A Comprehensive Investigation of Yoga, Attention, and Self-Perception

by

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Abstract

Yoga is an ancient spiritual tradition that has retained some of its original elements while also showing a clear evolution. Historically, yoga consisted mainly of stationary meditative practices for spiritual purposes; over time, yoga has seen an increase in movement-based practices for both spiritual and non-spiritual reasons. Previous research has shown that yoga, in its many forms, can lead to psychological benefits. The goals of the current research were to understand the relationship between yoga and several constructs that may influence yoga's effects, to determine how length of practice influences these relationships, and to identify the specific contribution of movement – also called physical postures (Sanskrit: *asanas*). Two studies were conducted. Study 1 was a cross-sectional design that compared psychological (depression, anxiety, stress, mindfulness, emotion dysregulation, interoceptive awareness, and self-compassion) and spiritual (spiritual intelligence) self-report measures among long-term, intermittent, and non-practitioners of yoga. Long-term practitioner scores reflected greater psychological and spiritual health compared to the other two groups on all measures, except depression, anxiety, and stress. Mediation analyses revealed that the relationship between yoga experience and emotion dysregulation was dependent on interoceptive awareness and spiritual intelligence in one model, and mindfulness and self-compassion in a second model. Study 2 was a randomized-control trial that compared participation in an eight-week *asanas*-based *Hatha* yoga practice with an education group who learned about the history and philosophy of traditional yoga. Five self-report measures (depression, anxiety, stress, mindfulness, emotion dysregulation, interoceptive awareness, and self-compassion) and an attentional task were completed before and following each program. Compared to their pre-scores, the yoga group's post-scores were higher on all measures except attention. The yoga group had higher scores on stress and interoceptive

awareness compared to the education group. Mediation analyses revealed that mindfulness, interoceptive awareness, and emotion dysregulation mediated the relationship between yoga program and depression, anxiety, stress, and/or emotion dysregulation in six different models. Taken together, these two studies suggest prominent roles for these constructs in explaining yoga's mechanisms, corroborate findings that these are attainable benefits in even short-term interventions, and demonstrate that *asanas*-based yoga is associated with psychological improvements.

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Dedication

To my family, friends, and animal companions.

In memory of Ian Gonzales.

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Preface

My dissertation is in the format of a "sandwiched thesis," which includes two separate studies that will be submitted for publication. Chapter 1 includes a literature review relevant to both studies, Chapter 2 represents the first study, Chapter 3 connects the two studies, Chapter 4 represents the second study, and Chapter 5 is a discussion and summary of both studies. Overlapping information was unavoidable for both Chapters 2 and 4, due to the nature of the topics requiring similar background material for publication.

Both myself (first author) and Dr. Stephen Smith (second author) are included as authors on the studies for publication. These studies were designed, implemented, analyzed, and interpreted by the first author. All ethics applications were also written and submitted by the first author. Writing of the documents was completed by both authors. The first author submitted initial manuscripts and the second author provided edits and revisions.

A Comprehensive Investigation of Yoga, Attention, and Self-Perception

Chapter I: General Introduction

What is Yoga?

The traditional purpose of Yoga is to achieve self-realization, a state of being that represents reaching your greatest potential and consistently living within it (Feuerstein, 2008). One's greatest potential is often referred to as the "Self", representing the most desirable aspect of each person that is free from influences that cause or lead to suffering (Feuerstein, 2008). The process of achieving this state has a flexible interpretation in Traditional Yoga, with many paths and schools endorsing a variety of methods and lifestyles. This variability allows practitioners to customize their path while remaining focused on the common goal of self-realization.

Yoga represents a primarily spiritual practice in India; however, it is practiced for many different reasons in other parts of the world. There are three commonly cited reasons which encompass a person's intention to practice: Yoga for spirituality, yoga for health, or yoga for fitness or beauty. Yoga practiced for spirituality has been referred to as "Traditional Yoga" (Feuerstein, 2013). Practitioners typically view this intention positively, because it remains authentic to its original purpose. Yoga practiced for health reasons bypasses its original spiritual intention in order to acquire the physical and/or mental health benefits (Varambally & Gangadhar, 2012). This purpose is seen as a natural progression in yoga's lengthy history that is here to stay and is typically met with an attitude of acceptance (Mallinson, 2019; Varambally & Gangadhar, 2012). Yoga for fitness or beauty has been referred to as "modern yoga" or, more derisively, "McYoga" (Feuerstein, 2013).

Although the consensus among many traditional practitioners is that those who practice yoga solely for its fitness benefits or beauty completely miss the point and will never acquire the full benefits of what yoga has to offer (Cope, 1999, 2007; Feuerstein, 2003, 2008, 2011, 2013), it is important to note that yoga—in its many forms—does lead to health benefits. Indeed, a meta-analysis of 306 studies by Cramer and colleagues (2016) found that yoga produced numerous positive physical and mental health outcomes relative to control groups. Importantly, this review also noted numerous methodological deficiencies in the literature. It is clear that more methodologically rigorous experiments are needed in order to elucidate the potential benefits of yoga. The purpose of the current research is to fill some of the gaps in our knowledge of the relationship between yoga and well-being while avoiding the methodological shortcomings of some previous studies. However, before presenting these experiments, it is important to place yoga in its historical and therapeutic context. In the subsequent sections of this dissertation, I will provide a brief summary of yoga practice, highlighting different traditions that evolved into what Westerners view as yoga. I will also review the existing research investigating the (potential) benefits of yoga on physical and mental health. For ease, all Sanskrit words are *italicized*.

Yoga Origins and History

Yoga has its origins in an ancient, rich, complex history, beginning 5000 or more years ago (Feuerstein, 2003; Pandurangi et al., 2017). The disparity in age is due to the ambiguous and esoteric information currently available on India's prehistory, although it is estimated that Yoga is much older than originally predicted. Evidence for this is seen in the *Bhagavad-Gita* (Lord's Song), written 500 B.C.E. or earlier, which at the time already referenced Yoga as an archaic practice (Feuerstein, 2008).

In its earliest form, Traditional Yoga is hypothesized to have included dedicated meditation with at-home ritualistic practices. The underpinnings of yogic philosophy originally appeared in the *Vedas*, the oldest collection of the canons of Hinduism dating as far back as the fourth millennium B.C.E (4000 – 3001 B.C.E.). These writings are hypothesized to contain information on the Indus-Sarasvati civilization. This massive civilization was peaceful, prosperous, and socially, politically, and architecturally advanced for its time. The *Vedas* suggests this civilization engaged heavily in spiritual practices that were ethical and introspective in nature, including living ethically, concentrating, regulating the breath, reciting mantras, surrendering the Ego, and engaging with the Self. Most of these are foundational elements of yoga practices and have remained unchanged for thousands of years (Feuerstein, 2008; 2011).

Following the *Vedas* came the *Upanishads*, a text written before the sixth century B.C.E. The *Upanishads* were meant for a broader audience with its more easily interpretable language. It contained foundational concepts of yoga philosophy, was the first scripture in which the word "yoga" appears, and describes yoga as a practice that progressed from home-based rituals to inner contemplation and meditation exclusively. Despite the *Upanishads'* readability, spirituality became accessible only to sages who served as teachers and mentors to individuals seeking self-realization. The term, "*Upanishad*" translates to "sitting down near", which references an individual sitting close to a teacher in meditation. Receiving the teachings of the *Upanishads* became restricted to individuals who proved their worth as a student, a task often requiring years of dedicated effort. Specific instructions on how to practice introspection were decided between teacher and student, with the *Upanishads* containing no information on how individuals without a teacher may practice (Feuerstein, 2008; 2011).

Most early yoga texts included information on cultural practices and philosophies rather than a guide on how to practice. Furthermore, many different schools of yoga emerged over thousands of years, making yoga an exceptionally diverse practice. In response to the need for a streamlined, explicit guide, sage Patañjali wrote the Yoga *Sutras* (Feuerstein, 2011; Saraswati, 2008). The Yoga *Sutras* form the philosophical basis of one of the subdivisions of Yoga, *Râja* Yoga, and is the practice endorsed by *Ashtanga* Yoga, a school of yoga meaning eight-fold or eight-limbed path (Varambally & Gangadhar, 2012). The basic principles of the eight limbs describe how consistently engaging in self-restraining practices along with quieting of the mind leads to self-realization (Saraswati, 2008). Patañjali's eight limbs of yoga include *Yama* (ethical living towards others through self-control), *Niyama* (ethical living towards oneself through self-discipline), *Asana* (physical postures), *Pranayama* (breath regulation), *Pratyahara* (sense withdrawal), *Dharana* (concentration), *Dhyana* (meditation), and *Samadhi* (self-realization).

Yama and *niyama* each contain five sub-categories that describe ethical living practices, treating others and oneself with disciplined kindness and respect. The five *Yamas* include *ahimsa* (non-violence), *satya* (truthfulness), *asteya* (non-stealing), *brahmacarya* (control of the sexual organ), and *aparigraha* (without greed). The five *Niyamas* include *saucha* (cleanliness), *santosha* (contentment), *tapas* (austerity), *svadhyaya* (study), and *ishvara pranidhana* (surrender). These ethical living practices are not emphasized in modern practices nor in most Western yoga classes, yet they are a firm, essential foundation for traditional practitioners.

Asanas refer to physical postures. These postures are practiced for different reasons depending on the school of yoga. Some schools engage in physical postures solely to prepare the body to sit in long periods of time in meditation in order to reach enlightenment (*Râja* Yoga). Other schools believe *asanas* are the path to enlightenment (*Hatha* Yoga). In *Râja* Yoga, *asanas*

were minimal and originally described as finding a comfortable position in which to sit in meditation. *Asanas* have expanded from this simple description to include nearly one million postures. Currently, *asanas* include a mix of traditional postures and European calisthenics (Spence, 2021).

Pranayama includes a vast number of techniques that teach breath regulation. Typically, these techniques are individualized, where practitioners may repeat them regularly or on an as-needed basis. Common *pranayama* techniques adopted into Western classes include alternate nostril breathing and set ratios of inhalations, breath retention, and exhalations (typically a 1:4:2 ratio). In traditional yoga, *pranayama* is important to regulate the breath, which is considered an extension of *prana*, one's life force. In Western classes, *pranayama* techniques are used with the intention to link the body and mind, promote relaxation, or reduce stress.

