printed information that lists the operational definition of each will be provided to them with their questionnaire and they were instructed to contact the investigator should they have additional questions about these constructs.

This controlled clinical trial randomly assigned participants to treatment now versus treatment later, controlling for the shared environment. Threats to internal validity in the quantitative component of the study are extensive. Such factors as willingness to use Internet media, changes in health status or medications and use of other stress management or weight management techniques may vary between groups. These were partially addressed through the inclusion criteria included access to the Internet and exclusion criteria included acute medical problems that required immediate health care intervention.

Threats to validity (Cozby, 2009; deVaus, 2001; Tashakkori & Teddlie, 2010; Trochim & Donnelly, 2008) in the qualitative component of the study include the bias of the EBT Providers to favor perceptions of adaptive change in participants and the bias the researcher brings to the study in favor of adaptive change. The researcher will use codes that are predetermined based on the theory being examined and present the qualitative data using a quantitative format, showing frequencies of responses for significant and meaningful change and intervention-related aspects associated with each construct. The interpretation of what constitutes significant and meaningful change for each construct will be determined by statistical analysis based on quantitative coding software, and the findings of the intervention-related aspects of change for each construct will be compared to findings in the literature. Although the small sample size of 36 participants and 5 educators decreases external validity, this study is preliminary and any findings would require additional research, which would build theory and confirm or disconfirm the findings. Threats to internal validity include regression to the mean for those whose baseline measures were extreme and experimenter effect, in that the EBT Providers have strong positive attitudes toward EBT and belief in its effectiveness.

Threats to external validity (Glanz, Rimer, & Lewis, 2002; Meltzoff, 1997) are more significant in that the *n* was very small, and data about the participants is limited. In addition, given the attention to obesity treatment in response to increased prevalence of the problem, temporal factors may influence the external validity of this study, as public information regarding obesity-related factors, such as nutrition information, food availability, and media coverage of obesity and diet are widely available. The expectations for this study are modest in that other studies are in planning stages, and

initial reports are expected to provide data on trends that are consistent with theory or not in a broad range of stress-related variables.

The delimitations of the study (Cozby, 2009) include the inclusion and exclusion criteria of the participants, the use of a public health population for recruitment, and the provision of a short-term application of the theory-based intervention. As a first study in evaluating changes in stress-related biomarkers and psychological constructs, with the need to progress slowly in order to minimize harm to subjects, and given the assumptions of the study, the external and internal validity are sufficient.

Ethical Assurances

The study will be conducted by the ethical principles involving human subjects, consistent with the *National Commission for the Protection of Human Subjects in Biomedical and Behavioral Research* entitled the *Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research and* codified in Northcentral University's Institutional Review Board (IRB) guidelines. The research methods used in this study ensure that the participation of subjects is voluntary, protects participants from physical and mental discomfort, harm or danger, and is designed to increase knowledge that will benefit the participants and/or the larger community, with the benefits outweighing the risks. The research will be conducted in a fair and equitable manner, without overburdening or discriminating against participant population, and honoring commitments made to all participants, contributors, collaborators involved. Approval by the Northcentral University Institutional Review Board will be sought and obtained prior to transmission of the data from the EBT Providers and the collection of data for the qualitative component of the study, and no archival or primary data will be

collected until the university IRB approval has been attained.

This study design assures protection from harm, in that the archival data used in the quantitative component of the study will be de-identified prior to transmission from the researcher. The intervention was low risk for EBT Providers and intervention participants. In the quantitative component of the study, WCHD screened all respondents for significant psychological and medical problems, as this is their standard of care for all service provided. Those who were excluded from the study were referred to county services for obesity or other stress-related problems or, if they had private insurance, to their health care provider. The quantitative component of the study was approved by the institutional review board of the Maryland State Department of Health and Mental Hygiene prior to collection of data and officials of the department support this research endeavor (see Appendix C). The researcher will confirm their willingness to participate and obtain a signed informed consent form (see Appendix D). Right to privacy will be maintained in that the quantitative and qualitative data will be de-identified. No identifying information will be collected from participants in the study. Honesty with professional colleagues will be maintained throughout the study and compliance with the standards for conducting research as appropriate to this study design will be maintained. The researcher will submit an application to the Northcentral University Institutional Board and conform to the approved methods based on the dissertation proposal.

Summary

The proposed sequential mixed methods study is designed to provide an initial investigation of EPT, how intervening to promote adaptive self-regulation mediates beneficial changes in stress-related psychological and physiologic measures and

improves health (Mitrovic et al., 2011; Mitrovic et al., 2008). EPT is grounded in physiologic-based changes; however, not all physiologic changes that are salient to changes in stress-related biologic and psychological factors can be measured by quantitative methods (Djuric et al., 2008; Juster et al., 2010). This design is consistent with fundamental aspects of mixed methods design (Creswell et al., 2011; Miles & Huberman, 1994; Saldana, 2009; Trochim & Donnelly, 2008) as it approximated the optimal design of a double-blind controlled clinical trial randomized, double blind, placebo controlled clinical trial for evaluation of clinical interventions (Spodick, 1982). This mixed methods research integrates qualitative and quantitative approaches in an integrated initial report (Mertens, 2010; Tashakkori & Teddlie, 2010) to increase confidence in the findings of the qualitative study, specific to the psychological constructs that are investigated.

The quantitative component of the proposed study provides a preliminary report of mediators of EPT. The independent variable in this analysis of archived data from a 7-week application of a theory-based intervention (Mellin et al., 1997; Mellin et al., 1987a; Simon et al., 2009) was delivered to a convenience sample of 36 overweight and obese adults, which was sponsored by the Washington County Health Department (WCHD) in Maryland. The dependent variables are two measures of self-regulation (see Appendix A): a) mindfulness as measured by the Five Facet Mindfulness Questionnaire (FFMQ) and b) emotion regulation as measured by the Emotion Regulation Questionnaire (ERQ) and five measures of stress-related psychological variables, including: a) perceived stress as measured by the Perceived Stress Scale (PSS); b) depression, as measured by the Center for Epidemiologic Studies Depression Scale (CESD); c) affect as measured by the

Positive and Negative Affect Scale (PANAS); d) self-efficacy as measured by the General Self-efficacy Scale (GSS); and e) food dependence as measured by the Yale Food Addiction Scale (YFAS). In addition, obesity and blood pressure will be evaluated.

The second sequence of analysis will be qualitative, based on a 21-item open-ended survey questions (see Appendix B), which will use an unstructured response format (Tashakkori & Teddlie, 2010; Trochim & Donnelly, 2008). The survey will be reviewed by an expert panel of researchers who study EPT for face validity and will be completed by a criterion purposeful sampling (Patton, 2001) of EBT Providers (*N*=5) who facilitated or supported the facilitation of the interventions and signed a consent form (see Appendix D). Content analysis of responses will be analyzed (Miles & Huberman, 1994; Saldana, 2009) using Atlas.ti qualitative data analysis software as confirmatory of the findings of the analysis of the quantitative data.

The quantitative component of the study involves data analysis of a series of 3 (measures at baseline, 8 weeks, and end of study, repeated measures) x 2 (test vs. control, between) with pretest BMI as a covariate univariate ANCOVAs for each dependant variable. This is 2 x 3 design that has six cells, with participants were blocked on baseline BMI prior to random assignment, and pretest BMI will be used as a covariate. Descriptive statistics will be provided for all 6 cells in design. The 2 x 3 extended preteat/posttest design (Cohen et al., 1995; Subak et al., 2005; Trochim & Donnelly, 2008) using ANCOVA (Subak et al., 2005) will begin with a standard 2 (pretest BMI or blood pressure) x 2 (test vs. control) x 3 (observation times) analysis of variance (ANCOVA) and groups will be compared using ANCOVA analysis to answer the research questions regarding the theory-based intervention causing improvements in self-

regulatory processing, stress-related psychological variables stress-related physiological and anthropometric variables. The convergence of quantitative and qualitative data with trends in the direction that are consistent with decreased stress may result in the rejection of the null hypotheses and provide an preliminary report to begin to build theory and identify improvements in the theory-based intervention.

Chapter 4: Findings

The purpose of the sequential mixed methods study is to provide an initial evaluation of mediators of EPT by determining the influence of the EBT intervention on stress-related psychological and physiologic measures in a sample of obese adults. The study includes a quantitative component using an archival data set of research conducted by the Washington County Health Department (WCHD), Maryland, on a convenience sample (Jackson, 2009; Trochim & Donnelly, 2008) of 36 obese adults. A counterbalanced, waitlist controlled design was utilized for the quantitative component of the study because it best approximates the optimal design of a randomized, double-blind, placebo controlled clinical trial for evaluation of clinical interventions (Spodick, 1982).

The independent variable was a brief program based on EPT, which was delivered to all participants. The dependent measures included (a) two measures of self-regulation (mindfulness and emotion regulation); (b) five psychological variables (perceived stress, depressive symptoms, positive and negative affect, self-efficacy, and food dependence); and (c) two measures of physiologic stress (Body Mass Index and blood pressure). Participants were blocked on baseline BMI prior to random assignment, and pretest BMI was used as a covariate (Cohen et al., 1995; Subak et al., 2005). An analysis of variance (ANCOVA) was performed for all dependent variables. A criterion purposeful sample was used for the study's qualitative component (Patton, 2001) to include the five EBT Providers who facilitated or supported the delivery of the intervention (Creswell et al., 2011; Mertens, 2010).

The qualitative component of primary data was based on responses to an open-ended survey from five EBT Providers, the health professionals who facilitated or supported the EBT intervention, probing their assessment of the changes in participants

in the seven constructs related to self-regulation and stress-related psychological variables. In addition, the data probed their reflections on the intervention-related components that were useful and not useful in promoting those change in these measures. Content analysis of responses were analyzed (Miles & Huberman, 1994; Saldana, 2009) with codes for the constructs emerging inductively from the data and the development of theme tables from them.

As a first study of EPT, the priority was to demonstrate feasibility and proof of concept as the priorities, rather than a clinical trial, which is premature before such foundational research has been conducted (Jackson, 2009; Trochim & Donnelly, 2008). When the qualitative data confirmed meaningful changes in the constructs studied, and the quantitative data demonstrated statistically significant results in the direction hypothesized, the hypothesis of the null was rejected and the alternative hypothesis was supported. This chapter first presents the findings from the quantitative study to respond to the first three research questions, then the findings from the qualitative study to respond to the fourth research question, and finally, organizes the results and evaluates the findings from which conclusions will be described.

Data Preparation: Quantitative Component

The de-identified data was electronically transferred to the researcher for analysis and reporting. The data set were collected by staff of the Washington County Health Department (WCHD) who, in response to media announcements that were consistent with their normal practices of public health education, screened 114 potential participants by telephone based on the inclusion and exclusion criteria. Fifteen individuals were excluded because they did not meet the weight criteria and one potential participant was

excluded because of criteria other than weight. One hundred participants passed the screening and were invited to the orientation meeting, and 51 participants who attended the orientation meeting were given an opportunity to enroll in the study. Forty-three signed the consent form and were entered into the study through random assignment and 37 participants attended the first scheduled treatment session. Of these participants, one dropped out and three did not complete all the assessments, so were eliminated from the study, with the final data set based on 33 participants.

Descriptive statistics of the sample were performed and are presented in Table 6. The means, median, standard deviation, middle value in first half (Q1) and second half (Q2) of the rank ordered data set and the second half of the data set to calculate the interquartile range for each of the dependent variables are shown. In addition, the reliabilities of the instruments are presented. They were calculated to determine if the measures were working properly, which they were (range .68–92).

Table 6

Descriptive Analysis and Reliabilities: Dependent Variables

Dependent variable	*M*	*Median*	*SD*	*Range*	Q_1	Q_3	*Alpha*
Mindfulness observe	2.99	3.12	.83	3.00	2.50	3.62	.82
Mindfulness describing	3.34	3.12	.88	3.50	2.50	3.62	.89
Mindfulness acting	2.94	3.12	.65	2.63	2.50	3.62	.83
Mindful nonjudging	3.36	3.12	.85	3.63	2.50	3.62	.89
Mindfulness nonreactance	2.74	3.12	.70	2.86	2.50	3.62	.80
Emotion regulation suppression	2.79	3.12	1.24	4.25	2.50	3.62	.68
Emotion regulation reappraisal	4.56	3.12	1.76	6.00	2.50	3.62	.87
Perceived stress	4.09	4.00	.31	1.40	3.00	5.25	.82
Depression	17.6	17.0	8.08	35.00	11.00	24.00	.87
Affect positive	2.80	3.12	.73	2.90	2.50	3.62	.92
Affect negative	2.15	3.12	.66	2.50	2.50	3.62	.84
General self-efficacy	2.84	3.12	.50	2.20	2.50	3.62	.91
Food dependence	4.09	4.00	1.76	6.00	3.00	5.25	.84
Systolic BP	139.45	138.00	22.67	113.00	121.00	149.00	
Diastolic BP	77.15	74.00	9.77	38	70.00	84.00	
Body Mass Index	33.29	33.54	3.8	15.90	30.45	36.32	

Note. N=33. BP = blood pressure

Four tests were performed. All tests analyzed all constructs and variables. The basic analysis for all 16 dependent variables (except BMI) was a 2 (condition, between) x 3 (time, within) ANCOVA. BMI at the beginning of the study was used as a covariate. An ANOVA was conducted for the inferential analysis for BMI. Sixteen full ANCOVA/ANOVA tables are presented in Appendix F (Tables F1 to F16). For each research question, a summary table (see Tables, 6, 7, and 8) is presented and mean comparison figures are shown (see Figures 5 to 20) for the 16 dependent variables.

Figure 4 presents a visual representation of the pattern of results that would be consistent with theory, with adaptive changes occurring in the test group (immediate intervention) and no change demonstrated in the control group (delayed intervention) between Time 1 and Time 2. Between Time 2 and Time 3, the pattern of results that would be consistent with theory is shown as the maintenance of adaptive changes during the posttreatment period for the test group and adaptive change in the control group, coinciding with participation in the intervention. The analysis included a 2 x 2 x 3

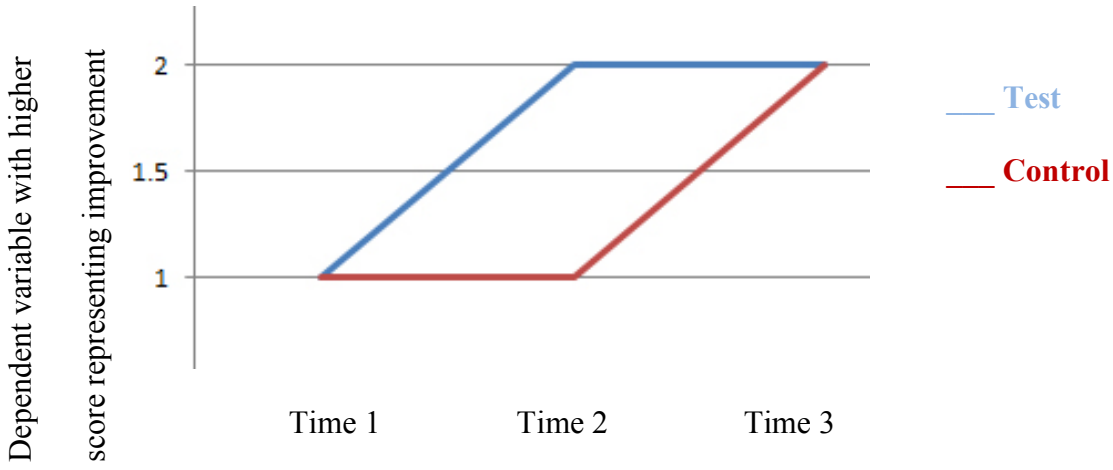


Figure 4. A visual representation of general form of hypothesized condition x time

ANCOVA with one covariate, which generates *F* and *p* values for five effects: (a) BMI (*df* =1); (b) Condition (*df* =1, test vs. control averaged over 3 measurement times); (c) Time (*df* = 2, averaged over condition); (d) Time x condition (*df* = 2, represented in Figure 4); and (e) BMI x condition (*df* = 1).

The analysis reported on four comparisons to answer research questions 1 through 3, which were based on the quantitative component of the study. The first comparison asks the question: Did the test group improve more from T1 (baseline) to T2 (8 weeks) during which time they received the EBT intervention than the control (which received no intervention between T1–T2)? In mathematical terms, this comparison is: T2–T1 (for test group) minus T2–T1 (for control group). This is the "gold standard" statistic for a randomized trial with a pretest and one posttest measure. The second comparison asks the question: Did the control group improve more from T2 (8 weeks) to T3 (16 weeks) during which time they received the EBT intervention than the test group (which received no intervention between T1–T2)? In mathematical terms, this is: T3–T2 (for control group) minus T3–T2 (for test group). The third comparison was the combination of the first two comparisons, the time x condition interaction (*df* = 2) in the inferential statistics. The fourth comparison asks the question: Did the test group maintain significant improvements over the 16 weeks of the study? This analysis compared the test group at the end of the study (T3) and the beginning of the study (T1). In practice, the EBT intervention is continuous for 1 year, starting with an introductory intervention and continuing with advanced courses, and recidivism in any improvements shown in the dependent variables was expected in the test group. However, the comparison of baseline

and follow-up measures in the fourth comparison was included in the analysis as the current study is preliminary and this comparison contributes to the rigor of the study.

In general, rejection of the null hypothesis and acceptance of the alternative to build theory was based on finding a significant time x condition interaction, with results in support of theory based on changes associated with decreased stress. No predictions were made for the main effect of BMI or the BMI x condition interaction. In the event that BMI was correlated with any of the dependent variables, including BMI as a covariate, the statistical power of the analyses would have increased. There were only two significant effects, with BMI significantly correlated with diastolic blood pressure ($p < .002$) and mindfulness nonjudging of inner experience with time ($p < .034$) There were two marginally-related effects: BMI was related to diastolic blood pressure ($p < .058$) and emotional regulation suppression ($p < .096$).

Demographic Characteristics: Quantitative Component

Frequency tables for participant demographic characteristics of the quantitative sample are presented in Appendix E. For the continuous variables, the mean age was 53.58; the mean Body Mass Index (BMI) was 30.8 (SD = 3.80); the mean systolic blood pressure was 133.45 (SD = 13.76); and the mean diastolic blood pressure was 77.15 (SD = 9.77). With respect to the categorical variables, 29 (87.9%) of the 33 participants were female, 30 (90.9%) were White, one (3.0%) was Black, and two (6.1%) were Asian or Pacific Islander. All 33 (100%) were non-Hispanic. For education, seven (21.2%) were high school graduates, 10 (30.3%) had some post-high school education, 10 (30.3%) were college graduates, and 10 (18.2%) had a post-graduate or professional degree. With respect to marital status, two (6.1%) were single and never married, 23 (69.7%) were

married, one was separated (3.0%), and six were divorced (18.2%). The demographic data were analyzed for means and ranges.

Results: Quantitative Component

What follows are specific findings for the each of the research questions and related hypotheses addressed by the quantitative component of the study. The specific findings for each of the research questions and related hypotheses 1 to 3 are presented, and the analysis of confirmatory qualitative data and theme tables for research question 4.

Research Question 1 and Hypotheses.

Q1. Does the EBT intervention cause improvements in self-regulatory processing (mindfulness and emotion regulation)? There are five mindfulness scales and two emotional regulation scales, so there are seven dependent variables covered by Q1.