Pratyahara refers to withdrawing the senses through manipulation of one's environment. Beginner practitioners are encouraged to engage in the final three limbs using *pratyahara*; in a quiet place free from distraction from their environment to facilitate learning and focusing inward. *Pratyahara* becomes less important as an individual becomes less inclined to be taken in by their outside surroundings and more easily maintain their practice in the midst of distractions.

Dharana, *dhyana*, and *samadhi* are considered continuous practices, where one leads into another in a vacillating fashion. *Dharana* refers to the act of concentration on an object, idea, or abstract concept of the individual's choosing. Historically, the object of concentration is chosen with the assistance of a mentor or teacher to promote interest and focus. Choosing the object is carefully done to meet the need of the student.

Dhyana refers to an advanced meditative state achieved through the practice of *dharana*. This state is akin to Csikszentmihalyi's (1997) description of flow, which is defined as a state of conscious harmony in which effortless action towards a goal occurs. Csikszentmihalyi (1997) explains how a flow state may be experienced by anyone, although it is commonly referred to by athletes and musicians as, "being in the zone" (p. 29). It is important to note that a Western understanding of meditation is more akin to *dharana* (focused concentration) whereas *dhyana* refers to an advanced state of consciousness.

Samadhi refers to achieving enlightenment. Enlightenment is also referred to as self-transcendence or self-realization, a state of ecstasy or bliss that comes when one fuses with the Self. These states refer to an individual's achievement of transcending the ego, letting go of attachment from all things finite (i.e., thoughts, emotions), and connecting with the highest potential of the Self that is free from suffering. Achieving this state is the purpose of traditional yoga. In *samadhi*, an individual becomes fully congruent with their Self (one's own highest potential) and is able to maintain this state consistently in all aspects of their lives, leading to a deep sense of connectedness within and between all beings. It is important to note that while suffering is eliminated in *samadhi*, the Self is not free from pain. Although it is possible that a Western practitioner of yoga may achieve *dhyana* and *samadhi* through meditation, it is important to note that these are not practices; rather, they are states. As previously described, what many people refer to as "meditation" in a non-yoga context is similar to *dharana*, the practice of concentrating and returning the mind to its object of focus. It is also important to note that other schools and philosophies of yoga exist outside of Patañjali's system. However, the eight-fold path has perpetuated over the years, is endorsed by universities in India, and is

typically taught to aspiring yoga instructors. Furthermore, aspects of this system were used in Study 2 of this dissertation and are therefore relevant to the current discussion.

Hatha Yoga

The main subdivisions of Yoga include *Râja* Yoga, *Hatha* Yoga, *Mantra* Yoga, *Jnana* Yoga, *Karma* Yoga, *Bhakti* Yoga, and *Laya* Yoga. *Râja* Yoga practitioners have historically considered their method of practice superior to any other, focusing on meditating and renouncing their life to the pursuit of self-realization. *Hatha* yoga, a rival of *Râja* Yoga, has placed a focus on physical practices, rather than exclusively meditation, and endorsing the belief that self-realization may be achieved by living in the world without the need for renunciation. *Hatha* Yoga became popular for this reason (Feuerstein, 2008).

Hatha Yoga has changed significantly since its origins. *Hatha* Yoga translates to "forceful yoga" and originally included ascetics practicing extreme physical techniques to cleanse their bodies (Mallinson, 2019). Practices included hanging upside down from a tree branch, holding one's breath for as long as possible, holding one's arm above the head for long periods of time, or sitting naked on the ground by a fire on a hot day (Mallinson, 2019). Practices were originally passed on in an oral tradition and included influences from Hinduism, Buddhism, and Jainism (Feuerstein, 2008; Mallinson, 2019).

The most important *Hatha* Yoga text, the *Hathapradīpika,* appeared in 1450 CE (Feuerstein, 2008; Mallinson, 2019). This short text is a practical guide that compiled approximately 20 written works on *Hatha* yoga, detailing its defining features (Svatmarama, 2002). Rather than eight levels of practice, as outlined in Patañjali's Yoga *Sutras*, the *Hathapradīpika* describes four features (Mallinson, 2019; Svatmarama, 2002). These include

specific guides on how to establish a practice (i.e., location, diet, ethics, cleansing techniques), breath control techniques, 15 *asanas* (physical postures), and *mudras* (techniques designed to direct the breath and body's energy; Mallinson, 2019; Svatmarama, 2002). The intensely physical nature of traditional *Hatha* Yoga began with mainly seated postures for meditation, where an individual would choose one posture and practice it consistently. Physical practices have evolved to include a vast array of static and dynamic postures designed to be kind to the body (Mallinson, 2019). *Hatha* Yoga overlaps with many other yoga schools emphasizing ethical living, diet, introspection, meditation, breath regulation, and physical postures. The defining features of *Hatha* Yoga, however, are a predominantly physical practice which uses postures, breath control techniques, and meditation over a foundation of ethical living. This is similar to how *Hatha* yoga is practiced in present Western society, with the exception that the intention is not always for self-realization and that ethical living is not emphasized to the same extent.

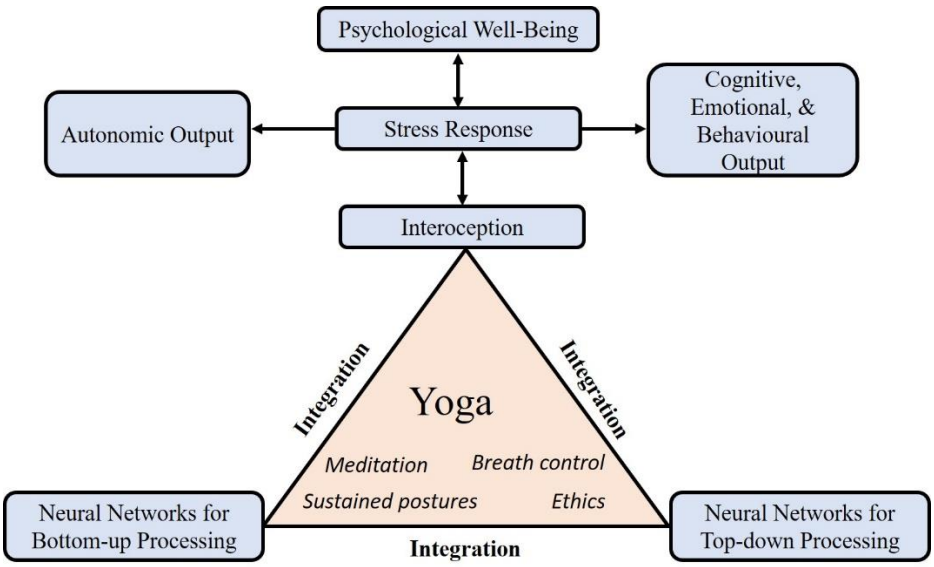
Mechanisms of Yoga: A Model

The previous section of this chapter highlighted a number of physical and psychological processes that could explain potential processes underlying yoga's benefits. Gard and colleagues (2014) organized these processes into a comprehensive model depicting the mechanisms through which yoga may exert its effects. They conceptualized yoga as being a practice that promotes self-regulation through both bottom-up and top-down mechanisms that apply widespread effects (Figure 1). Because many of the components in this model were measured in the current study (e.g., psychological well-being, interoceptive awareness) and some of the other processes are discussed in terms of avenues for future exploration (e.g., top-down vs. bottom-up processing), I will describe the general structure of this model. My hope is that this model will provide readers

with an appreciation for the number of processes that may be interacting during and after a yoga practice.

Figure 1.

Yoga Model Involving Bottom-Up and Top-Down Mechanisms



Note. Reproduced with permission from Gard and colleagues (2014).

In their model, Gard and colleagues (2014) condense the eight limbs of yoga into four components: sustained postures (*asanas*), breath control (*pranayama*), ethics (*yama* and *niyama*), and meditation (*pratyahara*, *dharana*, *dhyana*, and *samadhi*). They propose that yoga's four components influence bottom-up and top-down processing through distinct neural networks and interoceptive processing. These processes are suggested to be naturally integrative and have an effect on an individual's stress response (Gard et al., 2014).

Yoga emphasizes the concept of "embodiment," where the Self is experienced as the body rather than the Self being experienced as separate from the body. With this emphasis, bottom-up mechanisms are proposed to be integral to the experience. Importantly, embodiment involves both attention to ascending signals from the viscera as well as executive control processes that maintain this attentional focus. Body movement (e.g., an *asana*) can strengthen an individual's perception of their sensory experiences, activating neural regions involved in sensory, motor, somatic, and visceral processing, and help focus attention on bodily signals. Gard and colleagues (2014) suggest that these changes promote self-regulation and can alter stress hormones, inflammatory cytokines, and autonomic activity in a manner that reduces perceived stress (Gard et al., 2014).

In order to maintain attentional stability during a yoga practice, disengagement from distraction, continuous re-engagement with the object of focus, and a non-evaluative stance are required. These processes overlap with the concept of mindfulness (discussed later in this chapter) and are classified as top-down strategies that enhance cognitive flexibility and attentional control. The authors suggest that top-down processes required for yoga practice are regulated by neural networks that control executive functioning, including emotional regulation, awareness of interoceptive experiences, and attentional control (Gard et al., 2014). All of these potential mechanisms will be examined in the current research.

It is likely that the integration and bidirectional activity of bottom-up and top-down regulatory processes are key to the mechanisms of yoga's effects. Gard and colleagues (2014) suggest that the integration of these processes inevitably influence self-regulatory systems in the context of an individual's stress response. These systems affect cognitions, emotions, behaviours, autonomic processes, and psychological and physical well-being. Furthermore,

through repeated practice, these methods of self-regulation generalize to other areas, affecting stress responses both on and off the yoga mat (Gard et al., 2014). This is relevant for both the current research and clinical psychology in general because many yoga practitioners state that improving psychological well-being and reducing stress are key motivators for practicing yoga. Therefore, the mechanisms reviewed by Gard and colleagues (2014) can serve as a catalyst for future research.

Yoga and the Brain

A review of yoga's mechanisms requires an examination of the neural substrates underlying yoga's beneficial effects. A number of researchers are investigating the neural correlates of yoga, although the body of research pales in comparison to the amount of research examining similar practices such as mindfulness and meditation. Although the studies in this dissertation did not including neuroimaging (due to pandemic-related restrictions on in-person testing), a brief review of the literature on structural and functional neuroimaging is included here to identify possible underlying processes.

Structural Neuroimaging Studies

Structural neuroimaging studies have demonstrated that both yoga interventions and long-term yoga practice leads to changes in the volume of brain structures related to emotional perception and regulation. Villemure and colleagues (2014) compared gray matter concentration and pain tolerance between yoga practitioners (those maintaining a regular practice, averaging 10 years in length) and those with no yoga experience. Participants in this study incorporated *pranayama, asanas,* meditation, and chanting into their yoga practices. The authors reported that yoga practitioners showed greater gray matter concentration in the insular cortex; this difference

correlated with enhanced pain tolerance. The change in the insula is noteworthy because of the role this structure plays in interoception, the ability to detect and interpret signals from the body (e.g., changes in heart rate). Yoga's effect on interoceptive awareness is thus reflected in anatomical changes in the insula.

Yoga research has also consistently reported differences in hippocampal volume. Increases in hippocampal volume have been reported in elderly participants following a six-month yoga intervention that included *pranayama*, OM chanting, and *asanas* (Hariprasad et al., 2013) and in a cross-sectional study comparing experienced yoga practitioners (minimum three years experience, at least three times each week of predominantly *asanas*) with matched non-practitioners (Gothe et al., 2018). This trend is important because the hippocampus plays a role in both memory formation and the control of emotions.

Yoga practitioners have also shown differences in cortical thickness in a variety of neural regions involved with attention and executive functioning (van Aalst et al., 2020). Froeliger and colleagues (2012) reported in their cross-sectional study on *Hatha* yoga meditation practitioners compared to matched non-practitioners that practitioners demonstrated greater grey matter volume in frontal, limbic, temporal, and occipital regions and the cerebellum. They found that this increase in cortical thickness negatively correlated with scores on the Cognitive Failures Questionnaire (Froeliger et al., 2012). Afonso and colleagues (2017) compared cortical thickness in age and activity-matched elderly yoga practitioners and non-practitioners. Yoga practitioners had an average of 14.9 years experience (minimum eight years) with *Hatha* yoga and exhibited significantly greater cortical thickness in left prefrontal regions including anterior and lateral areas of the middle and superior frontal gyri (Afonso et al., 2017).

Taken together, these studies collectively suggest that practicing yoga is associated with structural differences in a variety of neural regions. These regions may be associated with the interoceptive pathway (insula, amygdala, and hippocampus), emotional regulation (hippocampus), and attention and executive functioning (cortical regions), suggesting multiple areas of consideration for future research.

Resting-State fMRI Studies

The brain is consistently active, even when an individual is not performing a cognitive or motoric task (i.e., during a "resting state") (Fox & Raichle, 2007; Zhang & Raichle, 2010). Importantly, the patterns of neural activity that occur "at rest" are not entirely random. Biswal and colleagues (1995) observed temporally correlated spontaneous fluctuations in neural activity; this activity is referred to as functional connectivity. Neural regions showing functional connectivity are not necessarily structurally connected and appear to be organized based on function (Fox & Raichle, 2007; Zhang & Raichle, 2010). Resting-state functional connectivity is hypothesized to represent a baseline level of neural functioning that is involved in information processing in addition to organizing and integrating multiple functional brain systems (Raichle, 2015; Uddin et al., 2010). The most widely studied of these "networks" is the default mode network (DMN), which comprises the medial prefrontal cortex, posterior cingulate gyrus / precuneus, and lateral parietal cortex (Raichle et al., 2001). The DMN includes regions involved in processing information related to self-reference, emotions, and episodic memory (Gard et al., 2014; Raichle et al., 2001).

Two studies have identified differences in DMN functional connectivity in yoga practitioners. Eyre and colleagues (2016) compared the functional connectivity of participants who completed 12 weeks of Kirtan Kriya meditation (consisting of *pranayama*, meditation,

chanting, and relaxation) with those who completed memory enhancement training (consisting of practical strategies to enhance memory including verbal and visual strategies). The authors reported greater functional connectivity within the DMN as well as improvements in verbal memory (Eyre et al., 2016). Santaella and colleagues (2019) compared DMN resting state functional connectivity in elderly experienced yoga practitioners (minimum eight years of experience) with matched yoga naïve individuals. These authors reported greater connectivity between the medial prefrontal cortex (mPFC; anterior DMN node) and right angular gyrus (posterior DMN node; Santaella et al., 2019). Both of these studies suggest that yoga may have neuroprotective effects in aging populations.

Although no research has specifically examined the effects of *asanas* and *pranayama* on functional connectivity, there are some studies that included more meditative forms of yoga. For example, Hernández and colleagues (2018) analyzed functional connections in long-term *Sahaja* Yoga Meditation practitioners during mental silence and meditation in comparison to non-meditators. *Sahaja* Yoga Meditation involves long-term sustained attention in the present moment that in theory results in mental silence or thought-free awareness. The authors reported greater connectivity of both the right anterior cingulate cortex and mPFC with the inferior parietal cortex during mental silence (Hernández et al., 2018). They also noted a reduction in connectivity between the thalamus and parahippocampal gyrus during meditation (Hernández et al., 2018). Gard and colleagues (2015) showed greater functional connectivity in the caudate in *Vipassana* meditators compared to meditation-naïve controls. The caudate has implications for attentional shifting (Grahn et al., 2008), an integral practice in mindfulness that involves bringing attention back to a point of reference (i.e., the breath or a body sensation; Gard et al., 2015).

Collectively, these studies suggest that meditation is related to connectivity in regions associated with attention.

Task-Based fMRI Studies

Evidence from task-based fMRI studies have shown significant differences in activation patterns between yoga practitioners and non-practitioners, particularly when participants were performing tasks involving emotional stimuli (see van Aalst et al., 2020, for a review). For example, Wadden and colleagues (2018) compared activation patterns during an emotion-eliciting task between yoga practitioners (a minimum of 6 months practicing yoga and maintaining a regular practice) and recreational athletes (participants practicing team-based recreational sports with little or no yoga or meditation experience). Participants were shown film clips corresponding to happiness, sadness, or anger and instructed them to focus on the emotions they were feeling during fMRI scanning. The authors reported differences in neural activation patterns between groups, with the recreational athletes demonstrating activity in the frontal cortex similar to that seen in novice meditators, and the yoga practitioners demonstrating activity in the superior parietal lobule, supramarginal gyrus, and postcentral gyrus, similar to expert meditators (Wadden et al., 2018). This study demonstrates how yoga may affect neural activity related to responding to emotional stimuli, with long-term practice associated with activation patterns similar to advanced meditators.

Froeliger and colleagues (2012) analyzed differences in neural activation patterns between *Hatha* yoga meditation practitioners and yoga and meditation naïve participants during a task measuring emotional-cognitive interactions. In this task, participants were sequentially presented with a number grid, visual stimuli that were negatively or neutrally valenced, a second number grid, and then the image a second time. Following these stimuli, participants indicated

which number grid contained a greater quantity of numbers. They reported greater activity while viewing negative emotional images for control participants and less reactivity in the amygdala and dorsolateral PFC (dlPFC) while viewing negative emotional images for yoga meditation practitioners. The authors suggested that reduced dlPFC and amygdala activation corresponds to differences in how yoga practitioners process emotional images. They suggested that attending toward emotion is a less reactive process for yoga meditation practitioners, where the need for cognitive control is reduced. They further suggested that the underlying neural processes involve an interplay of activity between the dlPFC and amygdala (Froeliger et al., 2012). These findings are consistent with the notion that yoga enhances emotional regulation skills with the use of top-down neural processes.

Although neuroimaging studies of yoga are still in their infancy, the early results demonstrate clear benefits for preserving cognitive function through the aging process. This has been shown through distinct neural activity patterns, with increased gray matter structure and functional connectivity, while also promoting emotional regulation, sustained attention, and body awareness. Importantly, these processes are also related to psychological well-being, the primary focus of this dissertation.

The Current Studies

The current research is an attempt to identify an approximate length of experience needed to identify benefits from yoga and to further our understanding on the mechanisms of how yoga may exert its positive effects (Studies 1 and 2). The first study consisted of a cross-sectional design where six measures of self-perception were provided to participants with one of three levels of yoga experience – no experience, intermittent experience, or long-term experience. The second study consisted of a randomized control trial (RCT) featuring an *asanas*-only intervention

where five measures of self-perception and an attentional task were provided to participants before and following either an eight-week *Hatha* yoga intervention or a workshop series. Both studies were completed during the COVID-19 pandemic and were therefore in an entirely online format. Five of the measures were the same for both studies. Overlapping measures included depression, anxiety, and stress (all measured by the same scale); emotion dysregulation; trait mindfulness; interoception; and self-compassion. A detailed description of these constructs is included below, along with why these were chosen and how they benefit from yoga practice. A sixth topic, spiritual intelligence, was also included for Study 1 but was not in Study 2. Finally, a review of literature related to yoga and attention is provided afterwards, which is relevant to Study 2. The information is included here for ease and organization.

Depression, Anxiety, and Stress

Depression is a persistent healthcare concern worldwide, representing the leading cause of disability (World Health Organization, 2018). Anxiety and stress are also major healthcare concerns, contributing to significant difficulties and distress in millions of people around the world (World Health Organization, 2017). Many studies have shown that yoga can help reduce depressive symptoms (de Manicor et al., 2016; Falsafi, 2016; Papp et al., 2019; Saeed et al., 2010; Schuver & Lewis, 2016), anxiety (Boni et al., 2018; de Manicor et al., 2016; Falsafi, 2016; Khalsa et al., 2009; Saeed et al., 2010), and stress (Falsafi, 2016; Gothe et al., 2016; Hylander et al., 2017; Pascoe et al., 2017; Smith et al., 2007). Understanding the mechanism of how yoga provides benefits related to depression, anxiety, and stress are valuable considerations for future clinical studies.