$H1_0$: There is no significant difference in changes in mindfulness as measured by the Five Facet Mindfulness Questionnaire (FFMQ) in obese adults who participate in the EBT intervention compared to waitlist control subjects.

$H1_a$: Obese adult participants in the EBT intervention demonstrate statistically significant improvements in mindfulness based on the FFMQ compared to waitlist control subjects.

$H2_0$: There is no significant difference in changes in self-regulation based on the Emotional Regulation Questionnaire (ERQ) in obese adults who participate in EBT and waitlist control subjects.

$H2_a$: Obese adult participants in the EBT intervention demonstrate statistically significant improvements in self-regulation as measured by the ERQ compared waitlist control subjects.

The full results of the ANCOVA analysis for RQ1 are depicted in Appendix F, and the *p* values are presented in Table 7. The mean comparisons for each of the 16 dependent variables are presented Figures 5–20).

Table 7

Mean Comparison P Values for RQ1: Self-regulatory Processing[1,2]

		Test Group: (intervention immediately) Pre-posttreatment change[3]	Control Group: (intervention delayed) Pre-post treatment change[4]	Total Sample Pre-post treatment change[5]	Test Group Only Pre-follow-up change[6]
Df		1	1	2	1
Mindfulness:					
Observing		.082	.044*	$p > .05$	$p > .05$
Describing		$p > .05$	$p > .05$	$p > .05$	$p > .05$
Acting with awareness		$p > .05$	$p > .05$	$p > .05$	$p > .05$
Nonjudging		$p > .05$	$p > .05$	$p > .05$	.055
Nonreactance		.001*	$p > .05$	$p > .05$	$p > .05$
Emotion Regulation:					
Suppression		$p > .05$	$p > .05$	$p > .05$	$p > .05$
Cognitive reappraisal		.066	.085	$p > .05$	$p > .05$

Note. [1] See Appendix G for ANCOVAs and Figures 5–11 for mean comparisons graphs; [2] * $p < .05$. Comparison of Test and Control Group at T1 and T2; [4] Comparison of Test and Control Group at T2 and T3; [5] Comparison of combined Test Group at T1 and Time 2 and Control Group at T2 and T3; [6] Comparison Test Group at T1 and Time 3.

Mindfulness observing. The summary of results of the ANCOVA analysis for mindfulness observing is presented in Appendix F (Table F1) and Table 7. The 2 *df* interaction was not found to be significant for mindfulness observing, but the more precise comparison of the test group (intervention immediately), which is the comparison that is closest to the gold standard of a controlled clinical trial, showed a trend (p=.082) for the condition x time interaction at T1 and T2. The same interaction at T2 and T3 was significant ($p < .044$) for the control group (intervention delayed). As illustrated in Figure 5, the improvement from T1 to T2 was greater for the test group than the control

group. The slope of the green line was somewhat steeper than the slope of the blue line between T1 and T2, (p=.082). Further, the improvement from T2 to T3 was steeper for the control group (p=.044). The slope of the blue line was greater than the slope of the green line between T2 and T3. Neither of the BMI effects was significant. Although the significance levels were marginal or low, the pattern of means for mindfulness observing was consistent with the hypothesized pattern for mindfulness. However, the data were not consistent with the visual representation of the hypothesized condition x time interaction (Figure 4). The null hypothesis could not be rejected and no support existed for the alternative.

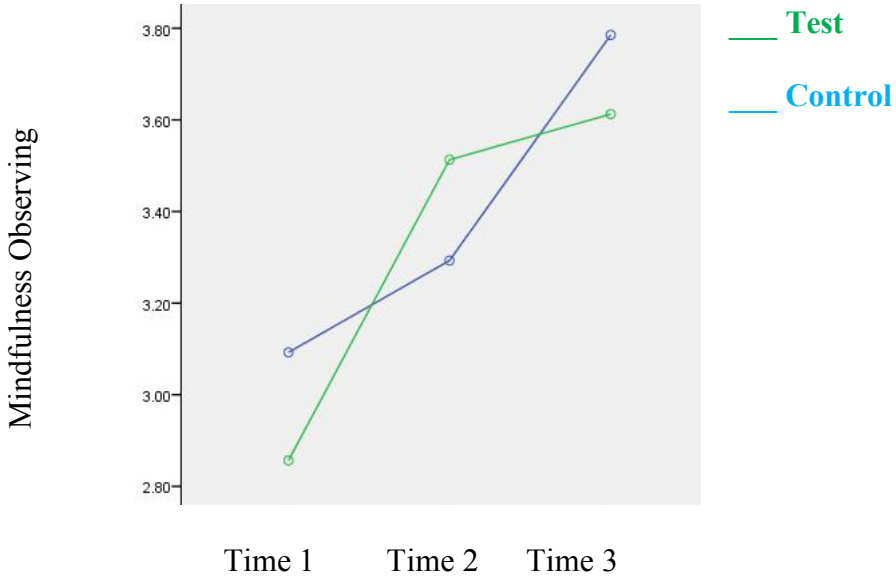


Figure 5. Mean comparisons: Mindfulness observing based on Five Facet Mindfulness Questionnaire

Mindfulness describing. As presented in Appendix F (Table F2) and Table 7, there was no significant time x condition effect (df = 2) for mindfulness describing. The

three comparisons of interactions were not significant. As illustrated in Figure 6, in both groups a decrease in mindfulness describing was observed from T1 to T2, and an increase from T2 to T3. The pattern of means is not consistent with the hypothesized pattern (Figure 4); there was no significant relationship between the EBT intervention and improvements in self-regulatory processing related to mindfulness describing. Neither of the BMI effects was significant. The null hypothesis is not rejected and the alternative hypothesis is not supported.

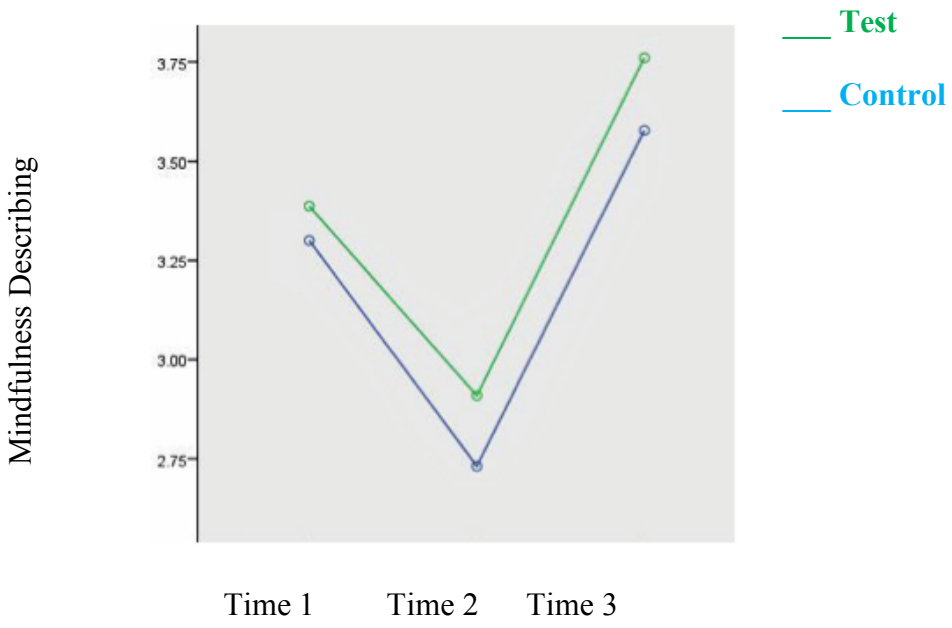


Figure 6. Mean comparisons: Mindfulness describing based on Five Facet Mindfulness Questionnaire

Mindfulness acting with awareness. There were no significant interaction effects for this variable, as presented in Appendix F (Table F3) and Table 7. Neither the time x condition (*df* = 2) result nor the three comparison interactions approached significance for mindfulness acting with awareness. As illustrated in Figure 7, the slope of the green line (treatment immediate) and the blue line (treatment delayed) are virtually identical. The changes in mindfulness acting with awareness were similar for the two

conditions. The BMI effects were not significant. The pattern of means is not consistent with Figure 4, a visual representation of the general form of hypothesized condition x time. The results are insufficient to reject the null hypothesis for this dependent variable.

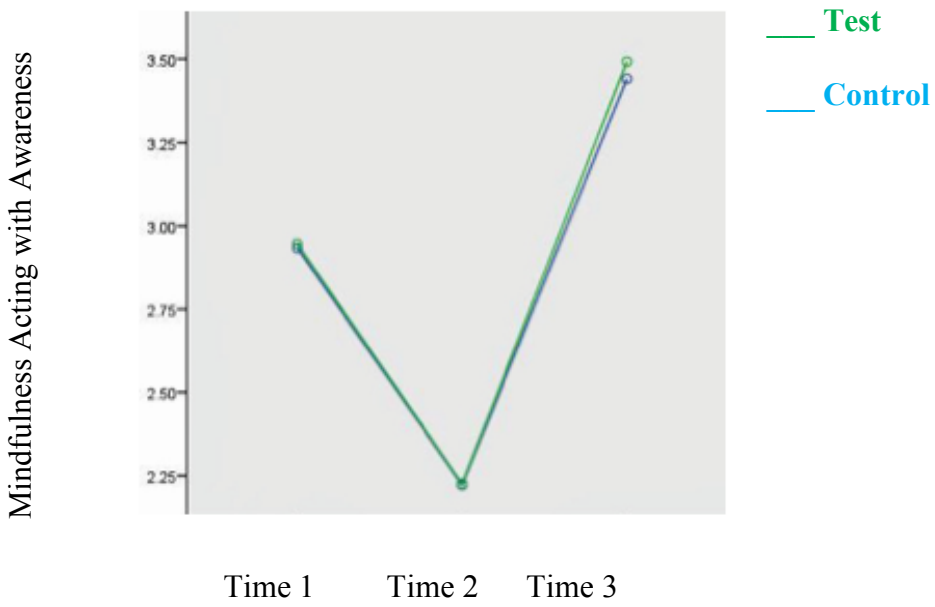


Figure 7. Mean comparisons: Mindfulness Acting with Awareness based on Five Facet Mindfulness Questionnaire.

Mindfulness nonjudging of inner experience. The results of the ANCOVA analysis for mindfulness nonjudging of inner experience are presented in Appendix F (Table F4) and Table 7. The 2 *df* time x condition interaction was not significant for mindfulness nonjudging of inner experience nor were the three other measures of interaction significant. As illustrated in Figure 8, the direction and extent of changes in the test group mirrored the changes in the control group. The BMI effects were not significant; however, the effect of time was significant (p=.034). The pattern of means is not consistent with the hypothesized pattern; there was no significant relationship between the EBT intervention and improvements in self-regulatory processing related to

mindfulness nonjudging inner experience and consistent with Figure 4, a visual representation of general form of hypothesized condition x time. The results are insufficient to reject the null hypothesis for this dependent variable.

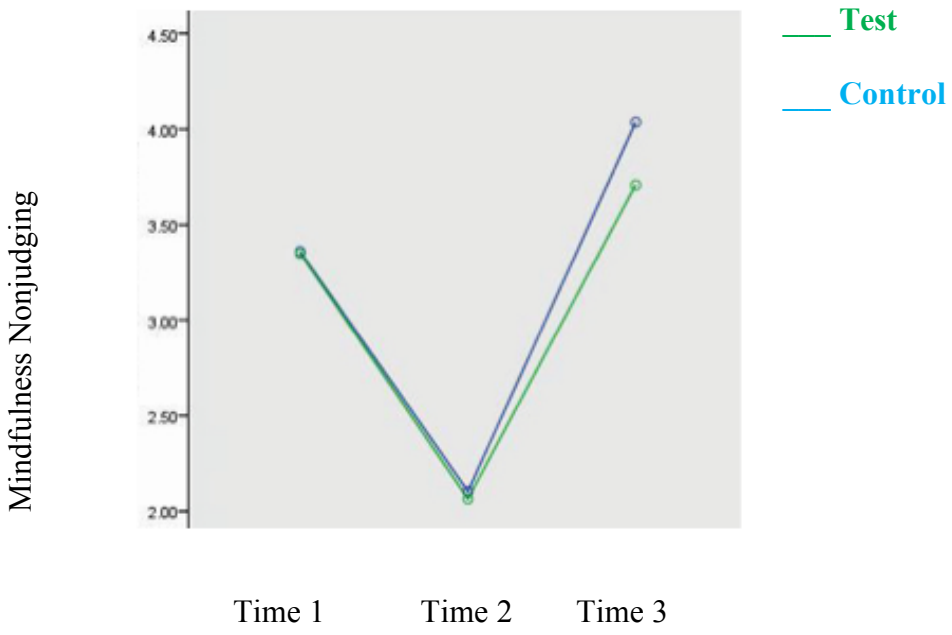


Figure 8. Mean comparisons: Mindfulness nonjudging of inner experience based on Mindfulness Five Facet Questionnaire

Mindfulness nonreactance to inner experience. The full 2 x 3 ANCOVA for mindfulness nonreactance to inner experience is presented in Appendix F (Table F5) and the summary of *p* values is presented in Table 7. Neither the 2 *df* interaction nor the comparison of the test and control groups (T2–T3) approached significance. However, the comparison of the test and control groups (T1–T2) was significant ($p < .001$). Neither measure of the effect of BMI was significant. As can be seen in Figure 7, the blue line (treatment immediately) is steeper than the green line (treatment delayed) during the period that each group was receiving the EBT intervention, which is consistent with

theory. These changes do not approach significance in three of the four comparisons. The significant T2–T3 interaction and the pattern of means for T1–T2 suggest that there was a relationship between the EBT intervention and improvements in self-regulatory processing measured by the mindfulness nonreactance to inner experience scale that was consistent with theory. This finding was significant ($p < .001$) for the test group, the based comparison that more closely mirrored a controlled clinical trial. Although the strength of the test group time x condition interaction is noteworthy, this result alone is sufficient to reject the null hypothesis. The results are not consistent with Figure 4, a visual representation of general form of hypothesized condition x time. The results do not support the rejection of the null hypothesis and the acceptance of the alternative hypothesis.

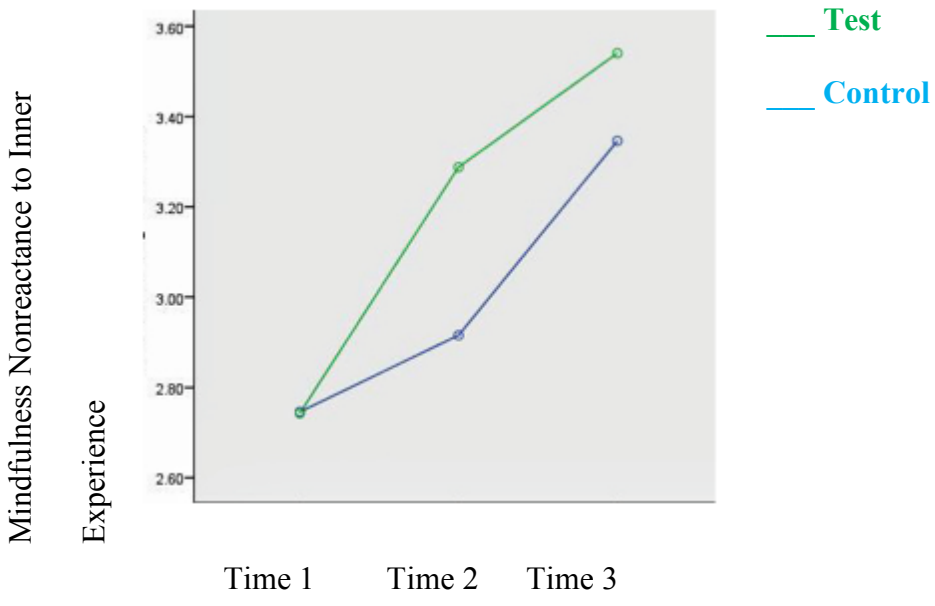


Figure 9. Mean comparisons: Mindfulness nonreactance to inner experience based on the Five Facet Mindfulness Questionnaire

Emotion regulation suppression. The summary of results of the ANCOVA analysis for emotion regulation suppression are consistent with theory, but do not reach significance. These results are presented in Appendix F (Table F6) and Table 7. The effect in time x condition (2 *df)* was significant for emotion regulation suppression. The two interactions based on controlled conditions and the comparison of baseline and follow-up emotion regulation suppression in the test group were not significant; nor was the effect of BMI significant. As illustrated in Figure 10, the test group emotion regulation suppression improved between T1 to T2 when they received the EBT intervention, and this dependent variable improved in the control between T2 and T3 when they were receiving the intervention. Moreover, for both comparisons, in the group that was not receiving the intervention, emotion regulation worsened. The pattern of means shown in Figure 10 is consistent with the hypothesized changes (Figure 4), but the predicted interactions were not significant. The null hypothesis could not be rejected for emotion regulation suppression.

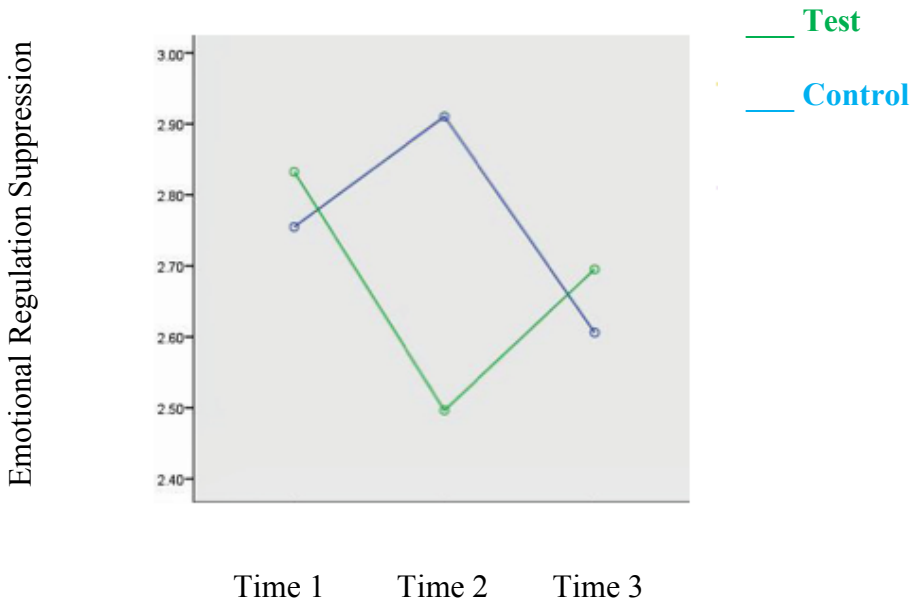


Figure 10. Mean comparisons: Emotional regulation suppression based on Emotional Regulation Questionnaire

Emotional regulation reappraisal. The full ANCOVA analysis for emotion regulation reappraisal are presented in Appendix F (Table F7) and the summary of *p* values is displayed in Table 7. The 2 *df* interaction was not significant for emotion regulation reappraisal, but the more precise comparisons of time x condition for the test group (T1–T2) and the control group (T2–T3) when receiving the intervention approached significance ($p = .066$ and $p = .085$, respectively). As illustrated in Figure 11, the improvement from T1 to T2 was greater for the test group than the control group. The slope of the green line was somewhat steeper than the slope of the blue line between T1 and T2, ($p < .082$). Further, the improvement from T2 to T3 was steeper for the control group ($p < .044$). The slope of the blue line was greater than the slope of the green line between T2 and T3. Neither of the BMI effects were significant; although the

significance levels were marginal or low, the pattern of means for mindfulness observing was consistent with the hypothesized pattern (Figure 4). However, the adaptive changes in emotion regulation appraisal did not reach significance; the null hypothesis could not be rejected and no support exists for the alternative.

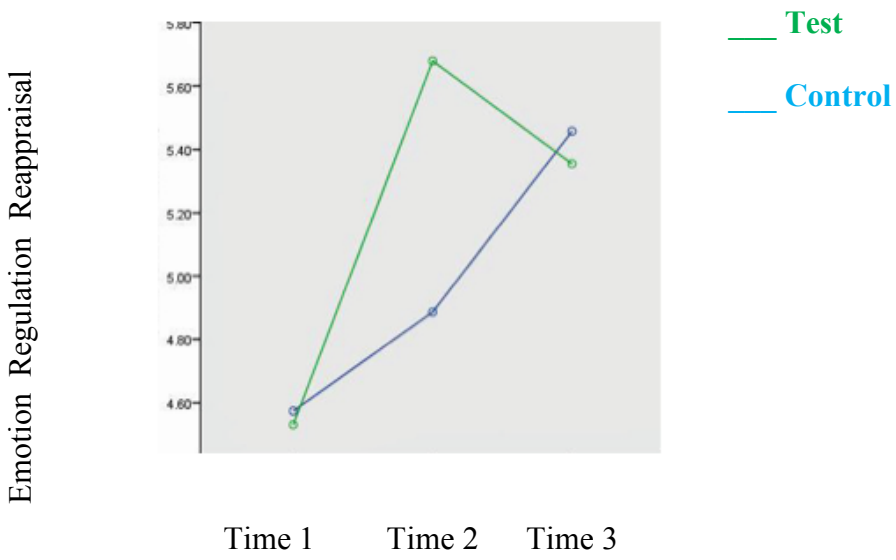


Figure 11. Mean comparisons: Emotion regulation reappraisal based on the Emotion Regulation Questionnaire

Research Question 2 and Hypotheses

Q2. Does the EBT intervention cause improvements in stress-related psychological variables (perceived stress, depressive symptoms, positive and negative affect, self-efficacy, and food dependence)?

$H3_0$: There is no significant difference in perceived stress as measured by the Perceived Stress Scale (PSS) in obese adults treated with the EBT intervention and waitlist control subjects.

$H3_a$: Obese adult participants in the EBT intervention demonstrate statistically significant decreases in perceived stress as measured by the PSS compared to waitlist control subjects.

$H4_0$: There is no significant difference in depressive symptoms as measured by the Center for Epidemiologic Studies Depression Scale (CESD) in obese adults who participate in the EBT intervention and waitlist control subjects.

$H4_a$: Obese adult participants in the EBT intervention demonstrate statistically significant decreases in depressive symptoms as measured by the CESD compared to waitlist control subjects.

$H5_0$: There is no significant difference in changes in positive and negative affect as measured by the Positive and Negative Affect Scale (PANAS) in obese adults who participate in the EBT intervention and waitlist controls.

$H5_a$: Obese adult participants in the EBT intervention demonstrate statistically significant increases in positive affect and decreases in negative affect as measured by the PANAS compared to waitlist control subjects.

$H6_0$: There is no significant difference in changes in self-efficacy as measured by the General Self-efficacy Scale (GSE) in obese adults who participate in the EBT intervention compared to waitlist control subjects.

$H6_a$: Obese adult participants in the EBT intervention demonstrate statistically significant improvements in self-efficacy as measured by the GSE compared to waitlist control subjects.

$H7_0$: There is no significant difference in changes in food dependence as measured by the Yale Food Addiction Scale (YFAS) between obese adults who participate in the EBT intervention and waitlist control subjects.

$H7_a$: Obese adult participants in the EBT intervention demonstrate statistically significant decreases in food dependence as measured by the YFAS compared to waitlist control subjects.

Table 8

Mean Comparison P Values for RQ2: Stress-related Psychological Variables[1,2]

		Test Group: (intervention immediately) Pre-post treatment change[3]	Control Group: (intervention delayed) Pre-post treatment change[4]	Total Sample Pre-post treatment change[5]	Test Group only Pre-follow-up change[6]
Df		1	1	2	1
Perceived Stress		.0005*	.0005*	.0005*	$p > .05$
Depression		.0005*	.010*	.0005*	$p > .05$
Affect					
Positive		.003*	.023*	.003*	$p > .05$
Negative		.002*	.003*	.004*	$p > .05$
Self-efficacy		.031*	.011*	.019*	$p > .05$
Food dependence		$p > .05$	.004*	.012*	$p > .05$

Note. [1] See Appendix G for ANCOVAs and Figures 12-17 for mean comparisons graphs; [2] * $p < .05$. Comparison of Test and Control Group at T1 and T2; [4] Comparison of Test and Control Group at T2 and T3; [5] Comparison of combine Test Group at T1 and Time 2 and Control Group at T2 and T3; [6] Comparison Test Group at T1 and Time 3.

Perceived stress. The full 2 x 3 ANCOVA for perceived stress is presented in Appendix F (Table 8), the *p* values are in Table 9, and the means are presented in Figure 12. The three main interaction results from the ANCOVA for perceived stress were all significant ($p = .0005$). The finding for the test group comparing baseline and 16-week

results (T1–T3) was not significant. The BMI effects were not significant. The mean comparisons presented in Figure 8 show that improvement in perceived stress from T1 to T2 was greater for the test group—the slope of the green line is greater than the slope of the blue line between T1 and T2; the improvement from T2 to T3 was greater for the control group—the slope of the blue line was greater than the slope of the green line between T2 and T3. This figure is consistent with the Figure 4, a visual representation of general form of hypothesized condition x time. As hypothesized, there was a relationship between the EBT intervention and improvements in perceived stress. There is evidence that supports rejecting the null hypothesis and accepting the alternative.

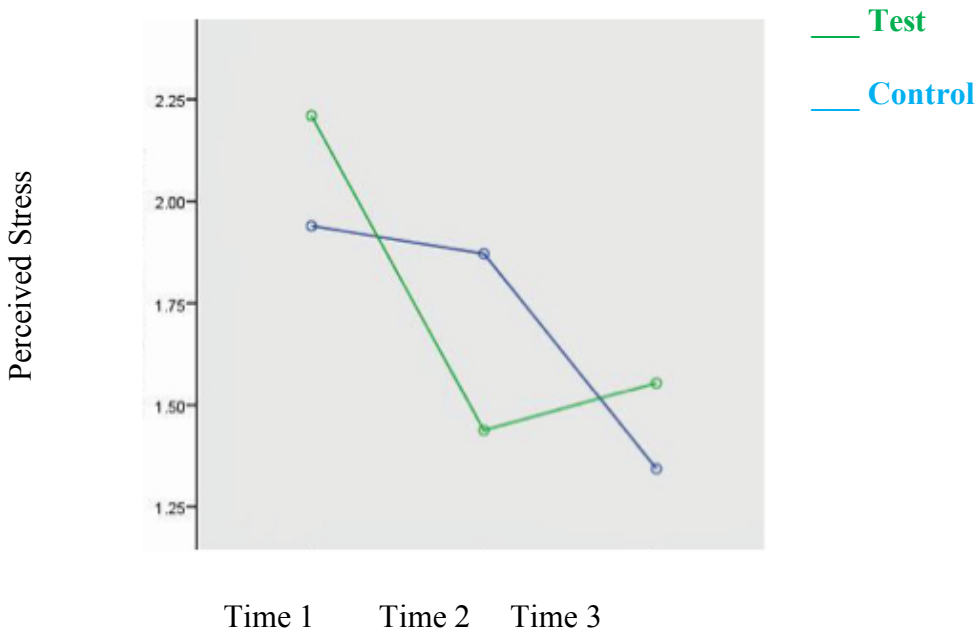


Figure 12. Mean comparisons: Perceived stress based on Perceived Stress Scale

Depression. The full 2x3 ANCOVA for depression is presented in Appendix F (Table F9); the *p* values are presented in Table 8. Three of the interaction effects were significant: the 2 *df* interaction (p=.0005), the test group comparison (p=.0005), and the control group comparison (p=.010). The finding for the test group comparing baseline and 16-week results (T1–T3) was not significant. The two BMI effects were not significant. In Figure 13, the test group in T1 to T2 was receiving the EBT intervention improved depression, whereas the control group that did not receive the EBT intervention during this period did not improve depression. The depression score (T1–T2) as shown by the blue line (test group) decreased, whereas the depression score as shown by the green line (control group) increased slightly. The control group in T2 to T3 received the EBT intervention and improved depression, whereas the test group that did not receive the EBT intervention during this period showed an increase in depression. These findings are consistent with Figure 4, the visual representation of general form of hypothesized condition x time. As hypothesized, there was a relationship between the EBT intervention and improvements in depression.

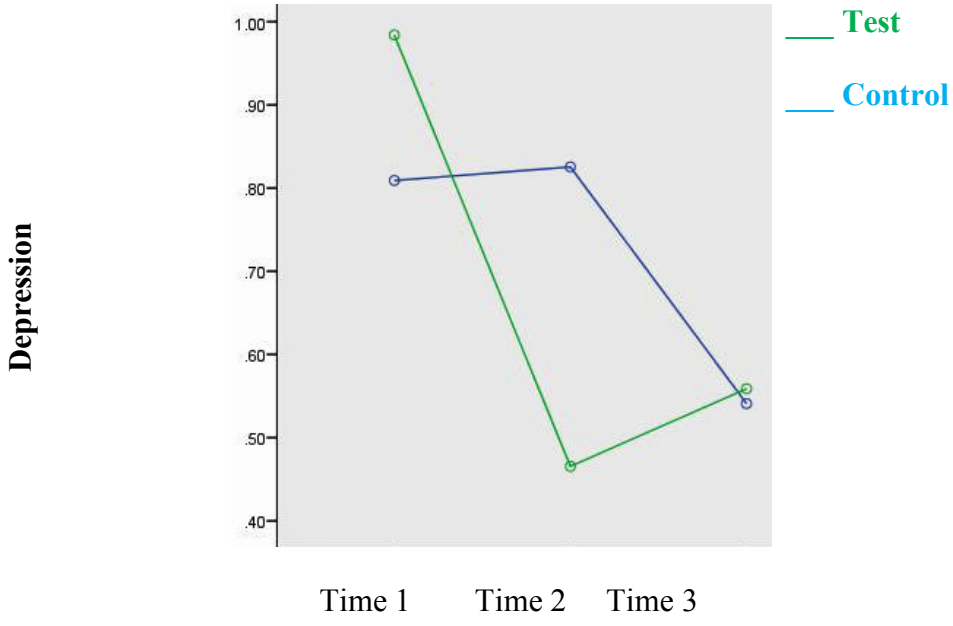


Figure 13. Mean comparisons: Depression based on Center for Epidemiologic Studies: Depression Scale

Positive Affect. The results of the ANCOVA analysis for positive affect are presented in Appendix F (Table F10) and Table 8. For the dependent variable of positive affect, three of the interaction effects were significant: the 2 *df* interaction ($p < .003$), test group (T1–T2) comparison ($p = .003$), and control group (T2–T3) comparison ($p = .023$). The finding for the test group (T1–T3) was not significant. The two BMI effects were not significant. In Figure 14, comparison of the means of positive affect, the improvement from T1 to T2, is greater for the test group—the slope of the green line is greater than the slope of the blue line between T1 and T2. Further, the improvement from T2 to T3 is greater for the control group—the slope of the blue line is greater than the slope of the green line between T2 and T3. These findings are consistent with Figure

4, the visual representation of general form of hypothesized condition x time. As hypothesized, there was a relationship between the EBT intervention and improvements in positive affect. The null hypothesis could be rejected and the alternative hypothesis supported.

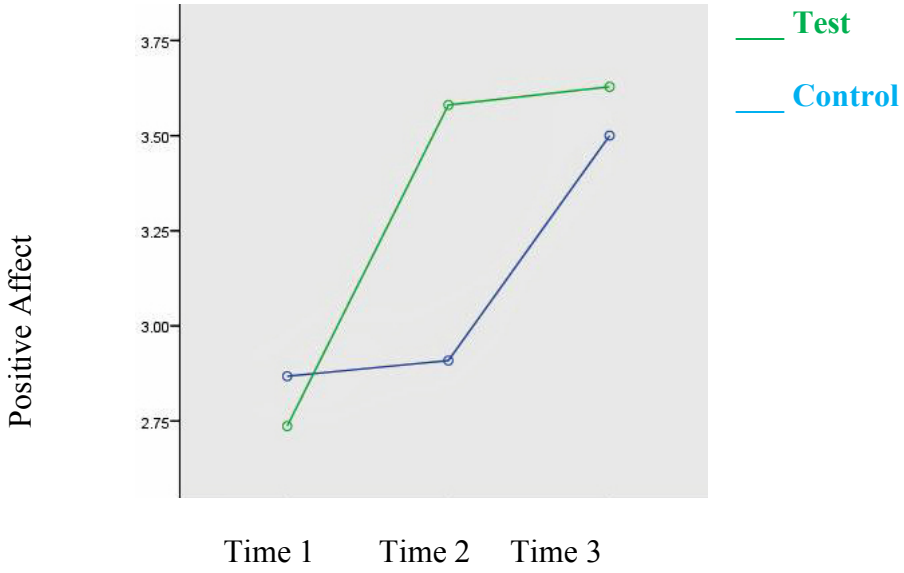


Figure 14. Mean comparisons: Positive affect based on Positive and Negative Affect Scale

Negative Affect. The results of the ANCOVA analysis for positive affect are presented in Appendix F (Table F11) and Table 8. For the dependent variable of negative affect, again, three of the interaction effects were significant. The 2 *df* interaction for the entire sample was significant (p=.004). The test group comparison (T1–T2) was significant (p =.002), and control group comparison (T2–T3) was also significant (p=.003). Change in negative affect for the test group based on the T1 to T3 comparison (baseline compared to 16 weeks) was not significant. The two BMI effects were not

significant. In Figure 15, the slope of the lines show that the test group (blue line) improved negative affect during treatment (T1 – T2), but regressed somewhat during the nontreatment period after the intervention. The control group improved negative affect as shown by the green line throughout the study period (T1, T2 and T3); however, the slope of the line reflecting the control group changes in negative affect was steeper during the intervention interaction effects, and the blue line was somewhat steeper than the green line, showing a greater improvement in negative affect during treatment compared to the waitlist control period that preceded it. These findings are somewhat consistent with Figure 4, the visual representation of general form of hypothesized condition x time. As hypothesized, there is evidence to support a relationship between the EBT intervention and improvements in negative affect.

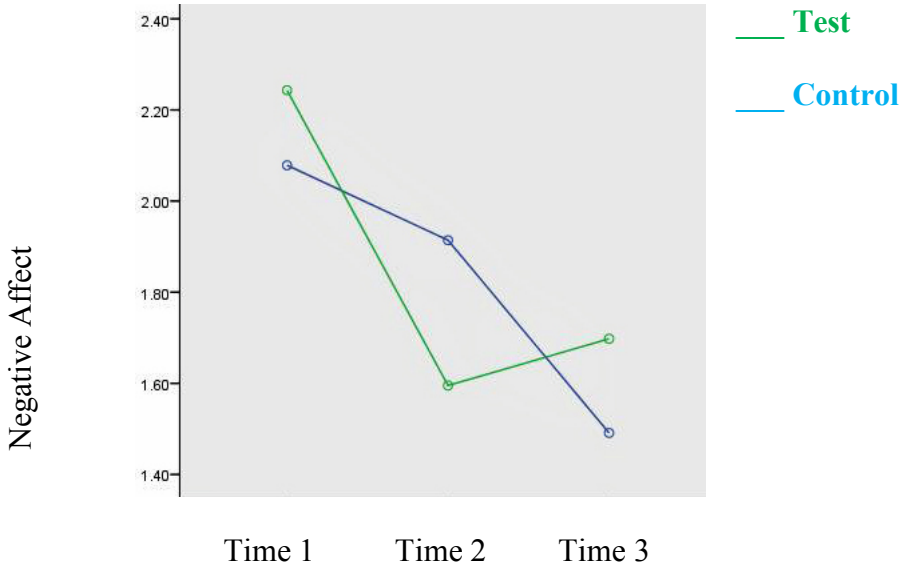


Figure 15. Mean comparisons: Negative affect based on Positive and Negative Affect Scale

General Self-Efficacy Scale (GSE). The full 2 x 3 ANCOVA for depression is presented in Appendix F (Table F12); the *p* values are presented in Table 8. Three of the interaction effects were significant: the 2 *df* interaction (p =.019), the test group comparison (p=.031), and the control group comparison (p = .011). The finding for the test group (T1–T3) was not significant. The two BMI effects were not significant. In Figure 16, the test group in T1 to T2 (blue line) that was receiving the EBT intervention improved general self-efficacy, and showed a decrease during the posttreatment period (T2–T3). The control group showed the opposite pattern (green line), with a decrease in general self-efficacy during the pretreatment period (T1–T2) and improved general self-efficacy while receiving the EBT intervention. These findings are consistent with general form of hypothesized condition x time (Figure 4), providing evidence for rejecting the null hypothesis and accepting the alternative hypothesis.

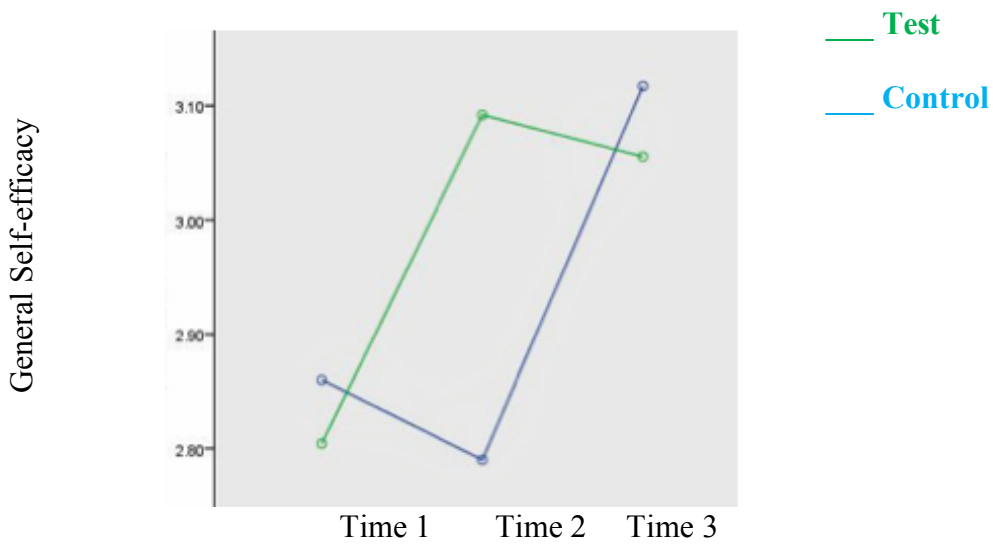


Figure 16. Mean comparisons: General Self-efficacy based on the General Self-efficacy Scale

Food Dependence. The full 2 x 3 ANCOVA for food dependence is presented in Appendix F (Table F13); the *p* values are presented in Table 8. The interaction 2 *df* interaction was significant (*p*=.012), as was the control group comparison (*p*=.004). The interaction of the test group at baseline and 16 weeks (T1–T3) was not significant, and the T1 to T2 test group comparison was not significant, however, the time comparison was significant (*p*=.038). The two BMI effects were not significant. In Figure 17, the test group in T1 to T2 (blue line) was receiving the EBT intervention improved food dependence, and showed a decrease during the posttreatment period (T2–T3). The control group showed an improvement in food dependence prior to treatment (green line), with a decrease in food dependence during the posttreatment period (T2–T3). These findings are somewhat consistent with general form of hypothesized condition x time (Figure 4), providing evidence for rejecting the null hypothesis and accepting the alternative hypothesis regarding the relationship between participating in the EBT intervention and food dependence.