A key source of information in understanding yoga's beneficial effects on depression, anxiety, and stress is the feedback of the participants themselves. In a qualitative study,

Uebelacker and colleagues (2017) reported aspects of a *Hatha* yoga intervention that were identified as important for participants diagnosed with Major Depressive Disorder. The authors conducted interviews with each participant following 10 weeks of *Hatha* yoga classes, asking for their feedback on the program. From 63 participants, several positive themes emerged, including a non-competitive, accepting, non-judgmental environment, a feeling of relaxation, learning about the *asanas*, quality instruction, use of breathing techniques, the practice of focusing on the present moment, and having individualized attention when required. The authors suggested that yoga classes for individuals with depression emphasize both *how* the classes are taught (i.e., a non-competitive atmosphere, emphasis on the present moment) and *what* is taught (i.e., incorporation of both *asanas* and *pranayama* with knowledgeable instructors, and making modifications when needed; Uebelacker et al., 2017).

An issue that is important both for the current dissertation and for the broader understanding of yoga's benefits is the need to identify *how* yoga reduces depression, anxiety, and stress using experimental studies; put simply, what cognitive or attentional mechanisms enable these improvements? Recently, Park and colleagues (2020) tested five potential mechanisms that may explain how practicing yoga may alleviate stress. Participants completed a 12-week yoga intervention of the Kripalu tradition and various measures at baseline, week eight, and after their final session. Questionnaires measured perceived stress; stress reactivity; trait mindfulness; interoceptive awareness; self-compassion; spiritual well-being; and self-control. Park and colleagues (2020) reported no significant difference in perceived stress or self-compassion following the intervention. Trait mindfulness, interoceptive awareness, and spiritual well-being increased significantly, whereas stress reactivity significantly decreased. Differences between perceived stress and stress reactivity were reported, with stress reactivity decreasing

significantly following the yoga intervention yet with perceived stress showing a stronger correlation to mindfulness, spiritual well-being, self-compassion, and self-control (Park et al., 2020)

These studies suggest that depression, anxiety, and stress may be attenuated with a yoga practice; they also highlight potential mediating roles for emotional regulation, interoceptive awareness, self-compassion, and mindfulness. A measure of depression, anxiety, and stress is included in the present study and the results from Uebelacker and colleagues (2017) were used as a partial guide for how to conduct the *Hatha* yoga classes for Study 2.

Emotional Regulation

Regulation of emotions involves a dynamic process of evaluating, monitoring, and modifying emotional reactions to prevent adverse consequences and to remain congruent with one's goals (Grant et al., 2018). Emotional regulation is required when an emotional state differs from an individual's goals (Hoeksma et al., 2004). Emotional regulation is an important component of self-regulation that is a common issue with individuals struggling with mental illness. Indeed, emotion dysregulation is associated with a variety of disorders including depression (Kassel et al., 2007), post-trauma symptoms (Tull et al., 2007), and borderline personality disorder (BPD; Tragesser et al., 2010), to name a few. It is not surprising, therefore, that many therapeutic orientations focus on processing emotions (e.g., Emotion-Focused Therapy; Greenberg, 2004) or teaching emotional regulation skills (e.g., Dialectical Behaviour Therapy; Linehan, 2015).

Intervention studies with several different populations have highlighted yoga's ability to enhance emotional regulation abilities. These include a six-week intervention with women who

had experienced trauma and who had substance abuse issues (Willy-Gravley et al., 2021), yoga-naïve participants struggling with Bulimia Nervosa or Binge-Eating Disorder (Brennan et al., 2020), and high school students between 15 and 17 years (Daly et al., 2015).These results suggest that yoga may be considered a viable treatment option to improve emotional regulation for adolescents (Daly et al., 2015), individuals with issues related to post-traumatic stress and addictions (Willy-Gravely, 2021), as well as for individuals experiencing eating disorders (Brennan et al., 2020). Therefore, although yoga does not specifically teach emotional regulation *strategies,* emotional regulation may be a valuable, indirect effect of practicing yoga (Gard et al., 2014). This possibility is examined in the current dissertation.

Trait Mindfulness

Mindfulness is typically referred to as an attention-based practice, where attention is focused intentionally and non-judgmentally in the present moment (Brown & Ryan, 2003; Kabat-Zinn, 1994). Focusing on the present moment in an intentionally curious, open, and non-reactive manner reduces rumination and habitual patterns of attention while promoting the development of an inner awareness that eases emotion processing, trauma processing, and an understanding of the Self that is separate from one's thoughts and feelings (Kabat-Zinn, 1994). Mindfulness has been studied extensively, separately from yoga, and shown to be beneficial for mental and physical health, chronic pain, and general well-being (Good et al., 2015).

Mindfulness, similar to yoga, is rooted in Eastern traditions and has permeated Western culture as a method to reduce stress, enhance quality of life, and reduce negative symptoms of various illnesses (Cavanagh et al., 2013; Chiesa et al., 2015; Teasdale et al., 1995). It is a critical element of yoga practice due to its non-judgmental focus on to the present moment; however, mindfulness and yoga differ because mindfulness does not necessarily involve a movement

component nor is the intention necessarily to bridge the self with the body. An important distinction relevant to this dissertation is the difference between trait and state mindfulness. Trait mindfulness refers to mindfulness as a personality attribute rather than a momentary (state) experience (Wheeler et al., 2017). Because trait mindfulness was measured for both studies in my dissertation, literature reviewing this construct will be discussed below.

Cross-sectional studies have reported enhanced trait mindfulness from practicing yoga. Brisbon and Lowery (2011) compared scores on a self-report measure of the attention component of trait mindfulness (the Mindful Attention Awareness Scale, MAAS) between beginner and advanced *Hatha* yoga practitioners. They reported significantly greater mindfulness scores for advanced practitioners for the MAAS, although they indicated no correlation between experience level with mindfulness scores (Brisbon & Lowery, 2011). Gaiswinkler and Unterrainer (2016) compared mindfulness scores using the Freiburg Mindfulness Inventory (FMI) in 455 participants (362 yoga practitioners, 93 gymnasts) to their degree of yoga involvement. They reported significantly greater mindfulness scores in yoga practitioners compared to those in the gymnastics group (Gainswinkler & Unterrainer, 2016). Importantly, intervention studies have demonstrated similar results to the cross-sectional studies summarized above (Brunner et al., 2017; Butzer et al., 2016; Hylander et al., 2017; Shelov et al., 2009). The fact that interventions ranging from six sessions to eight weeks in duration were consistent with the cross-sectional studies highlights the importance—and rapid impact—of mindfulness on yoga's benefits.

A role for the mindfulness component of yoga has been shown to be important for depressive rumination and anxiety. Schuver and Lewis (2016) investigated the efficacy of a yoga program in reducing depressive symptomology in 40 yoga-naïve women diagnosed with a

depressive disorder. Participants were randomized to a mindfulness-based yoga group (i.e., *asanas*, *pranayama*, and meditation components) or a walking group. The authors reported significantly reduced depressive scores as measured by the Beck's Depression Inventory (BDI) in both groups; the yoga group also showed significantly reduced rumination. The yoga program was partially based on the Mindfulness-Based Stress Reduction (MBSR) course (Kabat-Zinn, 1994), which has been shown to reduce rumination (Deyo et al., 2009). Schuver and Lewis (2016) suggest the mindfulness component of yoga is imperative for reducing depressive rumination, whereas exercise may be equally important to mindfulness in improving overall depressive symptoms.

Boni and colleagues (2018) investigated the relationship between mindfulness, anxiety, and practicing yoga using self-reports of anxiety and mindfulness. These researchers reported a negative correlation between length of practice and anxiety. They further reported a positive correlation between length of practice and all subscales of the Five-Facet Mindfulness Questionnaire (FFMQ). A mediation model was proposed, suggesting that mindfulness mediates anxiety through practicing yoga. However, the authors noted the need for further studies due to several limitations. The use of a convenience sample (i.e., some participants were personal contacts of those involved in the study), cross-correlational design, and primarily *Ashtanga* yoga practitioners are worth noting (Boni et al., 2018).

These studies demonstrate the importance of mindfulness in a yoga practice and its relation to anxiety and depressive symptoms. However, it is unclear the degree to which different component(s) of a yoga practice (i.e., *asanas*, *pranayama*) contribute to enhancing trait mindfulness.

Interoception

Interoception refers to a sense of physiological processes of the entire body (Craig, 2002). These processes (e.g., heart rate, blood pressure) have distinct cortical representations and may be the basis for generating a bodily self-awareness in addition to associating with emotions (Craig, 2009). Interoception and emotional experiences are tightly coupled anatomically, through the convergence of sensory signals in neural cortical regions via the spinal cord and vagus nerve (Critchley & Garfinkel, 2017). Behaviourally, the coupling of bodily and emotional experiences may have inter- and intra-personal implications. Critchley and Garfinkel (2017) suggest that bodily sensations may be described emotionally, or emotional experiences may be described using bodily sensations, in an effort to create a social language that relates to Self or others. Interoception thus represents a depth of experience, connecting bodily sensations with emotions through neuroanatomical and physiological pathways.

Schmalzl and colleagues (2015) provided a short summary of the literature between 1994 and 2014 on studies that investigated body awareness. These studies found that yoga practitioners used non-avoidant strategies to tolerate pain, had greater gray matter volume in the insula, greater pain tolerance, greater scores on the Body Perception Questionnaire, higher accuracy on a proprioceptive task, and higher self-transcendence traits measured by the Temperament Character Inventory. These findings suggest that yoga practitioners use mindful interoceptive approaches to process pain, which may lead to increasing parasympathetic activity and insular volume; this, in turn, may reduce the feeling of pain (Schmalzl et al., 2015).

Rivest-Gadbois and Boudrais (2019) reviewed 14 articles that compared body awareness to meditation or yoga practices. They reported that studies of meditating groups showed significantly enhanced body awareness. For yoga studies, they reported significant enhancements

in body awareness following yoga programs incorporating *asanas*, *pranayama*, guided meditation, integrative body-mind training, relaxation, mindfulness, and/or mental imagery (Rivest-Gadbois & Boudrais, 2019). Yoga was also associated with differences in gray matter concentrations in the right insula (a region implicated in interoceptive awareness), decreased in activity in the right amygdala and dorsal medial cortex, and greater activity in the prefrontal cortex and sensorimotor cortex (Rivest-Gadbois & Boudrais, 2019). This review suggests that enhanced body awareness corresponds to representations in gray matter concentration and neural activity for participants engaging in a meditative or yoga practice.