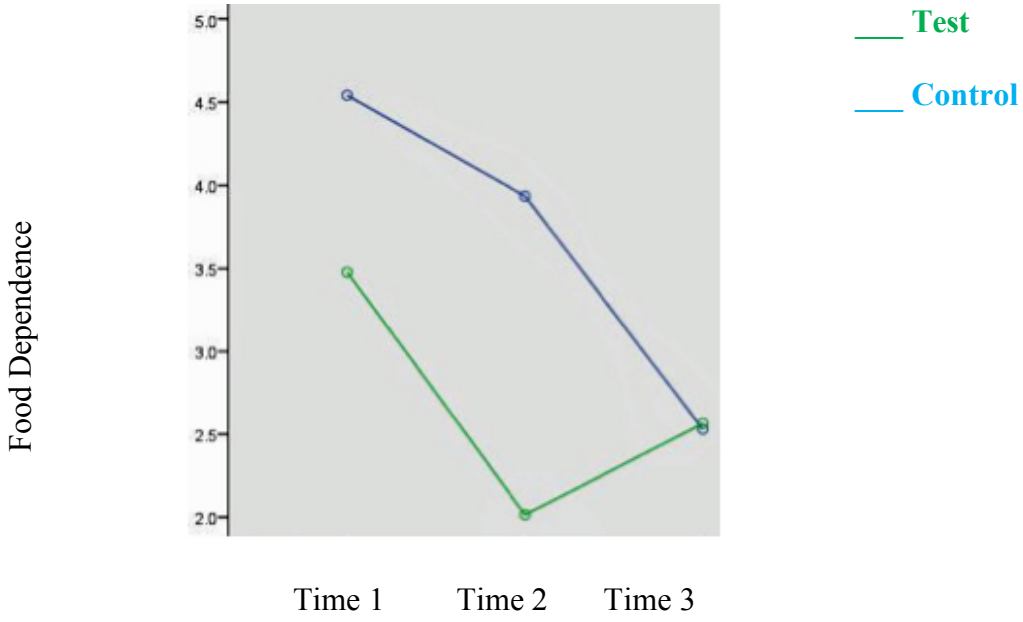


Figure 17. Mean comparisons: food dependence based on the Yale Food Dependence Scale

Research Question 3 and Hypotheses

Q3. Does the EBT intervention cause improvements in stress-related physiologic and anthropometric variables (blood pressure and Body Mass Index)?

H8$_0$: There is no significant difference in change in blood pressure in those who participate in the EBT intervention and waitlist control subjects.

H8$_a$: Obese adult participants in the EBT intervention demonstrate statistically significant improvements in blood pressure compared to waitlist control subjects.

H9$_0$: There is no significant difference in change in obesity in obese adults as measured by Body Mass Index in obese adults treated with the EBT intervention and waitlist control subjects.

$H9_a$: Obese adult participants in the EBT intervention demonstrate statistically significant decreases in obesity as measured by Body Mass Index compared to waitlist control subjects.

Table 9

Mean Comparison P Values for RQ3: Physiologic and Anthropometric Variables[1,2]

		Test Group (intervention immediately) Pre-post treatment change[3]	Control Group (intervention Pre-post treatment change[4]	Total Sample Pre-post treatment change[5]	Test Group Only Pre-follow-up change[6]
Df		1	1	2	1
Blood Pressure					
Systolic		*p*>.05	.033*	.088	*p*>.05
Diastolic		*p*>.05	*p*>.05	*p*>.05	*p*>.05
Body Mass Index		.032*	.033*	.012	.054

Note. [1] See Appendix G for ANCOVAs and Figures 18-20 for mean comparisons graphs; [2] * p <.05. Comparison of Test and Control Group at T1 and T2; [4] Comparison of Test and Control Group at T2 and T3; [5] Comparison of combine Test Group at T1 and Time 2 and Control Group at T2 and T3; [6] Comparison Test Group at T1 and Time 3.

Systolic blood pressure. The full 2 x 3 ANCOVA for systolic blood pressure is presented in Appendix F (Table F14); the *p* values are presented in Table 9. The 2 *df* interaction approached significance (p =.088), the test group comparison was significant (p=.033), but the control group comparison and the test group at baseline and 16 weeks (T1–T3) were not significant. One of the two BMI effects approached significance (p =.058). Mean comparisons (Figure 18) shows that the test group in T1 to T2 (blue line) improved blood pressure, as did the control group (green line, even though the slope of the line for the test group was greater). The control group showed no change in systolic blood pressure during the intervention, whereas the systolic blood pressure of the test

group increased. These findings are not consistent with general form of hypothesized condition x time (Figure 4), providing evidence for accepting the null hypothesis regarding the relationship between participating in the EBT intervention and systolic blood pressure.

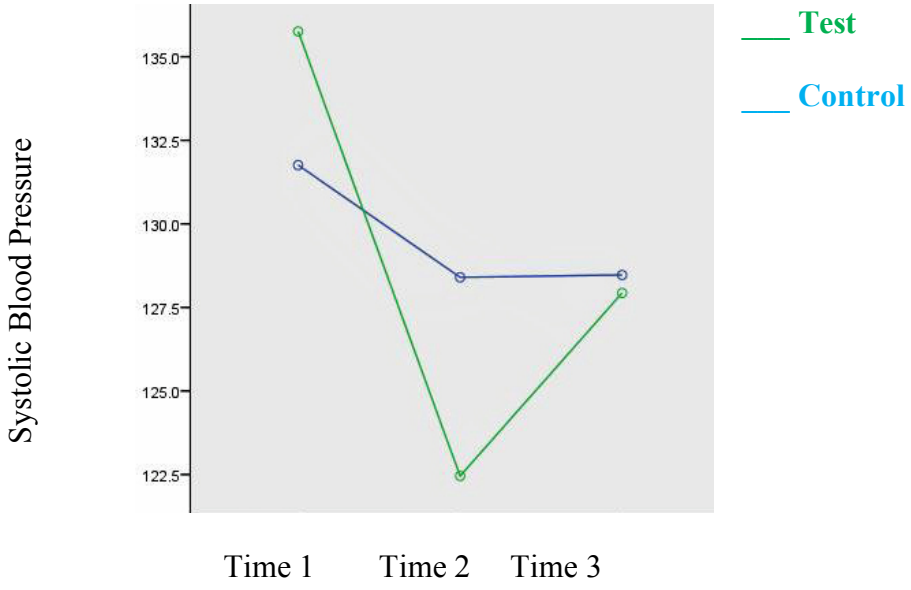


Figure 18. Mean comparisons: Systolic blood pressure (mmHg)

Diastolic Blood Pressure. Similar to the findings for systolic blood pressure, there was no significant interaction between the intervention and diastolic blood pressure. The findings are presented in Appendix F (Table F18); the *p* values are presented in Table 9. All interactions failed to approach significance, and one of the two BMI effects reached significance (p =.002). Mean comparisons (Figure 19) show that the test group in T1 to T2 (blue line) improved diastolic blood pressure, whereas the blood pressure measure of the control group increased (green line). For both the control group and the test group blood pressure improved in T2 to T3. The trends in these findings are

consistent with general form of hypothesized condition x time (Figure 4), however, because the changes did not approach significance, there is insufficient evidence for accepting the null hypothesis regarding the relationship between participating in the EBT intervention and diastolic blood pressure.

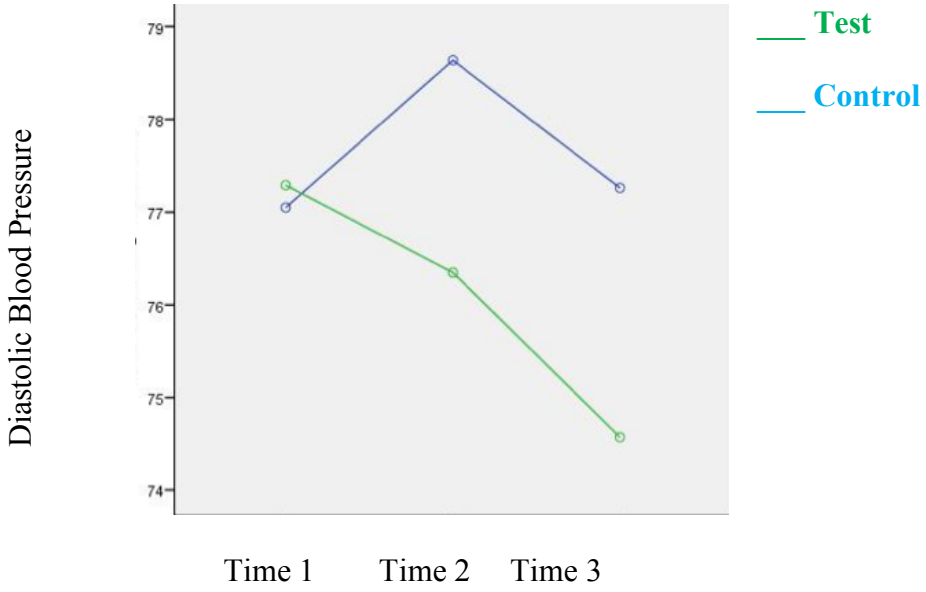


Figure 19. Mean comparisons: Diastolic blood pressure (mmHg)

Body Mass Index (BMI). The full 2 x 3 ANCOVA for BMI is presented in Appendix F (Table F9); the *p* values are presented in Table 9. All four interaction effects were significant or approached significance for BMI. The 2 *df* interaction (p=.085). The test group comparison (p=.032), and the control group comparison (p=.03) were both significant. The finding for the test group comparing baseline and 16-week results (T1–-T3) approached significance (p=.054). In Figure 20, the test group in T1 to T2 while receiving the EBT intervention showed decreases (blue line), whereas the waitlist control group showed increases (green line). The BMI (T1–T2) as shown by the blue line (test

group) continued to decrease and the control group, which was receiving the EBT intervention (green line) decreased. These findings are consistent with Figure 4, the visual representation of general form of hypothesized condition x time. As hypothesized, there was a relationship between the EBT intervention and improvements in BMI.

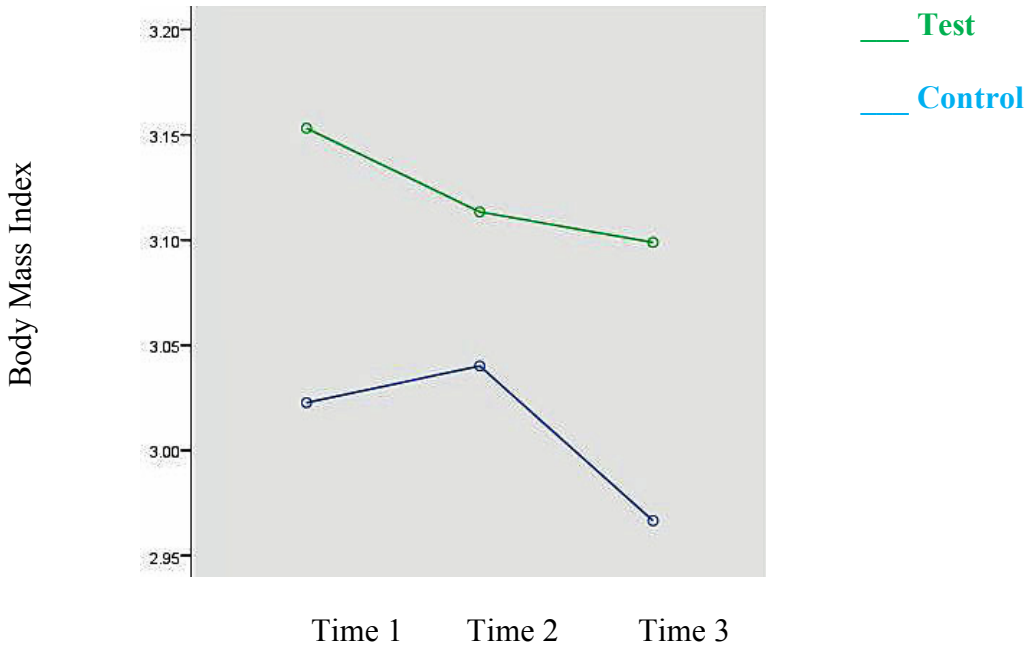


Figure 20. Mean comparisons: Body Mass Index

The findings of the quantitative component of the study showed a trend that is consistent with theory for stress-related psychological variables and inconsistent with theory for self-regulation measures.

Data Preparation: Qualitative Component

The qualitative component of this sequential mixed methods study expanded the scope of the report, and drew upon survey data to provide an initial evaluation of the mediators of EPT.

Pilot study. Prior to data collection, the researcher-designed survey was reviewed by a panel of EBT researchers for face validity. The structure and content of the initial iteration of the survey was maintained, with one open-ended question corresponding to each of the seven nonbiologic constructs measured in the qualitative component of this study. Minor modifications in the wording of the questions were made (see Appendix B).

All transmission of data was performed as planned with the EBT Providers (*n*=5) executing a consent form (see Appendix D) prior to survey completion. Data were analyzed for the emergence of minor themes within the a priori major themes, and the data set was analyzed to identify minor themes for each construct that may not have been fully elucidated by the measures used in the quantitative component of the study. In addition, the data that pertained to useful and non-useful program components elicited responses that were expressed in program-specific terms that are not relevant to the understanding of theory or to answering the research questions, so these data were not analyzed for the current report. The qualitative analysis focused on broader themes related to EPT that could be useful in informing the direction of future research.

Content analysis of the qualitative data was performed (Miles & Huberman, 1994; Saldana, 2009) using Atlas.ti qualitative data analysis software with codes emerging a priori based on the seven constructs that are study- and theory-relevant inductively from the data. Analysis involved first immersion (reading and rereading survey responses to become immersed in the data), coding (identifying specific segments of information, categorization, and elimination of redundancies, and identifying major and minor themes.

Units of meaning were assigned with one or more codes from the concepts in the a priori list of constructs associated with the constructs studied.

Participant Characteristics: Qualitative Sample

Of the qualitative component participants, 5 were female (100%), 4 (80%) were White, and 1 (20%) was Hispanic. All participants (100%) held a post-graduate or professional degree, and all reported a marital status of married. Two participants (40%) reported position titles as mental health professionals, two as nutritionists (40%) and one as an addiction counselor (20%). Level of certification in EBT varied among providers. One participant was certified in EBT to provide only introductory courses (20%), three were certified to provide introductory courses and some advanced courses (60%) and one participant was certified to provide introductory and all advanced courses (20%). The frequency table of demographic and training characteristics can be found in Appendix E (Table E3).

Results: Qualitative Component

What follows are specific findings for the fourth research question and the analysis of confirmatory qualitative data and theme tables for research question 4.

Research Question 4.

Q4. Do the subjective responses of the EBT Providers confirm the findings from the qualitative component of the study for self-regulatory and psychological variables?

The theme tables that emerged from the qualitative analysis for RQ4 are presented in Tables 10 and 11. The questions of the survey that was construct-specific that was approved by the EBT panel of experts is presented as the a priori major themes. All participants responded that participants had made meaningful and significant changes in

the variables. The explanatory comments that they inserted into the text boxes were analyzed to develop minor themes. They are presented in two tables, one for the constructs of self-regulation (Table 10) and the other for the constructs of stress-related psychological variables (Table 10).

Major Themes.

Mindfulness. As an a priori theme, the five participants observed changes in intervention participants in mindfulness, as illustrated by the statement of Participant 1, "At the beginning of the training most participants had limited skills to support mindfulness. By the end of the training they had experimented with numerous tools to develop and support mindfulness," and the assessment of Participant 2, "From the interaction and observation within the group, I was aware that at least 80% of participants displayed factors that represent being more mindful."

The finding of the quantitative component of the study was that participants did not make significant changes in mindfulness, suggesting an inconsistency between quantitative and qualitative data. For any variable in which the quantitative findings failed to show a significant interaction with participation in the theory-based intervention or the qualitative and quantitative findings were not consistent, the themes that emerged from the analysis of the qualitative data became more important.

Emotional connection to self. Participants described intervention participants as attuning to their emotions and feeling connected to themselves. This secure connection, in contrast to observing feelings or describing feelings, is consistent with secure attachment and adaptive neurophysiology (Hruby, 2011; Mikulincer & Shaver, 2012). All providers expressed this concept in their survey responses. This theme integrates the

importance of emotions over thoughts, consistent with brain physiology and the role of emotions in the homeostatic process that is the basis of survival (Damasio, 2003; LeDoux, 2012b). Emotional connection to self integrates both emotional awareness and secure, loving attachment, as stated by Participant 5, "Participants reported improvement in connection to themselves." Implicit in their statements was the priority of emotional awareness. Participant 1 stated that "they became aware of their feelings and embraced them," and Participant 4 observed, "Many could stay with their feelings rather then being numb." It is in that state of emotional awareness that the brain is in a homeostatic state, and warm, loving attachment is physiologically favored (Lewis et al., 1999; Siegel, 2007). This observation of intervention participants increasing their emotional connection to themselves was best characterized by the statement of Participant 3, "They could see themselves more clearly, more lovingly." This theme supports observations that the theory-based intervention causes improvements in self-regulation; however, it is not consistent with the findings of the quantitative component of the study and may not be consistent with the constructs of the mindfulness measure used in this report (Baer et al., 2008).

Brain state appraisal. All participants repeatedly stated that intervention participants learned to identify the physiologic state of their brain, such as Participant 5 noting, "I witnessed an increased ability to identify their brain state." Physiologic states integrate sensations, emotions, cognitions, and behaviors. Implicit in learning the skill of identifying one's brain state is awareness and nonjudgment, as reported by Participant 3, "They were able to be aware of their brain state, and be mindful of themselves, without judging." However, the theme that emerged from the data was brain states and their

appraisal. This theme is best exemplified by Participant 2 who noted, "I witnessed this during check ins, as participants had an increased ability to sit with themselves, breath, and warmly observe themselves, and their brain state." This appraisal is based on brain science, and in describing intervention participants' learning, providers repeatedly referred to concepts of neuroscience. This is exemplified by the statement by Participant 1, "The participants realized there was nothing wrong with them. It's just a wire," and by Participant 4 who noted, "Participants expressed relief knowing neuroscience concepts." This theme supports observations that the theory-based intervention causes improvements in self-regulation, however, the focus on appraising brain states, rather than sensations, emotions and thoughts differs from current constructs of the mindfulness that were measured in this report (Baer et al., 2008).

Power to accept or change brain state. Apart from the capacity to actively change state, the theme emerged of power to accept of change brain state. In the process of self-regulation that is consistent with the theory-based intervention, appraisal is followed by choosing either to accept or change that brain state. All participants stated that intervention participants felt empowered by this knowledge. This is exemplified by Participant 3 who noted, "If I had one word to describe their mood change, it would be empowerment." According to Participant 4, "Many participants expressed that they felt more power and control in their lives, and felt less like the victim of their circumstances." Participant 5 stated, "Participants stopped judging their brain states and themselves." Implicit in brain states is both nonjudgment and the sense that they could elect to change their brain state by their own emotional processing. This theme supports observations that the theory-based intervention causes improvements in self-regulation, as states of

high arousal are activated by allostatic circuits, which are positive feedback loops, promoting sustained experiences of stress and negative emotions. This theme was expressed by all participants and may be consistent with adaptive self-regulation, as activation of the left prefrontal cortex is associated with positive emotions and approach (Davidson, 2004). This activation associated with use of theory-based concepts and tools may differ from current concepts of mindfulness (Hayes et al., 2011), which emphasize acceptance rather than active appraisal of brain state and active change of brain state.

These findings may offer a possible explanation for the inconsistency between the findings of the qualitative and quantitative components of this report. These themes may be inconsistent with the constructs of mindfulness assessed by the existing measure (Baer et al., 2008). The concepts of mindfulness assessed by the instrument used in the quantitative component of the study (awareness, describing, acting with awareness, nonjudging inner experience and nonreactance to internal experience) may be inconsistent with EPT and the concepts of mindfulness that focus on emotional connection with self and appraisal of brain state and power to not only accept state but to use internal processing to modify brain state. These observations suggest that EBT may have improved mindfulness based on processes that the current measure did not evaluate, that is, the FFMQ may not have had sufficient construct validity for purposes of assessing self-regulatory changes in this theory-based intervention.

Table 10

Major Themes and Minor Themes: Self-regulation

	Participant				
Major Theme and Minor Themes	1	2	3	4	5
Mindfulness					
Emotional connection to self	X	X	X	X	X
Brain state appraisal	X	X	X	X	X
Power to accept or change brain state	X	X	X	X	X
Emotion Regulation					
Feeling the feelings	X	X	X	X	X
Bad feelings are good	X		X	X	X
Tools to switch brain state	X	X	X	X	X

Note. N=5

Emotion Regulation. All five participants observed adaptive changes in intervention participants in emotion regulation. This minor theme is illustrated by the statement of Participant 5, "Emotion regulation was another of the more significant improvements noted," and by the statement by Participant 4, "This course definitely made some significant changes in their daily outlook on life and enjoyment with others in their personal interactions through better regulation of their emotions." In contrast, the findings from the quantitative component of the study showed that participation in the theory-based intervention was associated with no significant improvements in emotion regulation. The analysis of the data for themes in the construct-specific survey data from the participants yielded three minor themes: (a) feeling the feelings, (b) bad feelings are good, and (c) tools to switch brain states.

Feeling the feelings. Survey responses from all participants included repeated references to intervention participants feeling their feelings. The theory-based tools of the intervention are based on emotional processing that includes internal emotional processing of emotions that emphasizes feeling the feelings, sustaining the focused attention on feeling until the arousal diminishes. This skill is integrated into all of the tools of self-regulation of the intervention, in contrast to affect labeling, reappraisal, distraction, or observing (Lieberman, Inagaki, Tabibnia & Crockeet, 2011). In stressed states, cognitive processing is compromised and cognitive strategies may be challenging because of compromised neocortical processing (McEwen et al., 2012) or deleterious, leading to rumination or sustained allostatic emotional states (Ray, Wilhem, & Gross, 2008). The tools are theorized to enable individuals to process intense negative emotions in a way that switches the brain to a homeostatic state, weakens allostatic circuits and

promotes adaptive growth. Although reappraisal is used to promote brain state identification, processing emotions from allostatic to homeostatic is core to theory-based emotion regulation. Participants described how challenging this is for intervention participants. Allostatic states are associated with hyperarousal or dissociation (Perry & Hambrick, 2008), and it is the experience of homeostatic emotions that promotes adaptive growth. As stated by Participant 5, "Many participants seemed to have great difficulty staying with their feelings without dissociating and showed significant improvement by end of services." Participants commented on improvements in the skill of emotional expression among intervention participants, which is best exemplified by the statement by Participant 5 "Emotional expression showed up as crying and sadness, as well as joy." By use of adaptive processing of strong negative emotions or dissociative states to return to homeostatic states, the expression of emotions can be more adaptive. Although expressing feelings is integral to the intervention, the emphasis is on internal processing of maladaptive emotional states to adaptive emotional states.

Bad feelings are good. A theme that emerged from the analysis of the survey data was that bad feelings are beneficial. This theme is best exemplified by Participant 2 who noted that, "Two participants that did not make progress had difficulty accessing any real anger." Skill in accessing negative homeostatic emotions such as anger, sadness, fear and guilt, and particularly negative allostatic emotions such as hostility, depression, panic or shame are applauded in the theory-based intervention. Participant 4 commented, "One participant who tended to disassociate was able to express red hot anger feeling during the last two group sessions." Negative feelings are beneficial in that activating a stress response is associated with fear memory reconsolidation (Schiller et al., 2010) and the

activation and dominance of these allostatic circuits (LeDoux, 2012b) is thought to be an important contributor to allostatic load and many health problems (McEwen, 2008). Participants described the progress of intervention participants in understanding that negative feelings can be rewarding. Participant 5 stated, "The participants found that by feeling the negative feelings they improved their feeling of connection to themselves." The theme of viewing negative feelings as beneficial arose in comments about adaptive growth. The concept that allostatic states promote maladaptive extremes of cognitions, emotions and behaviors, so using tools to arouse and reconsolidate those rewards, could enhance development. As stated by Participant 3, "Their connection to self improved by feeling negative feelings, and Participnt 5 reported, "They found that by feeling the negative feelings, they improved their feelings of connection to themselves."

Switching brain states. All the participants noted the importance of the self-regulatory tools. Participant 1 stated, "I witnessed participants moving themselves from stress to a more joyous state." Although this intervention was an introductory course in the theory-based method, their discovery of the tools encompassed most of the training experience. The tools for the allostatic states often cause a "pop" as the brain switches from allostasis to homeostasis, and the first time that a participant experiences the power of that experience can lead to a sense of excitement and a feeling of hope. Allostatic circuits are positive feedback loops, with no internal "shut off" valves to the allostatic response. Using these tools provides intervention participants with a means of switching their brain state from high stress arousal and negative affect or dissociation to a state of low arousal and positive affect. Participant 3 noted, "I could see and feel a climate of optimism take over from the first day." The awareness and experience of knowing what

action to take when experiencing negative emotional states seemed to bring a sense of security to some participants, as best exemplified by Participant 4 who noted, "They expressed confidence that they had the tools to prevent future stress." This theme of having the power to change brain states by choice, not chance, emerged as a theme in this data set from this sample of clinicians.

The three minor themes of emotion regulation that emerged in the analysis of the quantitative data suggest that participants experienced intervention-related improvements in their emotion regulation. The measure used to assess emotion regulation in the quantitative component of the study was the ERQ (Gross & John, 2003), which has two subscales, cognitive reappraisal, and emotion suppression. Items on the cognitive reappraisal subscale include items such as, "When I want to feel less negative emotion, I change the way I am thinking about the situation." This construct is different or even opposes the theory-based intervention in which negative feelings are good and feeling the negative feelings through various brain state-specific processes is the pathway to relief and even joy. The emotional expression subscale includes items such as, "When I am feeling negative emotions, I make sure not to express them." Although emotional expression is practiced and encouraged in the intervention, most of the emphasis in the introductory training is on learning the tools to self-regulate. These observations suggest that EBT may have improved emotion regulation based on processes that the current measure may not have had sufficient construct validity for purposes of assessing self-regulatory changes in this theory-based intervention.

Table 11

Major Theme and Subthemes: Stress-related Psychological Variables

	Participant				
Major Themes and Minor Themes	1	2	3	4	5
Perceived Stress					
Multiple changes	X	X	X	X	X
Adaptive growth	X	X	X	X	X
Depression					
Pain alleviation	X	X	X	X	X
The power of joy	X	X	X	X	X
Affect					
Emotional competence	X	X	X	X	X
Group sharing	X	X	X		X
Self-efficacy					
Capacity to change	X	X	X	X	X
Structured training	X	X	X	X	
Food Dependence					
Emotional drive reduction	X	X	X	X	X
Adaptive rewards	X	X	X	X	X

Note. N=5

Perceived Stress. The EBT Providers reported observing improvements in perceived stress in intervention participants associated with the treatment. Participant 1 stated, "The majority of participants in my group made significant improvements and changes in their perceived stress." These changes appeared to increase as the training continued, as stated by Participant 3, "Participants reported feeling less stressed with the first week of receiving services. As the group progressed, they reported having milder stress responses to events of significant stress that would have previously put them at Brain State 5 for weeks." Often the change in perceived stress was reported during the group session, such as responding to a challenge in a more adaptive way. This is demonstrated by the statement by Participant 2, "The participant reported dealing with a stressful situation at work and handling it much better."

The findings based on the quantitative data was that the intervention did promote improvement in perceived stress. Two themes emerged from the data on the construct-specific responses to the survey: (a) multiple changes, and (b) adaptive growth.

Multiple changes. EBT Providers described participants as experiencing fewer stress symptoms. The overarching approach of EPT is to promote brain state changes that impact a broad range of stress-related variables. Change in one stress-related variable appeared to promote adaptive changes in others. This was exemplified best by Participant 5 who noted, "Participants found that their sleep was more restful, and they had energy to exercise." Participant 4 reported that experiencing less stress translated into behavioral changes: "They shared that the tools offloaded stress and reduced eating binges." Participant 1 stated, "participants changed in more than one area (weight, exercise and stress.)" This pattern of multiple areas of change co-occuring is consistent

with brain physiology and the neuroscience concepts of EPT. Implicit in their experience was a sense of control as they found it easier to change behavior, as exemplified by the comment from Participant 3: "They reported feeling more in control of their lives as stress was no longer driving them to make unhealthy choices."

Adaptive growth. A theme that emerged from the data was that participants observed multiple signs that the intervention was promoting adaptive growth. The homeostatic state is associated with development (Damasio, 2003) and the tools were initially conceived as skills to promote adaptive development (Bowlby 1988; Eriksen, 1982). The theme of adaptive growth emerged from statements exemplified by the statement by Participant 2, "The participants began to generalize their learning to other areas." Participant statements suggested a dynamic process in which the individual was evolving in ways that did not seem linear and the changes were catching. According to a comment by Participant 4, "Many reported that their lift in mood was permeating their days and even spreading out to others in their lives (family, friends and co-workers)."

These themes are confirmatory of the findings of the quantitative component of the study and are consistent with theory.

Depression. Participant responses regarding depression were consistent and enthusiastic, as illustrated noted by Participant 5, "Many participants reported having significant depression prior to initiation of services. In addition, many reported being on medications for depression. Yet, during the course of services, participants reported feeling more joy and less depression more of the time." The findings of the quantitative component of this study were consistent with survey data in that significant interactions

between the intervention and depression were shown. Two themes emerged from the survey data pertaining to depression: (a) pain alleviation, and (b) the power of joy.

Pain alleviation. In their responses to the construct-specific question probing their assessment of change in intervention participants in depression, the theme of alleviation of pain and suffering emerged. In this data set, EBT Providers described hopelessness, guilt, shame, powerlessness, and shame, all allostatic emotions that promote stress and block the natural homeostatic process that activates the brain's reward centers and the associated approach and positive affect (Davidson, 2004). More recent understandings of depression point to both the role of stress in causing depression (Risch et al., 2009) and the related neurophysiology of depression (Johnstone et al., 2007). Repeated episodes of stress contribute to left prefrontal cortex dominance with significant decreases in positive affect and approach. To the extent that stress triggers the activation and prolongation of the allostatic circuitry that are positive feedback loops, an individual who has insufficient self-regulatory tools to activate homeostatic circuits would not only be likely to be "joy insufficient" but to experience persistent maladaptive allostatic emotions. The theme of pain alleviation was evidenced in statements from all EBT Providers. Participant 5 noted, "The most significant of these changes were the feelings of worthlessness and helplessness. Participant 2 reported "guilt was perceived and experienced as a feeling that was safe to process in a safe manner. Processing guilt with the tools became a motivator to move forward," mirroring right prefrontal cortex activation and the coupling of approach and positive emotions. Implicit in many of the statements referencing the persistent negative emotional states of intervention participants was the power of the tools and the neuroscience concepts. This concept was

best exemplified by the report of Participant 3, "Participants shared feeling less guilt and hopelessness as they understood brain tools that these feelings were often triggered by wires that they could change." The neuroscience orientation of the training was viewed as alleviating pain by Provider 4, who stated "Some participants were able to see depression as a stress response and felt empowered by the tools and not feel like a victim of depression." Overall, the themes that emerged suggested that participants were experiencing depressive symptoms which improved during treatment, which was reported by Participant 3, "As they progressed through the study, their feelings improved and they had more self-esteem and hopefulness for the future."

The power of joy. The theme of the power of joy was expressed by all participants. As noted by Participant 2, "Joy Points were often cited as highlights and wonderful tools for bumping up their brain state and spending less time feeling depression." Rather than waiting for surges of joy to occur, the orientation of the theory-based intervention is to use the tools to create moments of positive affect throughout the day. Participant 5 stated, "They made a conscious effort to find and create joy even in stressed brain states." The importance of the role of purposeful experiences of positive affect was reported by all participants, as evidenced by the statement of Participant 4, "As they became more familiar with the tools, especially collecting joy points, their mood lifted."

The themes of pain alleviation and the power of joy are confirmatory of the findings of the quantitative component of the study and consistent with EPT.

Affect. All participants confirmed repeatedly in their statements that they observed adaptive changes in affect in intervention participants. Their statements were

characterized by brevity and clarity, exemplified by the remarks of Participant 4, "As a group, their affect changed markedly from the seven-week course." The response of Participant 5 included a comparison of the relative change in positive and negative affect: "Yes, the group did make changes in their affect, particularly the positive affect. The changes in affect were more pronounced in the positive than the negative." Participants drew upon personal observations during the group training in evaluating intervention-associated changes in affect, as illustrated by the statement of Participant 2, "As a whole, the group displayed a positive attitude in general and through their interactions in and outside of the group I saw them maintaining the positive emotions (joyful faces, laughter, and positive feelings) for longer periods and even during times they perceived as more stressful." The findings of the quantitative component of this study were aligned with the observations of intervention facilitators, that there were significant interactions between the intervention and affect. Two themes emerged from the survey data pertaining to depression: (a) emotional competence and (b) group sharing.

Emotional competence. The theme of emotional competence emerged from the data as participants described the training as a skill set they were providing to individuals who tended to value and use them to improve their lives. Emotional competence, described by Baumrind, whose early studies of parenting style influenced the development of EPT (Baumrind, 1991) and more recently by Seligman (2011), was described by EBT Providers, best exemplified when Participant 4 noted, "Participants expressed that for the first time in their lives they have an idea of what to do for their emotional well-being." The provider role in training individuals to use a range of tools to respond effectively to stressors was implicit in the statement by Participant 4, "They

developed the skills to identify their brain states and use the corresponding tool for their identified brain state. Most participants could express all the positive and negative feelings and use the tools to decrease negative feelings and increase positive feelings."

Group sharing. Aligned with the close relationship between emotional and social processes (Heatherton, 2011), the emotional sharing in the group emerged as a theme from the construct-specific data pertaining to affect. The remarks of Participant 1 reflected the importance of emotional sharing in the treatment program: "During the intervention, there was an obvious increase in the positive affect of the group, as witnessed in the warm, compassionate gestures of participants to each other. At the close of the group, members left with hugs and smiles, and a willingness to buddy up for weekly connections." As the training progressed, improvements in interactions and affect were noted by all participants, as exemplified by the statement of Participant 4, "The positive affect was obvious in the more relaxed facial expressions, and behavioral gestures towards me and the group, and also with a more nurturing and responsive tone for themselves." Vocal tone is associated with brain state (Porges & Furman, 2011) and several participants used that observation to note affective changes. Participant 2 noted, "I saw a significant change in more positive expressions as their faces would light up coming into the room. They shared their Joy Points with one another and their voices were more upbeat and less monotone." Participant 2 stated, "The vocal tone in the group varied, however I witnessed on numerous occasions a shift toward positive tones toward self. The safety of the group as establishing a holding environment for reconsolidation circuits associated with dysregulation and insecure attachment to circuits associated with regulation and secure attachment has been a recent focus (Badenoch & Cox, 2010;

Flores, 2010; Siegel, 2010) in group psychotherapy. The importance of the emotional sharing in the group may be a powerful influence on affect. All providers described the emotional sharing in the group and development of supportive relationships. Participant 3 reported "Two less mobile, morbidly obese participants in their 60s connected daily and seemed to form a lasting friendship and both presented with a significant reduction in depressive symptoms." The interaction of group members was observed by Participant 5 as experiences of joy, "In each group, many participants would greet each other with hugs, share Joy Points they had throughout the week as well as report using their tools to bump up their brain state." As the relationships deepened and their competence in tool use increased, affect was reported to improve. Participant 1 noted, "I heard them share how they could use the tools to go from a bad mood to feeling more joyful. The positive outlook stayed with them longer as they became more practiced in using the tools. They shared positive emotional experiences that lifted up the rest of the group."

The themes of emotional competence and group sharing are confirmatory of the findings of the quantitative component of the study and they are aligned with theory.

Self-efficacy. Participants reported that intervention participants made significant and meaningful improvements in their belief in their capacity to complete tasks and reach goals. Participant 3 reported, "One individual who came to the group feeling overwhelmed and unable to cope became empowered and was "taking charge" of her life and felt good about herself." Participant statements confirmed the quantitative data, which showed a significant relationship between intervention participation and improvement in self-efficacy. This was best exemplified in the qualitative component of the study when Participate 1 noted, "Many reported feeling empowered to respond to

their lives differently." Two themes emerged from the survey data pertaining to depression (a) capacity to change, and (b) structured training.

Capacity to change. Participants noted that group members developed a belief that they had they had the resources to meet the challenges of life. Participant 4 remarked, "Following the intervention, and via observations, and interactions, there was a general consensus of participants realizing their own potential to make a change, aware of an inner motivation and the resources to take the course of action needed." Participants reported on the change in self-efficacy as the training progressed. Participant 1 noted "At the start of the group there was an overall group feeling reported that they were not really capable of changing. By the end of the group the majority reported a strong belief that they now had the tools to effect change."

Structured training. In describing their assessment of the intervention participants' improvement in self-efficacy, participants introduced topics related to the structured expectations and activities of the training. This theme is best exemplified by Participant 4 who noted, "Participants shared during accomplishment/challenges the increase in motivation to move their bodies, strive for 10 check ins, and realize and access community connections." Accountability is integral to the program, such as recording use of the tools, reporting on accomplishments, and identifying challenges; the theme of rigorous training with clear expectations, weekly accountability, and support emerged from the survey data. The technique of a "lightning round" in which intervention participants state their progress toward a goal illustrates the structured educational methods used in the theory-based interventnion. According to Provider 2, "During lightning rounds at each group session, everyone had a change to be seen, heard

and accountable." The structured training of the group may have provided additional experiences in which they enhanced their self-efficacy.

The themes of capacity to change and structured training are confirmatory of the findings of the quantitative component of the study and they are aligned with EPT.

Food dependence. Participants reported that the intervention participants improved their food dependence, as best exemplified by Participant 1 who noted, "Participants demonstrate a positive improvement in a reduction in food dependence. By the end of the intervention more than half of the participants reported a reduced drive to overeat." The quantitative component of the study showed a relationship between participation in the intervention and decreased food dependence, consistent with the statement of Participant 4, " Participants decreased their dependence on food as a coping mechanism. Most reported that by the end of the session they were much more aware of how their mood affected their food intake and most were making better food choices."