Overall, the positive results of the existing literature and conceptual notions relating movement to interoception suggest that interoception is a valuable measure to include in a yoga study. As such, it is included in both Studies 1 and 2 of my dissertation.

Self-Compassion

Self-compassion is a construct that involves three components: treating oneself with kindness, perceiving difficult experiences as a common part of humanity rather than as something that separates us from others, and de-identifying from thoughts and feelings in a mindful manner (Neff, 2003). Self-compassion is a foundational component of a yoga practice, where individuals learn to attend to their bodily sensations with acceptance in the absence of judgment.

The role of self-compassion in yoga has been examined by researchers using quantitative and qualitative methodologies. In a repeated measures single-group study, Falsafi and Leopard (2015) reported a significant increase in self-compassion scores as measured by the Self-Compassion Scale (SCS) at four-week follow-up. In a qualitative study on the benefits of yoga,

Gulden and Jennings (2016) reported themes of enhanced spiritual growth, mental and physical benefits, love, self-acceptance, and self-perceived safety in addition to reductions in trauma symptoms. Participants also reported improvements in their personal and inter-personal relationships. In another qualitative study on the benefits of yoga related to personal and interpersonal relations, Kishida and colleagues (2018) identified themes in establishing a sense of calm and peacefulness, cultivating mindfulness and kindness, and feeling a sense of connection and belonging. The authors suggested that yoga practice first lays a foundation of mindfulness and self-compassion that extends to interpersonal relationships (Kishida et al., 2018).

Cultivating self-compassion also appears to be an important mechanism in yoga's ability to enhance quality of life. Gard and colleagues (2012) examined the relationship between self-compassion, quality of life, and a yoga practice in participants who completed a four-month intensive yoga practice called The Kripalu Semester Intensive Program. This program consists of daily yoga practice (*asanas*, *pranayama*, and meditation) and course work (integrating yoga into daily life) for 3-5 hours each day for the four-month period. Participants reported significantly greater quality of life, mindfulness, and self-compassion scores as well as significantly reduced perceived stress. In a mediation analysis, the researchers noted that both quality of life and perceived stress were mediated by self-compassion. Quality of life was also mediated by trait mindfulness; however, self-compassion was found to be a better predictor (Gard et al., 2012). This study demonstrates that self-compassion may represent a mechanism for how yoga-based programs enhance quality of life and reduce stress.

Interestingly, self-compassion appears to be related to other constructs measured in the present study. First, self-compassion has been shown to be related to how people view their

body. Cox and colleagues (2019) used latent growth curve modeling to analyze how self-compassion, body surveillance (subscale of the Objectified Body Consciousness Scale), body appreciation (Body Appreciation Scale), and intrinsic motivation for physical activity (Intrinsic Motivation subscale on the Behavioural Regulation for Exercise Questionnaire 2) may change following a 16-week yoga program. Participants met twice each week for 75-minute yoga classes, with no specific curriculum or school of yoga identified. The authors reported a significant positive change in all measures except body surveillance over the 16-week period, where body surveillance showed a significant negative change (Cox et al., 2019). This result is applicable to the present study because yoga promotes paying attention to one's body in a kind and compassionate manner and could have implications for interoception.

Second, self-compassion and mindfulness also appear to be related. This has implications for understanding yoga's possible self-regulatory process as described by Gard and colleagues (2014). In a quasi-experimental single-group pre- and post-intervention study design, Erkin and Aykar (2020) analyzed differences in scores on the SCS following a 14-week yoga program for yoga novices. The yoga program consisted of 90-minute sessions once each week, which included physical postures, breath work, relaxation, and mindfulness meditation (Erkin & Aykar, 2020). The authors reported a statistically significant difference in the SCS total score and on all sub-scales as well as a positive correlation between a measure of attentional mindfulness on the MAAS and the SCS (Erkin & Aykar, 2020).

Together, these studies suggest that self-compassion is an important component of yoga and may be used in the future as an aspect of treatment for those experiencing stress (Riley & Park, 2015). A measure of self-compassion was used in the present studies due to extensive

evidence of its benefits, importance in a yoga practice, and relationship to other variables measured.

Spiritual Intelligence

Yoga is firmly embedded as India's spirituality and developed alongside the country's pre-history and history. Given these longstanding roots, its original, intended purpose, and that many practitioners engage in a yoga practice for its spiritual component, a measure of spiritual intelligence was included in Study 1.

King and DeCicco (2009) defined spiritual intelligence as the following:

> A set of mental capacities which contribute to the awareness, integration, and adaptive application of the nonmaterial and transcendent aspects of one's existence, leading to such outcomes as deep existential reflection, enhancement of meaning, recognition of a transcendent self, and mastery of spiritual states. (p. 3)

The authors note that they based their definition of spiritual intelligence on the concept of spirituality rather than religion (King & DeCicco, 2009). Spirituality is regarded as the pursuit of meaning and understanding existential questions about life whereas religion encompasses ritualistic practices and sets of beliefs that *may or may not* be consistent with spirituality (King & DeCicco, 2009). A second consideration that the authors note is that their view of spiritual intelligence is rooted in a cognitive focus to remain in line with theories of intelligence rather than a measure that analyzes behaviour (King & DeCicco, 2009).

Research on the concept of spiritual intelligence is debated and ongoing (Skrzypińska, 2021). Researchers are deciding on whether it should be considered an aspect of personality that contributes to intelligence, if another term (i.e., existential intelligence) should be used to replace

it, or if it should be considered at all as a construct to investigate (Skrzypińska, 2021). Science and psychology have a long history of ignoring spirituality in research studies; however, an argument could be made for its inclusion due to its prominence in the lives of many individuals across cultures and, in the context of yoga, for the reasons cited above.

There appear to be no experimental yoga studies to date that have included a measure of spiritual intelligence or indicated how spirituality may be beneficial in a yoga context. It is hoped that the data in this dissertation will serve as a catalyst for future studies in this area.

Attention

Attentional stability is the foundation of a yoga practice. In traditional yoga, attentional stability represents the ability to focus within, eliminating all stimuli in an effort to bridge the Self and body. Several studies have shown significant attentional benefits associated with practicing yoga. For example, Clark and colleagues (2015) found that movement training (such as yoga) engages attentional inhibition and selection on a desired movement goal, enhancing cognitive control and attentional selectivity. Multiple studies have reported that *pranayama*, alone or in combination with *asanas*, may improve sustained attentional capacity (Schmalzl et al., 2018; Vineetha et al., 2018). Finally, meditation has been associated with improved attention, including positive effects on sustained attention (Valentine & Sweet, 1999), attentional accuracy (Braboszcz et al., 2013), attentional regulation (Lutz et al., 2008), shifting attention (Prakash, 2010), and reduced distraction (Semple, 2010). These results suggest that a various components of a yoga practice improve several different elements of attention.

Given the number of attentional processes that have been influenced by yoga practice in previous studies, a challenge for researchers is to identify a task that can assess multiple

components of attention. Gothe and colleagues (2017) measured three aspects of attention (alerting, orienting, and executive attention) using the Attention Network Task (ANT) prior to and following the completion of an 8-week *Hatha* yoga intervention or a stretching-strengthening exercise program. Participants for this study were sedentary older adults, randomly assigned to one of the two conditions (Gothe et al., 2017). The yoga intervention consisted of a modern interpretation of *Hatha* yoga, using *asanas*, *pranayama*, and meditative exercises (Gothe et al., 2017). The authors reported significant improvements in reaction time on the ANT between groups, with medium to large effect sizes (Gothe et al., 2017). Due to its ability to measure several aspects of attention in a single paradigm, is the ANT was included in Study 2 of this dissertation.

Online Studies

It is important to note that both studies in this dissertation were held online during the COVID-19 pandemic. There is a growing body of literature examining the impact of teleyoga programs to examine whether they may be beneficial in a similar manner to studies where the intervention was held in-person. For example, Uebelacker and colleagues (2018) reported reductions in negative affect in people diagnosed with various mood disorders after completing online yoga classes. Furthermore, 67.9% of these participants rated that they were either somewhat or very likely to participant in teleyoga in the future (Uebelacker et al., 2018). In a subsequent study by Huberty and colleagues (2020), trauma, depression, and grief outcomes improved following a 12-week online yoga intervention in mothers who experienced stillbirth, with 70% of participants reporting satisfaction with this home-based program. In contrast, Schulz-Heik and colleagues (2017) reported no difference in satisfaction and outcome improvement for participants practicing teleyoga compared to those practicing in person.

Positive outcomes from teleyoga have also been reported in studies investigating outcomes related to physical disease (see Brosnan et al., 2021 for a review). In summary, it appears that this literature is promising and suggests that teleyoga interventions may be used to promote improvements in mental health outcomes. The results of Study 2 in this dissertation may add to this growing body of literature on the effects of teleyoga.

Summary

From these studies, we can see that depression, anxiety, stress, emotional regulation, mindfulness, interoceptive awareness, and self-compassion appear to not only be influenced by a yoga practice but also may be related constructs that contribute to the overall benefits seen from yoga. Spiritual intelligence is a newer concept that may be beneficial in a study of yoga, although little research is available on the topic. Mediation analyses will be helpful to elucidate the relationship between and among these constructs and to provide an understanding of how yoga works to produce benefits. Attention is also a consideration because it is foundational to practicing yoga. The two studies of my dissertation will be helpful in developing an understanding of the mechanism(s) of a yoga practice, the importance of *asanas* to different benefits, and the length of practice required to see such benefits. This information may assist clinicians in deciding how and when yoga may be used as an adjunct to treatment. It may also inform an individuals' decision on whether to pursue yoga as a personal practice.