Emotional drive reduction. The theme of drive reduction emerged from the data on the construct-specific responses from EBT Providers. EPT is a pro-symptom method, with the activation of the drive for a maladaptive reward viewed as a "moment of opportunity" to emotionally process and depotentiate a circuit that encodes a false association between survival and the maladaptive response. In this introductory application of the theory-based method, participants are trained to identify their circuit and process the emotions that it activates, with the goal of adopting adaptive behaviors as the emotional drive for the maladaptive response decreases (Schwartz et al. 1996; LeDoux, 2012b). This change in concept from behavior change to drive change is challenging for participants to learn. Participant 1 stated, "The idea that it's not about the

food was new to participants initially." Participants reported decreased emotional drive for food, including Participant 4 who noted, "Participants report a noticeable change in the degree of the drive or urge to go to the food." One strategy for reducing emotional drive is to decrease intake of inflammatory foods ("Stress Foods") to decrease the stress that increases the emotional drives. Participant 5 stated, "Some reported that the Stress Foods didn't have the power over them that it did before." The emotional drive for food was an important concept in the training and progress appeared to be progressive, as illustrated by the report of Participant 3: "Participants displayed less dependency on food as an emotional crutch as the weeks went by in our study."

Adaptive rewards. The theme of affective rewards as a treatment for stress and maladaptive behavior emerged from the data analysis. Adaptive rewards are both natural lifestyle pleasures and higher order ("eudonic") rewards (Urry et al, 2004; Valliant, 2009). The emphasis on accessing them is to improve brain state to decrease the frequency and duration of allostatic responses that promote maladaptive behavior and to promote potential changes in the brain's reward centers that may be related to maladaptive drives and addictive behaviors (Koob, 2010). EBT Providers observed participants accessing natural lifestyle pleasures, as reported by Participant 3, "Many shared an ability to experience the present moment and delight in nature, a beautiful sunset, and the experience of sharing time with a loved one." The use of natural pleasures as a treatment for stress and food dependency was apparent in the data, as exemplified by the statement of Participant 5, "Many also reported adopting other behaviors (exercise, breathing, connecting with others and creating joy) to deal with their mood rather than eat as they did before the intervention." Participant statements about

the use of eudonic rewards (sanctuary, authenticity, vibrancy, integrity, intimacy, spirituality, and freedom) were even more frequent. Provider 1 stated, "At the end of training participants stated and demonstrated their reduced interest and desire to shortchange themselves with food, and an increased desire to live life with more vibrancy." The convergence of the themes of adaptive rewards and emotional drive reduction was apparent in several statements, best exemplified when Participant 4 noted, "Participants felt a sense of hope of achieving freedom from food dependency as they continued to develop the skills."

The themes of emotional drive reduction and adaptive rewards are confirmatory of the findings of the quantitative component of the study and consistent with theory.

The findings of the qualitative component of the study showed a trend that is consistent with theory for self-regulation and stress-related psychological variables and consistent with the findings of the quantitative component of the study for stress-related psychological variables, and inconsistent with the findings from the quantitative data for self-regulation.

Evaluation of Findings

The findings of this report provide an initial formal study of the overarching approach of EPT in a sequential mixed methods study of training individuals in the tools that are consistent with emerging research in neurophysiology results in broad spectrum improvements in stress-related variables. What follows is an evaluation of findings related to self-regulation, stress-related psychology variables, and biomarkers.

Self-regulation.

The interaction between the independent variable of the EBT intervention and the

dependent variables of mindfulness and emotion regulation in the quantitative component of the study (RQ1) showed consistent findings. In the five facets or mindfulness and the two subscales of emotion regulation, there was no significant relationship between participation in the intervention and adaptive changes in these constructs. For RQ1, regarding improvements in self-regulatory processing (mindfulness and emotion regulation), the null hypothesis is accepted, that is, there is no significant difference in changes in self-regulation based on the Emotional Regulation Questionnaire (ERQ) or the Five Facet Mindfulness Scale (FFMS) in obese adults who participate in EBT and waitlist control subjects. In contrast, the qualitative data (RQ4) evaluation self-regulation based on open-ended survey data completed by EBT Providers suggested that participants made significant and meaningful changes in mindfulness and emotion regulation.

The inconsistency of findings led to a review of the threats to validity of the study. Although no baseline determinations of psychological and biomarker variables other than BMI were used as inclusion criteria in the study, the sample has been described (Table 6) and subjects were randomly assigned to test group and control group. Random assignment included blocking for higher levels of BMI, a covariate in the analysis. The assumption that these constructs and variables would be modifiable was made, as data were not available to suggest otherwise. The qualitative data (Table 11) suggest that the theory-based self-regulatory processes vary considerably or are even contradictory to self-regulatory constructs that are measured by the FFMQ and the ERQ. The themes that emerged in qualitative research, such as “feeling bad is good” and “feel your feelings” may not be concepts that are mastered in short-term interventions. In

addition, the study included no measures of fidelity in the application of the intervention. Although steps were taken to mitigate this limitation, including weekly telephone consultations with the theory-based research intervention facilitators, and clinical challenges were responded to, the effectiveness of that response was not evaluated and could have compromised the fidelity to the study. A threat to internal validity (deVaus, 2001; Meltzoff, 1997) of the qualitative component of the study was that EBT Providers may have inconsistent or limited knowledge of the seven constructs examined in the EBT Providers survey. To the minimize this threat to validity, printed information that lists the operational definition of each was provided to them with their questionnaire and they were instructed to contact the investigator should they have additional questions about these constructs. In addition, the bias of the EBT Providers to favor perceptions of adaptive change in participants and the bias the researcher brings to the study may favor adaptive change. The codes used were predetermined based on the theory and construct. The data were reviewed for discrepant information.

The analysis of the quantitative data was a series of 3 (measures at baseline, 8 weeks, and end of study, repeated measures) x 2 (test vs. control, between) univariate ANCOVAs for each dependent variable. The use of conducting multiple univariate tests may have inflated Type 1 error, which was not a concern in this study as the hypothesis was not supported. The measures used in the quantitative component of the study for evaluating self-regulation had demonstrated acceptable validity and reliability. The alpha reliabilities (See Table 6) of the ERQ (Gross & John, 2003) subscale of Reappraisal was .87 and .68 for Suppression. The lower level of internal consistency of the Suppression subscale may decrease confidence of the reliability of the measure and the findings. The

alpha reliabilities of the FFMQ (Baer et al., 2004) were adequate (See Table 6) with alpha reliabilities for the five subscales good (.80–.89). The constructs and concepts of self-regulation that are consistent with EBT may differ from the constructs measured by these instruments. The themes that emerged in the qualitative component of the study (see Table 11) were inconsistent with or opposed the constructs measured, and all EBT Providers assessed that participants had made significant and meaningful changes in mindfulness and emotion regulation. It may be that the constructs that these measures assess do not adequately measure the constructs that are consistent with EPT.

As an initial report of the EPT mediators to determine if the theory-based intervention impacts self-regulation in obese adults, these findings cannot be compared to other theory-based interventions. The studies that have been conducted (Mellin et al., 1997; Mellin et al., 1987; Simon et al., 2009) have not measured self-regulation.

Stress-related Psychological Variables.

The interaction between the EBT intervention and stress-related psychological regulation in the quantitative component of the study (RQ2) showed consistent findings. In the seven constructs, (a) perceived stress, (b) depression, (c) positive affect, (d) negative affect, (e) self-efficacy, and (f) food dependence were statistically significant. The consistency of these findings, that all constructs evaluated showed significant improvements between pretreatment and posttreatment (see Table 8). The themes that emerged in the qualitative component (RQ4) of the study were confirmatory, suggesting that intervention participants had made significant and meaningful improvements in these constructs (see Table 11). This confluence of findings is sufficient to reject the null hypothesis for all hypotheses for stress-related psychological variables.

The analysis as a series of univariate ANCOVAs for each dependent variable may have inflated Type 1 error, however the consistency of the findings and the observation that for depression and perceived stress, the *p* value is .0005. The measures used in the quantitative component of the study for evaluating psychological variables demonstrated acceptable alpha reliabilities (See Table 6), ranging from .82 and .92.

Consistent with EPT, the measures of self-regulation assess the mechanisms of change in physiologic state. Although prior to the formal evaluation conducted in this study, there was no evidence that current measures of self-regulation would not provide valid measures for the theory-based intervention. In contrast, the measures of stress-related psychological variables may be both related to self-regulation, that is, the success of the treatment in increasing the frequency and duration of homeostatic states and outcome measures (Djuric et al 2008; Juster et al., 2010). Although the researcher hypothesized that the intervention would cause statistically significant changes in these variables, the findings build theory and although hoped for were not expected.

These results were not expected for several reasons. First, the introductory program is designed to be educational, not therapeutic. EBT is a 1-year program. The duration of the program is consistent with theory in that self-regulatory circuitry is low plastic (Perry, 1999) and, consistent with theory, requires focused intensive progressive practice over time for sustained broad spectrum adaptive changes to be observed. The findings of this study supported this concept, for the comparison of the interaction between the intervention and dependent variables for the test group at baseline and 8 weeks after treatment ended was not significant. For all dependent variables, sustained improvements were not observed. Second, the WCHD facilitators of the training had not

completed full certification in the clinical method and they had not previously conducted this introductory course. Third, the sample size was small and although the power calculations suggested that this sample size would be sufficient to show differences if they existed and avoid Type II errors, most clinical trials have a larger sample size.

Studies have been conducted to evaluate outcomes associated with previous iterations of EBT. These programs were developed prior to the proliferation of brain research and were based on training developmental skills associated with secure attachment (Bowlby, 1988) and authoritative parenting style (Baumind, 1991). These programs included several of the tools of self-regulation that are used in EBT. Although a study of method effectiveness in promoting smoking cessation did not include psychological measures (Simon et al., 2009), both studies on the method that measured at least one psychological variable were conducted on obese individuals. A waitlist controlled clinical trial of 66 obese adolescents (Mellin et al., 1997; Mellin et al., 1987; Simon et al., 2009) was based on weekly meetings for 14 weeks. Self-esteem was measured with the Rosenberg Self-esteem Scale and depression was assessed with the Rosenberg Depression Scale. Significant improvements in self-esteem were shown at end of treatment ($p < .005$) and 1-year follow-up ($p <. 001$). Improvements in depression were demonstrated the same trend, with significant changes at end of treatment ($p < .005$) and 1-year. Although this study was conducted 25 years ago, it is interesting to note that the postulates of EPT apply, in that participants experienced significant and sustained posttreatment changes in stress-related variables. In addition, the neuroplasticity of children and adolescents is greater than that of adults (Lewis et al., 1999).

A more recent study, an uncontrolled observational study (Mellin et al., 1997) was conducted on 22 adult overweight adults that worked at a medical center or lived in the surrounding community and participated in a mean of 18 two-hour weekly sessions. Data were collected at baseline, 3, 6, 9 12, and 24 months. Measures of depression obtained by using the Beck Depression Inventory: Short Form (Beck & Beck, 1972) for a subset of 12 participants showed trends toward decreased depression that did not reach statistical significance. No other stress-related psychological variables were tested. The depression scores for the current study are based on posttreatment rather than follow-up data, however, the observation that changes in depression were significant even though not sustained is encouraging and merits more research attention.

Anthropometric and physiologic data.

The interaction between the EBT intervention and anthropometric (BMI) and physiologic (systolic and diastolic blood pressure) measures in the quantitative component of the study (RQ3) showed trends that are consistent with theory (see Table 9). Both systolic and diastolic blood pressure tended to improve but changes were not statistically significant. Body Mass Index did change significantly, and that change was sustained at follow-up in the comparison of the test group at baseline and 16 weeks. In EPT, these changes are of interest, but because consistent with theory, the psychological changes associated with increased duration of homeostatic states and decreased duration of homeostatic states are more confirmatory. One of the challenges of an introductory intervention in EBT is that the reconsolidation of Survival Circuits that promote strong emotional drives (LeDoux, 2012b) for maladaptive rewards is considered to be more important than change of food behavior. The unconscious emotional drive of a Survival

Circuit conveys a false association between survival and food (Schwartz, 1996). Reconsolidating that circuit is theorized to require homeostatic emotional processing, whilst forcing food behavior change triggers allostatic states that are inconsistent with behavioral adherence. It is challenging to evaluate a brief introductory intervention to build theory related to neuroplastic changes that are inherently long-term, however, reports that demonstrate significant improvements in stress-related variables are essential to begin building theory through additional research.

Two of the studies that have been conducted on previous iterations of the theory-based intervention both studied BMI. In the study of adolescents, BMI improved significantly at end of treatment ($p < .001$) and 1 year later ($p < .01$). In the study of obese adults, (Mellin et al., 1997; Mellin et al., 1987; Simon et al., 2009) a comparison of baseline and 2-year measures showed significant improvements in BMI ($p < .02$), systolic blood pressure ($p < .01$) and diastolic blood pressure ($p < .001$). Consistent with theory, these measurements improved throughout the study period and after the treatment (18 weeks) ended.

The qualitative component of the study analyzed survey data from the five EBT Providers that facilitated or supported the facilitation of the intervention upon which the quantitative component of the study is based. The themes that emerged from the construct-specific survey responses were consistent with theory and integrated the sciences upon which the theory is based: stress physiology, evolutionary biology, attachment theory, and affective neuroscience. This component of the study provided a rich understanding of the convergence of the sciences and the layers of meaning of the theory-based intervention. The major and minor themes portrayed the participant

experience of EBT, that they have a capacity to change using brain-based tools and celebrating the power of joy. The elucidation of the meanings of mindfulness and emotion regulation to the EBT Providers led to a better understanding of the quantitative data on self-regulation and provided confirmatory data to build theory.

Summary

The purpose of this sequential mixed methods study was to provide an initial evaluation of EPT mediators to determine how an intervention that is based on Emotional Plasticity Theory impacts self-regulation and stress-related variable in obese adults. The archival quantitative data (n=33) based on a random assignment, waitlist controlled clinical trial were analyzed with inferential statistics (ANCOVA). Four tests were performed, with all tests analyzing all constructs and variables for 16 dependent variables. Full ANCOVA tables are presented (Appendix F) and a visual representation of the pattern of mean comparisons for the three observation times of baseline (T1), 8 weeks (T2) and 16 weeks (T3). The qualitative component of the study involved primary survey data collection to probe the assessments of EBT Providers (n=5) who facilitated or supported the facilitation of the intervention to provide confirmatory evidence of changes associated with participation in the EBT intervention.

All measures of self-regulation were not significantly related to participation in the intervention. All mean comparison figures were not consistent with theory. The null hypotheses for mindfulness and emotion regulation were accepted and the answer to RQ1 is that the EBT intervention does not cause changes in self-regulation. In contrast, all stress-related psychological measures showed significant changes related to participation in the intervention, including perceived stress (p=.0005), depression (p=.0005) , positive

affect (p=.003), negative affect (p=.004), self-efficacy (p=.019) and food dependence (p=.012). All mean comparison figures were consistent with theory. The null hypotheses for the psychological constructs is rejected and the alternative hypotheses were accepted. The answer to RQ2 is that the EBT intervention does cause changes stress-related psychological variables. The anthropometric and physiological measures showed trends that were consistent with theory. BMI improved significantly (p=.012), however blood pressure changes were not significant. The BMI mean comparison figures were consistent with theory but the blood pressure figures were not consistent with theory. The null hypotheses for stress-related anthropometric and physiological variables were accepted and the alternative hypothesis was rejected. The answer to RQ3 is that the EBT intervention does cause changes anthropometric and physiologic measures.

Qualitative themes confirmed the findings from the quantitative component of the study. The assessment of the changes in constructs of mindfulness, emotion regulation, perceived stress, depression, affect, self-efficacy, and food dependence was that significant and meaningful changes had occurred. From the analysis of survey responses regarding participant changes related to that construct emerged themes that revealed an undercurrent of meanings and concepts that were consistent with EPT but not elucidated by the measures of the quantitative component of the study. The themes for mindfulness were emotional connection to self, brain state appraisal, and power to accept change of state. What emerged from the analysis of the survey data related to emotion regulation were the themes of feeling the feelings, bad feelings are good, and tools to switch brain state. For the construct of perceived stress, the themes of multiple changes and adaptive growth emerged, and for depression, pain alleviation and the power of joy. Statements of

providers that were made in response to a question about changes in self-efficacy in participants were capacity to change and structured training. From their responses regarding food dependence emerged the themes of emotional drive reduction and adaptive rewards.

The qualitative component of the study generated themes that were confirmatory of EPT, the overarching concept of changing self-regulatory wiring to improve a broad range of stress-related variables. These responses and the themes that emerged from them confirmed the findings for stress-related psychological variables in the quantitative component of the study and did not confirm the findings of the qualitative component that found no significant relationship between the measures of self-regulation and participation in the intervention. The answer to RQ4 is that the subjective responses of the EBT Providers did not confirm the findings from the quantitative component of the study for self-regulatory and psychological variables. The themes that emerged from the EBT Provider survey responses suggested that theory-based concepts of self-regulation may differ significantly from the construct measured in the instruments applied in this study.

Overall, the study provided preliminary data on the mediators of EPT and suggested directions for future research on the theory.

Chapter 5: Implications, Recommendations, and Conclusions

The problem this study addressed was that the overarching approach of EPT, changing the self-regulatory circuits to mediate improvements in stress-related psychological and physiologic measures, has not been formally studied (Mitrovic et al., 2011; Mitrovic et al., 2008). The purpose of the sequential mixed methods study is to begin to build theory by providing an initial evaluation of mediators of EPT. The strategy was to determine the influence of the theory-based intervention on stress-related psychological and physiologic measures in a sample of obese adults, as previous research on the intervention was conducted on obese subjects. The first sequence of the study was the analysis of an archival data set from a convenience sample of 36 obese adults that was collected by health professionals at the Washington County Health Department in Maryland. A convenience sample was used to increase external validity (Jackson, 2009; Trochim & Donnelly, 2008) and participants were randomly assigned to an introductory course based on EPT immediately or delayed. Data were collected at baseline, 8 weeks and 16 weeks. The second sequence of the study used qualitative methods, gathering data using an open-ended survey from five EBT Providers who facilitated the intervention or supported the facilitation of the intervention to provide confirmatory data for the findings of the qualitative component of the study.

The independent variable was the EBT intervention, a 7-week program (Mellin, 2011d) and the independent variables were (a) two measures of self-regulation (mindfulness and emotion regulation), (b) six psychological variables (perceived stress, depression, positive affect, negative affect, self-efficacy, and food dependence), and (c) three measures of physiologic stress (Body Mass Index, systolic blood pressure and

diastolic blood pressure). The survey data from the EBT Providers who facilitated the intervention in the constructs of self-regulation and psychological variables were collected, codes were developed based on the a priori constructs and theme tables were developed. The confluence of sequential data was analyzed to evaluate the mechanisms of action of EPT (Mitrovic et al., 2011; Mitrovic et al., 2008).