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Chapter II: Study 1

A Cross-Sectional Analysis of Yoga Experience on Emotional and Cognitive Variables Associated with Psychological Well-Being

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Abstract

Previous research has identified numerous physical, psychological, and spiritual benefits associated with the practice of yoga. Indeed, yoga has been linked with improved quality of life, reduced stress, and numerous markers of psychological well-being. In the current research, a cross-sectional design was used to examine whether the psychological benefits associated with yoga only apply to long-term practitioners or whether more "casual," intermittent yoga practice could produce positive outcomes. An American population of long-term practitioners (n = 129), intermittent practitioners (n = 161), and non-practitioners (n = 164) completed online self-report measures of emotional regulation, trait mindfulness, self-compassion, interoceptive awareness, and spiritual intelligence variables. The results indicated that long-term practitioners scored higher than intermittent practitioners on measures of mindfulness, interoceptive awareness, self-compassion, and spiritual intelligence. Intermittent practitioners scored higher than non-practitioners on interoceptive awareness and spiritual intelligence. Contrary to our hypotheses, yoga practice had no effect on depression, anxiety, or stress levels. Mediation analyses revealed that interoceptive awareness, spiritual intelligence, mindfulness, and self-compassion mediated the relationship between yoga experience and emotion dysregulation for long-term and intermittent practitioners compared to those with no experience. Furthermore, emotion dysregulation mediated the relationship between yoga experience and depression, anxiety, and stress for the same comparisons. Taken together, the results of this study suggest that long-term practitioners experience more benefits compared to intermittent and non-practitioners, and that the mechanisms underlying these benefits are multi-faceted.

Keywords: Yoga; Emotional Regulation; Self-Compassion; Mindfulness; Interoception; Spiritual Intelligence

Yoga originated over 5000 years ago and has evolved into a popular activity that is practiced worldwide for a variety of physical, psychological, and spiritual purposes (Feuerstein, 2003; Pandurangi et al., 2017). For the purpose of this study, yoga is defined as a practice involving any combination of the following components or "limbs": physical postures (Sanskrit: *asanas*), breathing techniques (*pranayama*), meditation, and/or ethical living towards oneself and others. These limbs may be practiced independently or in a classroom format with a certified instructor. Although yoga was originally performed in order to achieve a state of self-realization representing one's greatest potential (Feuerstein, 2003), the primary focus of present-day Western yoga is on the numerous physical and emotional benefits that result from its practice (see Büssing et al., 2012, for a review). For example, yoga has been associated with improvements in self-reported quality of life (Birdee et al., 2017), well-being (Cartwright et al., 2020), and sleep quality (Sloan & Kanchibhotla, 2021). It has also been linked with more objective measures of physical health such as a lower waist/hip ratio and body mass index (see Lauche et al., 2016, for a review). Other research has demonstrated that yoga may enhance psychological well-being; yoga practitioners frequently score lower than non-practitioners on measures of perceived stress (Cartwright et al., 2020) and depression (Forseth et al., 2021; Sahni et al., 2021). However, although a rapidly expanding body of research has consistently highlighted the numerous potential benefits of yoga, few studies have included length of yoga practice as a variable of interest. As a result, it is unclear whether the benefits associated with yoga appear with intermittent practice (as would occur for "casual" practitioners) or if longer-term practice is required. The goal of the current research is to examine whether the length of yoga practice is related to multiple measures of psychological health.

A key component of yoga's long-term psychological benefits appears to be its positive effects on emotional regulation (Gothe et al., 2019). Evidence from neuroimaging studies points to the fact that long-term yoga practice can have neuroplastic effects in areas related to emotional experiences and their regulation (van Aalst et al., 2020). For example, researchers have reported that yoga experience is associated with greater grey matter volume in multiple cortical regions—including the prefrontal cortex—as well as the cerebellum (Afonso et al., 2017; Froeliger et al., 2012; Villemure et al., 2015). This increased cortical volume is similar to that observed in previous studies of mindfulness meditation (Lazar et al., 2005; Tang et al., 2010) and suggests that long-term yoga practice may enhance executive control processes (Gothe et al., 2019). These yoga-related changes in the prefrontal cortex are particularly beneficial to older practitioners; changes in cortical thickness were negatively correlated with scores on the Cognitive Failures Questionnaire (Froeliger et al., 2012). Another volumetric brain-imaging study found that the volume of the right amygdala and left hippocampus, were *smaller* in yoga practitioners (Gotnik et al., 2018). The fact that yoga decreases the volume of limbic structures related to emotional responses while also increasing the volume of brain areas involved with emotional regulation may explain the superior emotional regulation abilities reported in previous studies of yoga practitioners (e.g., Gothe et al., 2019).

Although both self-report and neuroimaging studies demonstrate the benefits of long-term yoga practice, there are still many questions that remain unanswered. For example, while yoga is associated with improvements in a number of negative emotional states, less is known about the interoceptive mechanisms that might mediate these effects. Additionally, it is currently unclear whether the benefits of yoga found in long-term practitioners would also be detected in individuals who take yoga classes in a less consistent manner (e.g., people who take yoga classes

for some parts of the year but then have periods of time without practicing yoga). Addressing the first question would provide new insights into the factors underlying yoga's benefits. Examining the second question would clarify whether the positive outcomes associated with yoga only apply to dedicated practitioners—or could be relevant to the more casual practitioner. It is important to note that we do not define dedicated practitioners as "experts" in this study. This study also aims to acknowledge traditional Eastern philosophy suggesting that humility and a beginner's mind (*shoshin*) are important in a yoga practice in order to obtain benefits, particularly those of a spiritual nature, as a practitioner.

The Current Study

The current study used a cross-sectional design to investigate whether different measures of emotional well-being and three potential mediating mechanisms differ between individuals with no yoga experience, those with intermittent experience, and long-term yoga practitioners. Emotional well-being was quantified by using questionnaires that measured depression, anxiety, stress, and emotion dysregulation (Gratz & Roemer, 2004; Lovibond & Lovibond, 1995). To assess potential mechanisms of these changes, participants also completed self-report measures associated with mindfulness (Baer et al., 2006), interoceptive awareness (Mehling et al., 2012), and self-compassion (Neff, 2003). These specific variables were included because they are relevant to key components of yoga: physical postures (*asanas*), breath regulation (*pranayama*), and meditation. Specifically, mindfulness and self-compassion relate to the meditative component of yoga whereas interoceptive awareness is related to the postural, breath regulation, and, sometimes, to the meditative elements of yoga.

A large body of research has shown that all three of these constructs have positive impacts on psychological health. Mindfulness has been shown to improve mood (Boni et al.,

2018; Falsafi, 2016) and reduce psychological distress (Harnett et al., 2016). Self-compassion has shown negative correlations with depression, anxiety, and perfectionism and positive correlations with life satisfaction and self-esteem (Neff, 2003). Interoceptive awareness has been implicated in reducing trauma symptoms (Emerson, 2015) and improving psychological well-being (Hanley et al., 2017).

A measure of spiritual intelligence (King, 2008) was also included for exploratory purposes because many individuals report a spiritual motivation for practicing yoga (Park et al., 2016). Spiritual intelligence refers to an individual's ability to consider existential elements of existence using reflection, development of personal meaning, transcendence, and various states of consciousness (King & DeCicco, 2009). Weber and Pargament (2014) suggest that while spirituality has the capacity to be damaging to psychological health, patients in clinical settings have also shown benefits of spirituality for mood, well-being, and quality of life. These studies suggest that in a yoga context, it is possible that the spirituality component may produce benefits.

The data acquired from these different measures will allow us to not only determine which factors are related to the length of a yoga practice, but also to determine how *the relationships between these factors* vary as a function of yoga experience. We hypothesized that higher scores on mindfulness, self-compassion, and interoceptive awareness measures in yoga practitioners (intermittent and long-term) would predict lower emotion dysregulation. We hypothesized that long-term practitioners would have higher scores on all measures compared to intermittent practitioners. Furthermore, we hypothesized that spiritual intelligence in the yoga practitioners would be associated with improved emotional regulation. With regards to mediation analyses, we expected that mindfulness, self-compassion, interoceptive awareness, and spiritual intelligence act as mediators underlying yoga's beneficial effects on emotional regulation. We

hypothesized that mindfulness and self-compassion would act concurrently as mediators in the relationship between yoga and emotional regulation due to the top-down nature of these processes. Finally, we hypothesized that emotional regulation would mediate the relationship between yoga and mood (depression, anxiety, and stress).

Methods

Participants

The sample size of this study was determined using G*Power for effect size = -.15, power = 0.80, and $\alpha = .05$ for three groups. An estimate of 432 was provided, although more data was collected in the event of inaccurate reporting. A total of 492 participants completed the current study. Participants were recruited through the Qualtrics Online Market Research Panel (Qualtrics, Inc., Provo, UT) between April and August 2021. Participants were at least 18 years of age and fell into one of three groups: individuals with no experience practicing yoga in their lifetime, individuals who practiced yoga intermittently, or individuals who engaged in a dedicated yoga practice. Participants were provided with these options in multiple-choice format. Intermittent yoga practice was defined as phases of consistent practice (at least 45 minutes, once each week for several months or years) mixed with phases (months or years) of little to no practice. The intermittent yoga group was included in this study because many individuals have *some* yoga experience, but tend to take occasional classes rather than incorporating yoga regularly into their lifestyle. Long-term practice was defined as individuals with a minimum of three years or more of regular yoga practice (at least 45 minutes, once each week). A total of 38 responses were removed due to incomplete or inaccurate reporting. Therefore, a total of 454 participants remained: ($n_{\text{no experience}} = 164$; $n_{\text{intermittent}} = 161$; $n_{\text{long-term}} = 129$). The demographic

characteristics of these participants are included in Table 1. Information regarding gender was missing for up to 35% of the participants in a given subgroup and were not considered further.

This study received ethics approval from the Human Research Ethics Board at the University of Manitoba (Fort Garry Campus). All participants provided informed consent prior to participating in this experiment.