One of the assumptions of the study is that a short-term intervention based on EPT will decrease physiologic stress through changes in self-regulatory circuitry (deVaus, 2001; Leedy & Ormrod, 2010; Meltzoff, 1997). The methodological assumption is that study participants exhibited a broad range of stress-related characteristics and the inclusion and exclusion criteria were based a BMI of 25 to 40, as elevated BMI is associated with stress arousal and dysregulation (Djuric et al., 2008; Juster et al., 2010). As pronounced dysregulation is associated with higher levels of BMI (extreme obesity), and random assignment alone would not be expected to control for that, so a random assignment in which participants whose BMI was > 35–40, were blocked, with equal numbers of participants in that BMI category being assigned to both groups was used. Also, the EBT Providers who were involved in the facilitation of the intervention were not all fully certified to deliver the method. Fidelity to program processes were not assured, however, weekly telephone consultation of the researcher with the theory-based research intervention facilitators was employed. An assumption of the study is that these challenges were responded to effectively and did not compromise the fidelity of the study. Other threats to validity are the potential for the EBT Providers who responded to the survey to have inconsistent or limited knowledge of the seven constructs examined in the EBT Providers survey. To minimize this threat to validity,

printed information that lists the operational definition was provided to each participant and the investigator. The threats to validity (Cozby, 2009; deVaus, 2001; Tashakkori & Teddlie, 2010; Trochim & Donnelly, 2008) in the qualitative component of the study included the bias of the EBT Providers to favor perceptions that participants made significant and meaningful changes in the self-regulatory and stress-related psychological variables. To decrease the risk of bias in the research, codes that were predetermined were used, based on theory as well as allowing themes to emerge from the content. Although the small sample size of 33 participants and five educators decreases external validity, this study is preliminary and any findings would require additional research, which would build theory and confirm or disconfirm the findings. Threats to external validity (Glanz, Rimer, & Lewis, 2002; Meltzoff, 1997) are more significant in that the *n* was very small, however by using a waitlist control group, the conditions of the shared environment are controlled.

The delimitations of the study include the inclusion and exclusion criteria of the participants, the use of a public health population for recruitment, and the provision of a short-term application of the theory-based intervention. This was a preliminary study with the aim of demonstrating trends in stress-related biomarkers and psychological constructs. The study was conducted by the ethical principles involving human subjects, consistent with the *National Commission for the Protection of Human Subjects in Biomedical and Behavioral Research* entitled the *Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research* and codified in Northcentral University's Institutional Review Board (IRB) guidelines. The research was conducted in a fair and equitable manner, without overburdening or discriminating

against participant population, and honoring commitments made to all participants, contributors, and collaborators involved. Approval by the Northcentral University Institutional Review Board was obtained prior to transmission of the data for the qualitative component of the study, and no archival or primary data was collected until the university's IRB approval has been attained. What follows are reflections about the implications of the study, recommendations, and conclusions.

Implications

The implications of this study are that the participation in the EBT interventions is associated with trends toward improvements in stress-related variables. The problem that the study solves was that there had been no formal study of EPT mediators. The application of an introductory course in the theory-based intervention on a convenience sample of obese adults in a public health population provided a data set for the quantitative analysis. The qualitative analysis of survey information from facilitators of the intervention provided additional insight and understanding of EPT.

The most important implication of the study is that some stress-related variables changed related to participation in an intervention. Although the data showed significant improvements in stress-related psychological variables associated with participation in the intervention, the reliability and validity of those findings are not known. Even if all the measures had been shown to be statistically significant, this study is extremely preliminary. The findings that proved to be statistically significant are encouraging, however, replications of this study and additional research with larger sample sizes and random assignment to a control condition using another stress or educations method are essential. This method is rooted in science and as evidenced by the inconsistency

between the constructs of mindfulness and emotional regulation used in this study and the themes that emerged from the EBT Providers assessment of these constructs, there are serious challenges to developing a body of literature that builds theory and practice.

Another implication of the findings is that although a measured self-regulation that is based on concepts of neurophysiology upon which EPT is based may be an important next step in research, this study did demonstrate the feasibility of practice-based research. The providers who delivered the intervention, collected the data and completed the surveys completed the project and retained most participants. Of the 36 participants who were enrolled in the study, 35 participants were retrained. Only one participant dropped out of the intervention. For two participants, complete data were not available. Building theory requires extensive research and prior to the completion of this study, it was not known whether or not the intervention was feasible to conduct.

The results of this study fit with the purpose of conducting an initial report of mediators of EPT and providing data and insights to plan the next step in the process of building theory. The significance of this study is that it started a process to develop research related to a theory that could have important implications for health care.

Recommendations

The next step in the process of building theory is to replicate this study in another practice group. The findings are encouraging, however, before any conclusions can be drawn about program effectiveness or the validity of the theory that targeting the allostatic circuits in the emotional brain for adaptive neuroplasticity is a worthy strategy, more research is required. In the next study, the same measures would be used, even the FFMQ and the ERQ, which may not provide the construct validity needed to measure

EPT-based self-regulation. If these findings are replicated and participation in EBT is associated with significant improvements in psychological variables and biomarkers, but not in the FFMQ and ERQ, then consideration should be given to developing an EPT-based measure of self-regulation. The use of this preliminary research on obese adults is recommended and, based on the findings of the replication of this study, applying this methods to other stress-related problems, such as depression..

Conclusions

The purpose of this sequential mixed method study was to was to provide an initial evaluation of EPT mediators to build theory and determine if the theory-based intervention impacts stress-related variables. The confluence of qualitative and quantitative data shows trends that support this theory. All stress-related psychological variables and BMI improved significantly during participation in the intervention. Blood pressure changes were not significant, however, blood pressure may require longer than a brief intervention to change. The self-regulatory measures showed no significant change associated with participation in the intervention, and the themes that emerged from the survey of EBT Providers suggested that the concepts and tools of the intervention may be inconsistent with current constructs of self-regulation. A new measure of self-regulation that reflects brain physiology may be needed and the changes in stress-related variables are encouraging. Replicating this study at other sites would provide more assurance of the mediators of EPT and gain understanding of adaptive neuroplasticity of the emotional brain.

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Appendixes

Appendix A:

Quantitative Questionnaires

The questionnaires that were completed by participants were the same for each administration, except questionnaire 1 includes questions regarding demographic information.

Questionnaire 1

Date: _____

Code: _____

This questionnaire includes basic information about yourself and several groups of questions. Thank you for participating in this study.

1. What is your current marital status?
   - 1 = single/never married
   - 2 = married
   - 3 = separated
   - 4 = divorced
   - 5 = widowed

2. Are you of Hispanic, Latino, or Spanish Origin?
   - 1 = No, I am not of Hispanic, Latino, or Spanish origin.
   - 2 = Yes, I am of Hispanic, Latino, or Spanish origin.

3. What is your race? (Circle one or more numbers.)
   - 1 = White
   - 2 = Black, African American, or Negro
   - 3 = American Indian or Alaska Native
   - 4 = Asian or Pacific Islander
   - 5 = Some other race

4. What is your highest level of education completed?
   - 1 = Less than high school graduate
   - 2 = High school graduate
   - 3 = Post-high school education
   - 4 = College graduate
   - 5 = Post-graduate/professional degree

Please continue to the next page.

Please indicate how often you have had the thoughts and feelings described in the statements below **in the past month**.

IN THE PAST MONTH…	never	almost never	sometimes	often	very often
1. How often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. How often have you felt unable to control the important things in your life?	0	1	2	3	4
3. How often have you felt nervous or stressed?	0	1	2	3	4
4. How often have you felt confident about your ability to handle personal problems?	0	1	2	3	4
5. How often have you felt that things were going your way?	0	1	2	3	4
6. How often have you found that you could not cope with all the things you had to do?	0	1	2	3	4
7. How often have you been able to control irritations in your life?	0	1	2	3	4
8. How often have you felt that you were on top of things?	0	1	2	3	4
9. How often have you been angered because of things that happened that were outside of your control?	0	1	2	3	4
10. How often have you felt that difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Please continue to the next page.

INSTRUCTIONS: For each statement, please circle the number in the column that best describes how you have been feeling *in the past week*.

		Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2days)	Occasionally or a moderate amount of the time (3-4 days)	Most or all of the time (5-7 days)
1.	I was bothered by things that usually don't bother me.	0	1	2	3
2.	I did not feel like eating; my appetite was poor.	0	1	2	3
3.	I felt that I could not shake off the blues, even with the help from family or friends.	0	1	2	3
4.	I felt that I was just as good as other people.	3	2	1	0
5.	I had trouble keeping my mind on what I was doing.	0	1	2	3
6.	I felt depressed.	0	1	2	3
7.	I felt that everything I did was an effort.	0	1	2	3
8.	I felt hopeful about the future.	3	2	1	0
9.	I thought my life had been a failure.	0	1	2	3
10.	I felt fearful.	0	1	2	3
11.	My sleep was restless.	0	1	2	3
12.	I was happy.	3	2	1	0
13.	I talked less than usual.	0	1	2	3

Please continue to the next page.

14.	I felt lonely.	0	1	2	3
15.	People were unfriendly.	0	1	2	3
16.	I enjoyed life.	3	2	1	0
17.	I had crying spells.	0	1	2	3
18.	I felt sad.	0	1	2	3
19.	I felt that people dislike me.	0	1	2	3
20.	I could not get "going".	0	1	2	3

Please continue to the next page. If you have any questions or concerns, please ask the project staff to help you.

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way during the last few days.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

_____ interested

_____ distressed

_____ excited

_____ upset

_____ strong

_____ guilty

_____ scared

_____ hostile

_____ enthusiastic

_____ proud

_____ irritable

_____ alert

_____ ashamed

_____ inspired

_____ nervous

_____ determined

_____ attentive

_____ jittery

_____ active

_____ afraid

Please continue to the next page.

We would like to ask you some questions about your emotional life, in particular, how you control (that is, regulate and manage) your emotions. We are interested in two aspects of your emotional life. One is your emotional experience, or what you feel like inside. The other is your emotional expression, or how you show your emotions in the way you talk, gesture, or behave. Although some of the following questions may seem similar to one another, they differ in important ways. For each item, please answer using the following scale:

1	2	3	4	5	6	7
strongly disagree			**neutral**			**strongly agree**

1. ____ When I want to feel more *positive* emotion (such as joy or amusement), I *change what I'm thinking about*.
2. ____ I keep my emotions to myself.
3. ____ When I want to feel less *negative* emotion (such as sadness or anger), I *change what I'm thinking about*.
4. ____ When I am feeling *positive* emotions, I am careful not to express them.
5. ____ When I'm faced with a stressful situation, I make myself *think about it* in a way that helps me stay calm.
6. ____ I control my emotions by *not expressing them*.
7. ____ When I want to feel more *positive* emotion, I *change the way I'm thinking* about the situation.
8. ____ I control my emotions by *changing the way I think* about the situation I'm in.
9. ____ When I am feeling *negative* emotions, I make sure not to express them.
10. ____ When I want to feel less *negative* emotion, I *change the way I'm thinking* about the situation.

:

Please continue to the next page.

NOTE: This graphic was larger in the online questionnaire and pen and paper questionnaire.

This survey asks about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as:

- Sweets like ice cream, chocolate, doughnuts, cookies, cake, candy, ice cream
- Starches like white bread, rolls, pasta, and rice
- Salty snacks like chips, pretzels, and crackers
- Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza, and French fries
- Sugary drinks like soda pop

When the following questions ask about "CERTAIN FOODS" please think of ANY food similar to those listed in the food group or ANY OTHER foods you have had a problem with in the past 2 months.

IN THE PAST 2 MONTHS:	Never	Once a month	2-4 times a month	2-3 times a week	4 or more times or daily
I find that when I start eating certain foods, I end up eating much more than planned	0	1	2	3	4
I find myself continuing to consume certain foods even though I am no longer hungry	0	1	2	3	4
I eat to the point where I feel physically ill	0	1	2	3	4
Not eating certain types of food or cutting down on certain types of food is something I worry about	0	1	2	3	4
I spend a lot of time feeling sluggish or fatigued from overeating	0	1	2	3	4
I find myself constantly eating certain foods throughout the day	0	1	2	3	4
I find that when certain foods are not available, I will go out of my way to obtain them. For example, I will drive to the store to purchase certain foods even though I have other options available to me at home.	0	1	2	3	4
There have been times when I consumed certain foods so often or in such large quantities that I started to eat food instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	0	1	2	3	4
There have been times when I consumed certain foods so often or in such large quantities that I spent time dealing with negative feelings from overeating instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	0	1	2	3	4
There have been times when I avoided professional or social situations where certain foods were available, because I was afraid I would overeat.	0	1	2	3	4
There have been times when I avoided professional or social situations because I was not able to consume certain foods there.	0	1	2	3	4
I have had withdrawal symptoms such as agitation, anxiety, or other physical symptoms when I cut down or stopped eating certain foods. (Please do NOT include withdrawal symptoms caused by cutting down on caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)	0	1	2	3	4
I have consumed certain foods to prevent feelings of anxiety, agitation, or other physical symptoms that were developing. (Please do NOT include consumption of caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)	0	1	2	3	4
I have found that I have elevated desire for or urges to consume certain foods when I cut down or stop eating them.	0	1	2	3	4
My behavior with respect to food and eating causes significant distress.	0	1	2	3	4
I experience significant problems in my ability to function effectively (daily routine, job/school, social activities, family activities, health difficulties) because of food and eating.	0	1	2	3	4

Please continue to the next page.

IN THE PAST 2 MONTHS:	NO	YES
My food consumption has caused significant psychological problems such as depression, anxiety, self-loathing, or guilt.	0	1
My food consumption has caused significant physical problems or made a physical problem worse.	0	1
I kept consuming the same types of food or the same amount of food even though I was having emotional and/or physical problems.	0	1
Over time, I have found that I need to eat more and more to get the feeling I want, such as reduced negative emotions or increased pleasure.	0	1
I have found that eating the same amount of food does not reduce my negative emotions or increase pleasurable feelings the way it used to.	0	1
I want to cut down or stop eating certain kinds of food.	0	1
I have tried to cut down or stop eating certain kinds of food.	0	1
I have been successful at cutting down or not eating these kinds of food	0	1

How many times in the past year did you try to cut down or stop eating certain foods altogether?	1 time	2 times	3 times	4 times	5 or more times

Please circle ALL of the following foods you have problems with:

Ice cream	Chocolate	Apples	Doughnuts	Broccoli	Cookies	Cake	Candy
White Bread	Rolls	Lettuce	Pasta	Strawberries	Rice	Crackers	Chips
Pretzels	French Fries	Carrots	Steak	Bananas	Bacon	Hamburgers	Cheese burgers
Pizza	Soda Pop	None of the above					

Please list any other foods that you have problems with that were not previously listed:

Please continue to the next page. If you have any questions or concerns, please contact the project staff.

Please rate each of the following statements using the scale provided.

Write the number in the blank that best describes <u>how true each statement is for you.</u>

1	2	3	4
Not at all true	**Hardly true**	**Moderately true**	**Exactly true**

_____ 1. I can always manage to solve difficult problems if I try hard enough.

_____ 2. If someone opposes me, I can find the means and ways to get what I want.

_____ 3. It is easy for me to stick to my aims and accomplish my goals.

_____ 4. I am confident that I could deal efficiently with unexpected events.

_____ 5. Thanks to my resourcefulness, I know how to handle unforeseen situations.

_____ 6. I can solve most problems if I invest the necessary effort.

_____ 7. I can remain calm when facing difficulties because I can rely on my coping abilities.

_____ 8. When I am confronted with a problem, I can usually find several solutions.

_____ 9. If I am in trouble, I can usually think of a solution.

_____ 10. I can usually handle whatever comes my way.

Please continue by turning to the next page. Thank you.

Please rate each of the following statements using the scale provided.
Write the number in the blank that best describes <u>your own opinion of what is generally true for you</u>.

1	2	3	4	5
Never or very rarely true	**Rarely true**	**Sometimes true**	**Often true**	**Very often or always true**

_____ I.1. When I m walking, I deliberately notice the sensations of my body moving.

_____ I.2. I am good at finding words to describe my feelings.

_____ I.3. I criticize myself for having irrational or inappropriate emotions.

_____ I.4. I perceive my feelings and emotions without having to react to them.

_____ I.5. When I do things, my mind wanders off and I m easily distracted.

_____ I.6. When I take a shower or bath, I stay alert to the sensations of water on my body.

_____ I.7. I can easily put my beliefs, opinions, and expectations into words.

_____ I.8. I don t pay attention to what I m doing because I'm daydreaming, worrying, or otherwise distracted.

_____ I.9. I watch my feelings without getting lost in them.

_____ I.10. I tell myself I shouldn't be feeling the way I m feeling.

_____ I.11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.

_____ I.12. It's hard for me to find the words to describe what I m thinking.

_____ I.13. I am easily distracted.

_____ I.14. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.

Please continue to the next page.

1	2	3	4	5
Never or very rarely true	**Rarely true**	**Sometimes true**	**Often true**	**Very often or always true**

_____ I.15. I pay attention to sensations, such as the wind in my hair or sun on my face.
_____ I.16. I have trouble thinking of the right words to express how I feel about things
_____ I.17. I make judgments about whether my thoughts are good or bad.
_____ I.18. I find it difficult to stay focused on what s happening in the present.
_____ I.19. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.
_____ I.20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.
_____ I.21. In difficult situations, I can pause without immediately reacting.
_____ I.22. When I have a sensation in my body, it s difficult for me to describe it because I can t find the right words.
_____ I.23. It seems I am "running on automatic" without much awareness of what I'm doing.
_____I.24. When I have distressing thoughts or images, I feel calm soon after.
_____ I.25. I tell myself that I shouldn't be thinking the way I m thinking.
_____ I.26. I notice the smells and aromas of things.
_____ I.27. Even when I m feeling terribly upset, I can find a way to put it into words.
_____ I.28. I rush through activities without being really attentive to them.

Please continue to the next page.

1	2	3	4	5
Never or very rarely true	**Rarely true**	**Sometimes true**	**Often true**	**Very often or always true**

_____ I.29. When I have distressing thoughts or images I am able just to notice them without reacting.

_____ I.30. I think some of my emotions are bad or inappropriate and I shouldn't feel them.

_____ I.31. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.

_____ I.32. My natural tendency is to put my experiences into words.

_____ I.33. When I have distressing thoughts or images, I just notice them and let them go.

_____ I.34. I do jobs or tasks automatically without being aware of what I m doing.

_____ I.35. When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.

_____ I.36. I pay attention to how my emotions affect my thoughts and behavior.

_____ I.37. I can usually describe how I feel at the moment in considerable detail.

_____ I.38. I find myself doing things without paying attention.

_____ I.39. I disapprove of myself when I have irrational ideas.

Thank you for completing this questionnaire. If you have any questions, please speak with a project staff member.

Appendix B:

EBT Provider Survey

The survey for the qualitative component of the study includes questions regarding demographic information and 21 open-ended items.

Date: _____

This questionnaire includes basic information about yourself and several groups of questions. Thank you for participating in this study.

1. What is your current marital status?
   1 = single/never married
   2 = married
   3 = separated
   4 = divorced
   5 = widowed
2. Are you of Hispanic, Latino, or Spanish Origin?
   1 = No, I not of Hispanic, Latino, or Spanish origin
   2 = Yes, I am of Hispanic, Latino, or Spanish origin.
3. What is your race? (Circle one or more numbers.)
   1 = White
   2 = Black, African American, or Negro
   3 = American Indian or Alaska Native
   4 = Asian or Pacific Islander
   5 = Some Other Race
4. What is your highest level of education completed?
   1 = Less than high school graduate
   2 = High school graduate
   3 = Post-high school education
   4 = College graduate
   5 = Post-graduate/professional degree
5. In what discipline is your professional training and credentialing?
   1 = Mental Health
   2 = Nutrition or Dietetics
   3 = Medicine
   4 = Nursing
   5 = Other
6. What is your level of certification in the intervention?
   1 = Certified to provide introductory courses only
   2 = Certified to provide introductory and all advanced courses
   3 = Other

Please continue to the next page.