Table 1

Participants' Yoga, Meditation, and Praying Experience (Mean (M) and Standard Deviation (SD))

	No Experience		Intermittent		Long-Term	
	M (SD)	Range	M (SD)	Range	M (SD)	Range
Age	44.5 (8.7)	20-81	46.9 (17.4)	18-75	48.0 (16.0)	19-87
Lifetime Yoga Experience (Years)	N/A	N/A	7.0 (8.7)	1-50	11.9 (9.9)	3-60
Past Year Yoga Experience (Hours)	N/A	N/A	49.1 (73.1)	0-400	237.8 (397.4)	40-3240
Lifetime Meditation Experience (Years)	3.1 (8.2)	0-50	7.0 (9.5)	0-50	10.8 (11.4)	0-50
Past Year Meditation Experience (Hours)	42.9 (247.9)	0-3000	57.1 (80.2)	0-400	145.6 (285.7)	0-3000
Lifetime Experience Praying (Years)	21.7 (19.1)	0-70	25.0 (22.0)	0-75	23.8 (22.6)	0-80

Table 2

Participant Demographic Information (Percentage)

		No Experience (%)	Intermittent (%)	Long-Term (%)
Education	Some High School	7.3	2.5	0.8
	High School Diploma	32.9	12.4	7.0
	Some college/university	24.4	28.6	18.6
	Diploma or degree	29.3	41.6	47.4
	Graduate degree	6.1	13.7	26.4
	Other	0.0	1.2	0.0
Ethnicity	White	82.9	83.2	85.3
	Black	7.3	7.5	7.0
	Latin American	3.0	3.7	2.3
	South Asian	0.0	0.6	2.3
	Filipino	1.2	0.0	0.8
	Indigenous	0.0	0.6	1.6
	Chinese	0.0	0.6	0.8
	Korean	0.6	0.6	0.0
	Japanese	0.6	0.6	0.0
	Arab/West Indian	0.6	0.0	0.0
	Southeast Asian	0.6	0.0	0.0
	Other	3.0	2.5	0.0
Religious/	Agnostic/Atheist/Secular	7.3	11.8	6.2
Spiritual	Buddhism	0.6	1.2	1.6
Affiliation	Christian	61.0	60.2	59.7
	Hinduism	0.0	0.6	3.1
	Indigenous	0.0	0.0	0.0
	Judaism	0.6	0.6	3.1
	Muslim	0.6	0.0	3.9
	Other	7.9	7.5	7.0
	None Indicated	22.0	18.0	15.5

Specific information was also collected from the intermittent and long-term yoga groups on their yoga practice. This information included which limb(s) participants practiced, with the possibility of selecting *asanas*, *pranayama*, meditation, ethical living (towards oneself and others), or any combination of these responses. Participants also indicated which schools of yoga they have practiced, with the opportunity to select any combination of the following: *Ashtanga*, Bikram, *Hatha*, Hot Yoga (non-Bikram style), Integral, Iyengar, *Kripalu*, *Kundalini*, Power,

Restorative, *Vinyasa*, Yin, Other, or Unsure. Lastly, information was collected on the format in which participants practiced. Participants selected if they engaged in formal practices (classes led by a certified Yoga instructor for an individual or a group in-person or live online), informal practices (non-video home practice, YouTube videos, or self-guided through books), or both. This information is presented in Table 3.

Table 3

Participant Yoga Experience (Percentage of Participants Practicing Each Limb, School, and Format)

		Intermittent (%)	Long-Term (%)
Limb*	*Asanas*	47.8	62.8
	Pranayama	55.3	63.6
	Meditation	70.8	71.3
	Ethical living	32.9	39.5
School of Yoga*	*Ashtanga*	5.0	16.3
	Bikram	7.5	16.3
	Hatha	9.3	20.2
	Hot (non-Bikram)	6.8	14.0
	Integral	3.1	14.7
	Iyengar	1.9	11.6
	Kripalu	0.0	7.8
	Kundalini	4.3	14.7
	Power	9.9	26.4
	Restorative	17.4	31.0
	Vinyasa	9.9	33.3
	Yin	4.3	18.6
	Other	5.6	6.2
	Unsure	56.5	14.0
Format of Practice	Formal	8.7	8.5
	Informal	63.4	28.7
	Both	28.0	62.8

Note. *Participants were provided the opportunity to select more than one response.

Procedure

After providing informed consent, participants provided demographic information and completed six questionnaires. The questionnaires were presented in random order. These included the Depression, Anxiety, and Stress Scale (DASS-42; Lovibond & Lovibond, 1995), Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006), Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012), Self-Compassion Scale (SCS; Neff, 2003), and The Spiritual Intelligence Self-Report Inventory (SISRI-24; King, 2008). In order to detect the possibility of fatigue, additional statements were added to each questionnaire at random intervals. An example of these statements includes, “Please select 3” or, “Please select 1”. No participants responded incorrectly to these statements.

Questionnaires

Depression, Anxiety, and Stress Scale (DASS-42)

The DASS-42 is a 42-item measure of state depression, anxiety, and stress (Lovibond & Lovibond, 1995). Participants indicate on a 4-point Likert scale the degree to which each statement applies over the past week, from 0 (*Did not apply to me at all*) to 3 (*Applied to me very much, or most of the time*). The 42 items consist of 14 statements each corresponding to a measure of depression (MacDonald’s $\omega = 0.97$), anxiety ($\omega = 0.95$), or stress ($\omega = 0.96$).

Difficulties in Emotional Regulation Scale (DERS)

The DERS is a 36-item self-report measure of emotional regulation (Gratz & Roemer, 2004). Participants indicate on a 5-point Likert scale (*1 = Almost Never (0-10%); 2 = Sometimes (11-35%); 3 = About Half the Time (36-65%); 4 = Most of the Time (66-90%); 5 = Almost*

Always (91-100%)) the degree to which each of the 36 statements apply to them. Higher scores indicate greater difficulties in emotional regulation. The DERS produces one overall score (ω = 0.96) which encompasses all items as well as scores for six sub-scales. The six constructs of the DERS include, with abbreviations in parentheses, Nonacceptance of Emotional Responses (*Non-Accept*; ω = 0.91), Difficulties Engaging in Goal-Directed Behaviour (*Goals*; ω = 0.88), Impulse Control Difficulties (*Impulse*; ω = 0.90), Lack of Emotional Awareness (*Awareness*; ω = 0.85), Limited Access to Emotion Regulation Strategies (*Strategies*; ω = 0.92), and Lack of Emotional Clarity (*Clarity*; ω = 0.79; Gratz & Roemer, 2004). Only the total scores were used in the present investigation.

Five Facet Mindfulness Questionnaire (FFMQ)

The FFMQ measures the tendency to exhibit mindfulness as a personality trait (also called dispositional or trait mindfulness; Baer et al., 2006). The FFMQ consists of 39 statements; participants rate each statement on a 5-point Likert scale, from *1 = never or very rarely true* to *5 = very often or always true*. The FFMQ produces an overall score of trait mindfulness (ω = 0.88) and scores for each of five facets; higher scores delineate greater trait mindfulness. The five facets consist of *Observing* (paying attention to both internal and external sensations; ω = 0.86), *Describing* (the ability to describe inner experiences; ω = 0.84), *Acting with Awareness* (mindful engagement in activities; abbreviated as *Acting*; ω = 0.90), *Non-Judgment of Inner Experiences* (treating one's internal experiences with openness and curiosity rather than with negative evaluations; abbreviated as *Non-Judging*; ω = 0.91), and *Non-Reacting to Inner Experience* (the ability to remain objective, separate, and calm while one experiences thoughts and emotions; abbreviated as *Non-Reacting*; ω = 0.84; Baer et al., 2006). For the current study, only the total mindfulness scores were utilized.

Multidimensional Assessment of Interoceptive Awareness (MAIA)

The MAIA consists of 32 items in an eight-factor model where individuals rank on a 6-point Likert scale the degree to which each statement applies (*0 = Never; 5 = Always*; Mehling et al., 2012). The MAIA is calculated using a total score (ω = 0.94), corresponding to greater body awareness, and eight sub-scale scores, corresponding to each construct. The eight subscales of the MAIA consist of *Noticing* (being aware of one's bodily sensations; ω = 0.83), *Not-Distracting* (not ignoring or avoiding uncomfortable sensations; ω = 0.63), *Not-Worrying* (not experiencing distress during unpleasant or painful sensations; ω = 0.64), *Attention Regulation* (paying attention to and controlling bodily sensations; ω = 0.91), *Emotional Awareness* (connecting bodily sensations with emotions; ω = 0.89), *Self-Regulation* (attending to body sensations in order to regulate distress; ω = 0.88), *Body Listening* (using information from the body to inform decisions; ω = 0.88), and *Trusting* (trusting the validity of one's bodily sensations; ω = 0.89; Mehling et al., 2012). Only the total interoceptive awareness scores were used in the present investigation.

Self-Compassion Scale (SCS)

The SCS is a 26-item self-report measure developed by Neff (2003). Individuals indicate on a five-point Likert scale from *1 (almost never) to 5 (almost always)* the degree to which each statement applies. The SCS is comprised of an overall score (ω = 0.91) indicating a general factor of self-compassion as well as six sub-scales. These subscales include *Self-Kindness* (being understanding and supportive to oneself; ω = = 0.87), *Self-Judgment* (a person's tendency to judge themselves for their limitations; ω = 0.89), *Common Humanity* (the ability to recognize that personal difficulties or inadequacies are aspects of life experienced by everyone; ω = 0.82), *Isolation* (the tendency to feel alone or isolated following a mistake or when experiencing

difficulties; ω = 0.86), *Mindfulness* (the ability to live in the present moment; ω = 0.84), and *Over-Identification* (the tendency to get "carried away" by negative elements of one's life; ω = 0.85). Self-Judgment, Isolation, and Over-identification are all reversed scored. Greater scores on the SCS indicate greater self-compassion (Neff, 2003). For the current study, only the overall SCS score was used.

Spiritual Intelligence Self-Report Inventory (SISRI-24)

The SISRI-24 is a 24-item questionnaire that provides a measure of spiritual intelligence (King, 2008). An overall score is calculated by adding all items in the questionnaire (ω = 0.95), following reverse scoring of one item. A higher score is indicative of greater spiritual intelligence. Four sub-scales (King & DeCicco, 2009) are included in this questionnaire, including *Critical Existential Thinking* (*CET*; the ability to reflect on existential topics such as meaning, purpose, and death; ω = 0.87), *Personal Meaning Production* (*PMP*; the capacity to generate a sense of meaning, control, and mastery of life; ω = 0.88), *Transcendental Awareness* (*TA*; perceiving transcendent aspects of the Self, others, and the world that contribute to a sense of interconnectedness; ω = 0.87), and *Conscious State Expression* (*CSE*; the capacity to freely travel to and from other states of consciousness; ω = 0.93). Higher scores on these sub-scales indicates greater capacity to engage in these aspects that contribute to spiritual intelligence (King, 2008). Only the total scores were used in the present investigation.