Based on your observations, interactions with and perceptions of the participants whose training you facilitated, please provide your assessment on whether participants made significant and meaningful adaptive changes in:

1. Perceived stress

2. Depression

Based on your observations, interactions with and perceptions of the participants whose training you facilitated, please provide your assessment on whether participants made significant and meaningful adaptive changes in:

3. Affect

4. Emotion regulation

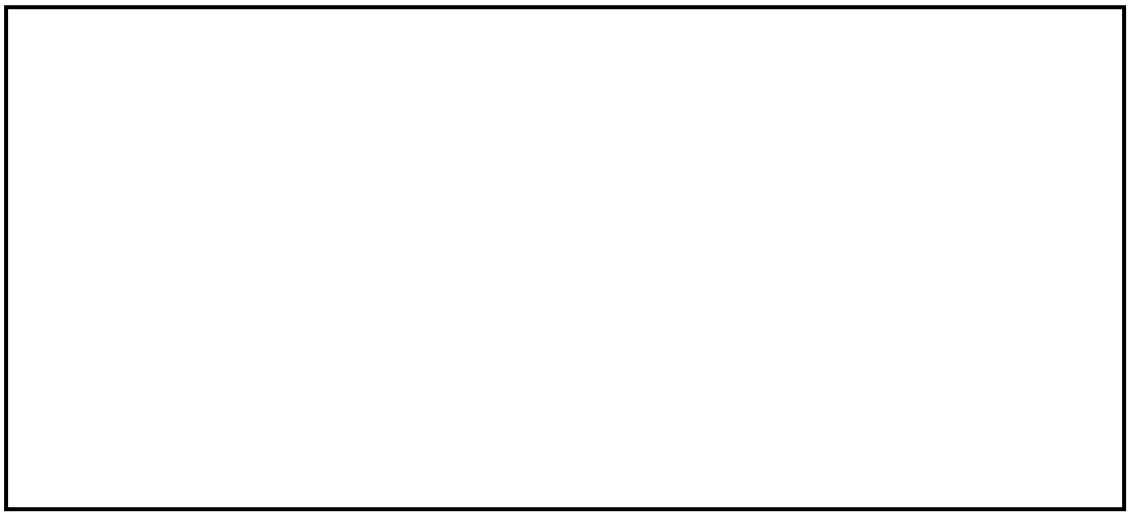
Based on your observations, interactions with and perceptions of the participants whose training you facilitated, please provide your assessment on whether participants made significant and meaningful adaptive changes in:

5. Self-efficacy

6. Mindfulness

Based on your observations, interactions with and perceptions of the participants whose training you facilitated, please provide your assessment on whether participants made significant and meaningful adaptive changes in:

7. Food Dependence



Please continue to the next page.

Which aspects of the intervention did you find useful in promoting adaptive changes for your participants?

8. Perceived stress

9. Depression

10. Affect

Please continue to the next page.

Which aspects of the intervention did you find useful in promoting adaptive changes for your participants?

11. Emotion regulation

12. Self-efficacy

13. Mindfulness

Which aspects of the intervention did you find useful in promoting adaptive changes for your participants?

14. Food Dependence

Please continue to the next page.

Which aspects of the intervention did you find not useful in promoting adaptive changes for your participants?

15. Perceived stress

16. Depression

Please continue to the next page.

Which aspects of the intervention did you find useful in promoting adaptive changes for your participants?

17. Affect

18. Emotion regulation

Please continue to the next page.

Which aspects of the intervention did you find not useful in promoting adaptive changes for your participants?

19. Self-efficacy

20. Mindfulness

Please continue to the next page.

21. Food Dependence

Additional comments:

Thank you for completing this survey.

Appendix C:

Letter of Collaboration

WASHINGTON COUNTY HEALTH DEPARTMENT

1302 Pennsylvania Avenue • Hagerstown, MD 21742

www.washhealth.org

April 10, 2012

Northcentral University
10000 East University Drive
Prescott Valley, AZ 86314

I am writing to describe the collaboration between Laurel Mellin and the Washington County Health Department in an evaluation of a program offered by the department for the treatment of stress and obesity in adults. I am the principal investigator for this project.

I and the chronic disease prevention staff of the health department worked very closely with Ms. Mellin, working with her to develop and conduct the project through the spring, summer, and fall of 2011.

Data collection for the project was completed in December 2011, with the approval (August 4, 2011) of the Maryland Department of Health and Mental Hygiene Office of the Inspector General Institutional Review Board. De-identified data from the study were archived. Laurel Mellin will complete the analysis of the archival data in support of her doctoral studies.

It is a pleasure to collaborate with Laurel Mellin on this project, and it was a great experience for our community and the staff involved.

If I can provide any other information that you would like, please contact me.

Regards,

R. MacRae

Roderick A MacRae, MA, MPH
Director, Health Services/Public Information

HEALTH SERVICES/PUBLIC INFORMATION
1302 Pennsylvania Avenue • Hagerstown, MD 21742

240-313-3250 Voice • 240-313-3391 TDD • 240-313-3202 Fax

Appendix D:

Informed Consent Form

Informed Consent

Emotional Plasticity Theory:
Preliminary Evaluation of Stress-related Variables in Obese Adults

Purpose. You are invited to participate in a research study being conducted for a dissertation at Northcentral University in Prescott, Arizona. The purpose of this survey is to examine the link (if any) between participation in stress management intervention, emotional brain training (EBT) and 7 psychological variables, based on the perceptions of health professionals who facilitate this intervention. In addition, responses to the survey will provide information about the aspects of the intervention that are useful and not useful for change in the psychological variables. There is no deception in this study. We are interested in your opinions and reflections about changes in program participants and the usefulness of various aspects of the intervention.

Participation requirements. You will be asked to complete 21 open-ended questions in paper-and -pencil survey questionnaire about your perceptions of participant changes and program aspects. Completing the questionnaire will take approximately one hour.

Research Personnel. The following people are involved in this research project and may be contacted at any time: Laurel Mellin: (ph) 415-272-4077 (email) laurel.mellin@ucsf.edu. Dissertation chair, Robin Throne, PhD: (ph) 888-327-2877 x6029.

Potential Risk/ Discomfort. There is minimal risk in participating in this study. However, you may withdraw at any time and you may choose not to answer any question that you feel uncomfortable in answering.

Potential Benefit. There are no direct benefits to you of participating in this research. No incentives are offered. The results will have scientific interest that may eventually have benefits for people who have stress-related problems.

Anonymity/ Confidentiality. The data collected in this study are confidential. Your questionnaire has been coded so that identifying information will not be collected. All data are coded such that your name is not associated with them. In addition, the coded data are made available only to the researchers associated with this project.

Right to Withdraw. You have the right to withdraw from the study at any time without penalty. You may omit questions on any questionnaires if you do not want to answer them.
We would be happy to answer any question that may arise about the study. Please direct your questions or comments to: laurel.mellin@ucsf.edu or 415-272-4077.

Signatures
I have read the above description of the Existential Aspects of Procrastination study and understand the conditions of my participation. My signature indicates that I agree to participate in the experiment.

Participant's Name : _____ Researcher's Name: ___ _____

Participant's Signature: _____ Researcher's Signature:_____

Date:_____

Appendix E:

Sample Descriptions

Table 1

Quantitative Sample Physiologic Characteristics

	N	Min	Max	*M*	*SD*
Body Mass Index	33	23.80	40.00	30.80	3.80
Age.	33	26.00	68.00	53.58	9.64
Systolic BP	33	110	166	133.45	13.76
Diastolic BP	33	62	100	77.15	9.77

Note. N=33.

Table E2

Quantitative Sample Demographic Characteristics

	Frequency	Percent
Gender		
Male	4	12.1
Female	29	87.9
Race/Ethnicity		
White	30	90.9
Black	1	3.0
Asian or Pacific Islander	2	6.1
Non-Hispanic	33	100
Highest education		
High school graduate	7	21.2
Post high school	10	30.3
College graduate	10	30.3
Post-graduate/professional degree	6	18.2
Marital Status		
Single/never married	2	6.1
Married	23	69.7
Separated	1	3.0
Divorced	6	18.2
Widowed	1	3.0

Note. N=33.

Table E3

Qualitative Sample Demographic and Certification Characteristics

	Frequency	Percent
Gender		
Female	5	100.0
Race/Ethnicity		
White	5	100.0
Non-Hispanic	4	80.0
Highest education		
Post-graduate/professional degree	5	100.0
Marital Status		
Married	5	100.0
EBT Certification		
Introductory course	1	20.0
Introductory and some advanced courses	3	60.0
Introductory and all advanced courses	1	20.0
Highest education		
Post-graduate/professional degree		100.0

Note. N=33.

Appendix F:

Full Dependent Variables ANCOVA Results

Table F1

Mindfulness Observing

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	.769	.769	0.56	.461
Time	2	.697	.349	1.49	.233
Condition	1	.093	.093	0.07	.797
BMI x Time	2	2.590	.129	0.55	.578
Time x Condition	2	.955	.477	0.27	.138
Within error	60	14.016	.234		
Between error	30	41.427	1.381		
Condition x time T1 -T2	1	1.627	1.627	3.24	.082
Condition x time T2-T3	1	1.207	1.207	4.41	.044
T3-T1 (Test)	1	1.330	1.330	2.12	.155

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Carrying BMI at Time 1) for Mindfulness Observing (Five Facet Mindfulness Questionnaire)

Table F2

Mindfulness Describing

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	4.000	4.000	0.26	.617
Time	2	.834	.417	2.26	.113
Condition	1	.521	.521	0.33	.569
BMI x Time	2	.408	.204	1.11	.337
Time x Condition	2	.046	.023	0.12	.884
Within error	60	11.051	.184		
Between error	30	47.015	1.567		
Condition x time T1 -T2	1	.001	.001	.001	.978
Condition x time T2-T3	1	.018	.018	.019	.890
T3-T1 (Test)	1	.374	.374	.844	.368

Note. *N*=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Carrying BMI at Time 1) for Mindfulness Describing (Five Facet Mindfulness Questionnaire)

Table F3

Mindfulness Acting with Awareness

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	.473	.473	0.84	.366
Time	2	1.673	.837	2.30	.109
Condition	1	.012	.012	0.02	.887
BMI x Time	2	.494	.247	0.68	.511
Time x Condition	2	0.10	.005	.014	.986
Within error	60	21.815	.364		
Between error	30	16.860	.562		
Condition x time T1 -T2	1	.001	.001	.01	.978
Condition x time T2-T3	1	.018	.018	.02	.890
T3-T1 (Test)	1	.374	.374	.83	.368

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Acting with Awareness (Five Facet Mindfulness Questionnaire)

Table F4

Mindfulness Nonjudging of Inner Experience

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	.075	.075	0.20	.657
Time	2	3.634	1.817	3.57	.034
Condition	1	.371	.371	0.99	.327
BMI x Time	2	1.248	.624	1.23	.301
Time x Condition	2	.486	.243	0.48	.622
Within error	60	30.513	.509		
Between error	30	11.183	.373		
Condition x time T1 -T2	1	.008	.008	.01	.939
Condition x time T2-T3	1	.652	.652	.71	.406
T3-T1 (Test)	1	.055	.055	.06	.055

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Mindfulness Nonjudging of Inner Experience (Five Facet Mindfulness Questionnaire)

Table F5

Mindfulness Nonreactance of Inner Experience

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	.253	.253	0.30	.590
Time	2	.610	.305	1.15	.324
Condition	1	.828	.828	0.97	.332
BMI x Time	2	.204	.102	0.38	.684
Time x Condition	2	.553	.276	1.04	.360
Within error	60	15.959	2.66		
Between error	30	25.530	.851		
Condition x time T1 -T2	1	.001	.001	.001	.001
Condition x time T2-T3	1	.249	.249	.715	.249
T 3-T1 (Test)	1	1.279	1.279	2.117	1.279

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Mindfulness Nonreactance of Inner Experience (Five Facet Mindfulness Questionnaire)

Table F6

Emotion Regulation Suppression

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	9.627	9.627	2.95	.096
Time	2	.168	.084	0.11	.897
Condition	1	.159	.159	0.05	.827
BMI x Time	2	.174	.087	0.11	.893
Time x Condition	2	1.290	.645	0.84	.438
Within error	60	46.262	.771		
Between error	30	97.883	3.263		
Condition x time T1 -T2	1	1.890	1.890	1.122	.298
Condition x time T2-T3	1	1.980	1.980	1.760	.195
T 3-T1 (Test)	1	.004	.004	.002	.964

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Emotion Regulation Suppression (Emotional Regulation Questionnaire)

Table F7

Emotion Regulation Reappraisal

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	.791	.791	0.19	.664
Time	2	2.843	.084	0.11	.229
Condition	1	1.093	.159	0.05	.610
BMI x Time	2	2.942	.087	0.11	.218
Time x Condition	2	3.926	.645	0.84	.133
Within error	60	56.398	.771		
Between error	30	123.066	3.263		
Condition x time T1 -T2	1	1,890	1.890	3.629	.066
Condition x time T2-T3	1	1.980	1.980	3.181	.085
T 3-T1 (Test)	1	.439	.439	.203	.655

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Emotion Reappraisal (Emotional Regulation Questionnaire)

Table F8

Perceived Stress

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	.840	,840	1.173	.287
Time	2	.294	.147	1.190	.311
Condition	1	1.056	.528	.737	.478
BMI x Time	2	.188	.094	.760	.472
Condition x time	2	2.406	1.203	9.723	.0005
Within error	60	7.424	.124		
Between error	30	21.489	.716		
Condition x time T1-T2	1	3.911	3.911	18.814	.0005
Condition x time T2-T3	1	3.911	3.911	18.814	.0005
T 3-T1 (Test)	1	.127	.127	.418	.523

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Perceived Stress (Perceived Stress Scale)

Table F9

Depression

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	.150	.150	0.43	.516
Time	2	.118	.059	0.88	.420
Condition	1	.073	.073	0.21	.651
BMI x Time	2	.135	.067	1.00	.373
Time x Condition	2	1.182	.591	8.80	.0005
Within error	60	4.030	.067		
Between error	30	10.47	.349		
Condition x time T1 -T2	1	2.237	2.237	21.310	.0005
Condition x time T2-T3	1	1.116	1.116	7.463	.010
T 3-T1 (Test)	1	.000	.000	.000	.995

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Depression (Center for Epidemiology Studies Depression Scale)

Table F10

Positive Affect

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	1.207	1.207	0.75	.392
Time	2	.714	.357	1.75	.183
Condition	1	1.167	1.167	0.73	.400
BMI x Time	2	.355	.177	0.87	.424
Time x Condition	2	2.626	1.313	6.43	.003
Within error	60	12.243	.204		
Between error	30	48.033	1.601		
Condition x time T1 -T2[1]	1	5.041	5.041	10.64	.003
Condition x time T2-T3[2]	1	2.309	2.309	5.72	.023
T3-T1 (Test)[4]	1	.907	.907	2.61	.116

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Positive Affect (Positive and Negative Affect Scale)

Table F11

Negative Affect

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	.654	.654	.72	.402
Time	2	.035	.035	.18	.678
Condition	1	.007	.007	.01	.930
BMI x Time	2	.123	.062	.57	.570
Time x Condition	2	1.335	.668	6.14	.004
Within error	31	6.525	.109	6.52	60
Between error	31	27.181	.906		
Condition x time T1 -T2[1]	1	1.830	1.830	11.425	.002
Condition x time T2-T3[2]	1	2.162	2.162	10.727	.003
T 3-T1 (Test)[4]	1	.058	.058	.198	.660

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Negative Affect (Positive and Negative Affect Scale)

Table F12

General Self-efficacy

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	.069	.069	0.09	.772
Time	2	.148	.074	0.93	.400
Condition	1	.089	.089	0.11	.741
BMI x Time	2	.242	.121	1.52	.226
Time x Condition	2	.677	.339	4.13	.019
Within error	60	.4774	.080		
Between error	30	23.959	.799		
Condition x time T1 -T2[1]	1	.999	.999	5.18	.031
Condition x time T2-T3[2]	1	1.033	1.033	7.27	.011
T 3-T1 (Test)[4]	1	.149	.149	1.06	.312

Note. *N*=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for general self-efficacy (General Self-efficacy Scale)

Table F13

Food Dependence

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	2.560	2.560	0.52	.474
Time	2	1.790	.895	0.57	.570
Condition	2	22.858	22.858	4.58	.038
BMI x Time	2	1.460	.747	0.46	.628
Time x Condition	2	15.152	7.576	4.79	.012
Within error	60	94.773	1.616		
Between error	30	146.327	4.787		
Condition x time T1 -T2[1]	1	5.792	5.792	2.05	.162
Condition x time T2-T3[2]	1	30.152	30.152	9.92	.004
T 3-T1 (Test)[5]	1	.006	.006	0.01	.967

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Carrying BMI at Time 1) for Food Dependence (Yale Food Dependence Scale)

Table F14

Systolic Blood Pressure

	df	SS	MS	*F*	*p*
2x3 ANCOVA					
BMI	1	1064.097	1064.097	3.88	.058
Time	2	76.513	38.257	0.50	.601
Condition	1	16.076	16.076	0.06	.810
BMI x Condition	2	44.351	22.175	0.29	.750
Time x Condition	2	387.811	193.905	2.53	.088
Within error	60	4597.915	76.632		
Between error	30	8225.983	274.199		
Condition x time T1 -T2	1	773.669	773.669	4.976	.033
Condition x time T2-T3	1	228.536	228.536	1.436	.240
T 3-T1 (Test)	1	228.536	228.536	1.44	.240

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Systolic Blood Pressure (mmHg)

Table F15

Diastolic Blood Pressure

2x3 ANCOVA	*df*	SS	MS	*F*	*p*
BMI	1	1068.460	1068.460	11.15	.002
Time	2	63.547	31.774	0.63	.536
Condition	1	58.450	58.450	0.61	.441
BMI x Time	2	76.724	38.362	0.76	.472
Time x Condition	2	39.410	19.705	0.39	.678
Within error	60	3025.590	50.426		
Between error	30	2875.238	95.841		
Condition x time T1 -T2	1	49.962	49.962	.387	.539
Condition x time T2-T3	1	1.250	1.250	.022	.882
T 3-T1 (Test)	1	96.364	96.364	.821	.372

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANCOVA (Co-varying BMI at Time 1) for Diastolic Blood Pressure (mmHg)

Table F16

Body Mass Index

ANOVA	*df*	SS	MS	*F*	*p*
Time	2	.6.323	.3.162	7.81	.001
Condition	1	20.761	20.761	.476	.496
Time x Condition	2	2.082	1.141	2.57	.082
Within error	60	.25.106	.003		
Between error	30	26,106	.405		
Condition x time T1 -T2[1]	1	3.029	3.029	5.02	.032
Condition x time T2-T3[2]		3.216	.3.215	5.00	.033
T 3-T1 (Test)[4]	1	4.766	.4.766	4.03	.054

Note. N=2; 2 (Condition) x 3 (Measurement Time) ANOVA for Body Mass Index