Data Analysis

All analyses were performed using IBM SPSS Statistics 28.0 Software. One-way ANOVAs were performed for all analyses. Assumptions were tested for normality (Shapiro-Wilk test, $p > .05$), homogeneity of variances (Levene's test, $p > .05$), and outliers (inspection of

boxplots). Data demonstrating a combination of non-normal distributions and outliers were transformed. If outliers were present, data was left due to the strong likelihood that it represented genuinely unusual values. If variances were heterogeneous, results of a Welch ANOVA were reported instead. The Tukey-Kramer post-hoc test was used for most ANOVAs because it allows for unequal sample sizes. If the assumption of homogeneity of variances was violated (Levene's test, $p < .05$), the Games-Howell post-hoc test was interpreted instead.

Results

Demographic Variables

A One-Way ANOVA showed that there was no statistically significant difference among groups with regards to age ($F(2, 451) = 2.43$, $p = .09$) or number of years praying ($F(2, 451) = 1.03$; $p = .36$). Meditation experience differed among the groups in terms of hours in the past year ($F(2, 451) = 9.00$; $p < .001$) and years in their lifetime ($F(2, 451) = 22.24$; $p < .001$). Post-hoc analysis using the Tukey-Kramer test demonstrated that the long-term group reported more years ($p < .001$) and hours in the past year meditating ($p = .004$) compared to the no experience group. Long-term practitioners also reported more years meditating ($p = .008$) and hours meditating in the past year ($p = .002$) compared to the intermittent group. The intermittent group demonstrated significantly more meditation experience than the no experience group in years ($p < .001$); however, hours meditating in the past year did not differ between the two groups ($p = .77$). As expected, using Independent Samples *t*-Test, yoga experience differed, with the long-term group reporting more hours in the past year ($t(135) = -5.32$; $p < .001$) and years in their lifetime ($t(188) = -4.55$; $p < .001$) compared to the intermittent group.

Because age and years of prayer were not significantly different among groups, no covariates were used in all subsequent analyses. Meditation history was not used as a covariate due to meditation being a significant part of most yoga practices (Feuerstein, 2003; 2008).

Total Score Profiles

A summary of the scores of all scales are included in Table 4 below. One-way ANOVAs were conducted for the total score of each measure to identify differences among the three groups. The Tukey-Kramer test was used to identify differences among groups if the ANOVA was significant. A correction was used to account for multiple comparisons. Because three groups were compared, an adjusted *p*-value of .05/3 was used as the cut-off.

The results for the DASS-42 did not indicate any differences among groups. Depression, Anxiety, and Stress scores from the DASS-42 were not significant (all *F*-values < 1). We analyzed the proportion of DASS-42 scores that fell in a clinically significant range (moderate, severe, or extremely severe; Table 2). There was a trend for the long-term depression, anxiety, and stress scores to have fewer proportions of clinically significant scores compared to the intermittent and no experience groups. The intermittent group had a trend for a lower proportion of scores in the clinically significant range for depression. This trend was not seen when comparing the intermittent and no experience groups for anxiety and stress. These scores were compared using a chi-square test. No scores were significant ($\chi^2 < 1.20$; $p < .05$), indicating that there were no differences in the proportions of scores in the clinically significant range among the groups.

Table 4

Summary of Scores (Mean (M) and Median)

	No Experience		Intermittent		Long-Term	
	M (SE)	Median	M (SE)	Median	M (SE)	Median
Depression (DASS-42)	12.2 (0.9)	9.0	12.0 (1.0)	7.0	10.6 (1.0)	6.0
Anxiety (DASS-42)	9.7 (0.7)	6.0	10.8 (0.8)	8.0	10.3 (0.9)	6.0
Stress (DASS-42)	12.6 (0.8)	10.5	13.9 (0.9)	11.0	12.1 (1.0)	8.0
DERS	91.2 (2.1)	91.0	85.2 (2.2)	82.0	78.8 (2.5)	71.0
FFMQ	121.2 (1.5)	118.0	127.6 (1.7)	125.0	137.3 (2.1)	137.0
SCS	3.0 (0.06)	3.0	3.1 (0.06)	3.1	3.4	3.2
MAIA	2.7 (0.06)	2.8	3.1 (0.7)	3.0	3.4 (0.06)	3.4
SISRI-24	46.6 (1.6)	46.0	55.5 (1.3)	56.0	63.5 (1.7)	65.0

The one-way ANOVA results were significant for the remaining five questionnaires; however, planned comparisons indicated that not all groups differed from one another. For the DERS, the overall ANOVA was significant: $F(2,451) = 7.24$, $p < 0.001$, $\eta_p^2 = 0.31$). As expected, the long-term experience group had lower scores compared to the no experience group on this measure ($p < .001$). However, there were no significant differences on the DERS between the long-term and intermittent groups or between the intermittent and no experience groups (see Figure 1).

The one-way ANOVAs for the FFMQ ($F(2,451) = 20.88$, $p < 0.001$, $\eta_p^2 = 0.085$) and the SCS ($F(2,451) = 12.95$, $p < 0.001$, $\eta_p^2 = 0.054$) were both significant (see Figure 2a and 2b, respectively). For both of these measures, the long-term group had higher scores than the no experience ($p < .001$) and the intermittent experience ($p < .006$) groups. However, no significant difference was found between the intermittent and no experience groups on either the FFMQ or the SCS, although there was a trend for significance for the FFMQ ($p = .019$).

In contrast, all groups differed from one another on the MAIA and the SISRI. The one-way ANOVAs for the MAIA ($F(2,451) = 34.09$, $p < 0.001$, $\eta_p^2 = 0.13$) and the SISRI ($F(2,451) = 28.95$, $p < 0.001$, $\eta_p^2 = 0.11$) were significant (see Figure 3a and 3b, respectively). For both of these measures, the long-term group had higher scores than the no experience group ($p < .001$) and the intermittent experience group ($p < .006$), and the intermittent group had greater scores compared to the no experience group ($p < .001$).

Table 5

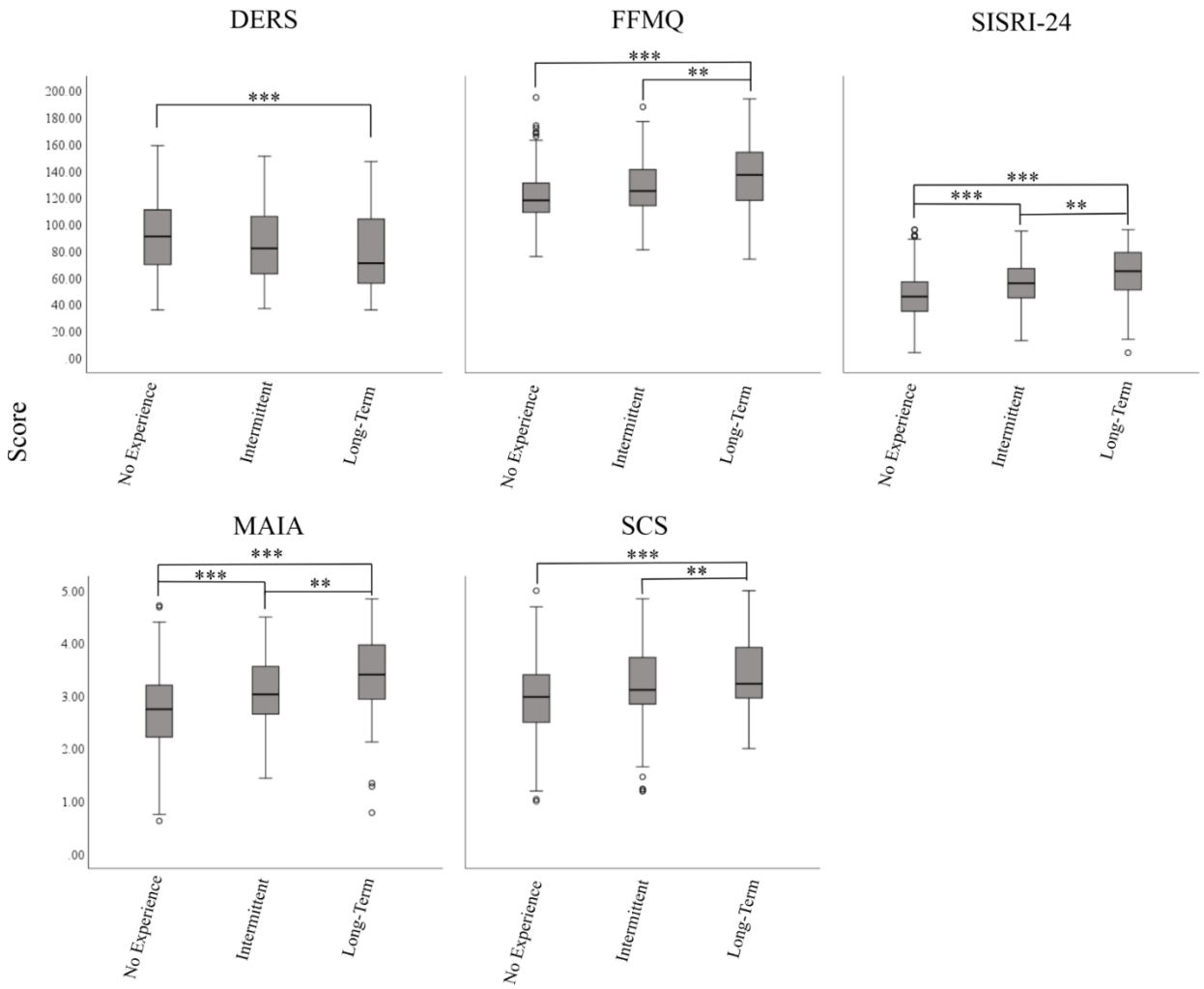
DASS-42 Results and Clinical Interpretation

	Depression			Anxiety			Stress		
	M	SD	% CS	M	SD	%CS	M	SD	%CS
No Experience	12.2	11.8	40.2	9.7	9.3	43.3	12.6	9.9	29.3
Intermittent	12.0	12.4	36.6	10.8	10.1	43.5	13.9	11.0	29.2
Long-Term	10.6	11.7	34.1	10.3	10.5	41.9	12.1	11.5	26.4

**Note*. %CS = percentage of scores in the clinically significant range (moderate, severe, or extremely severe). Depression scores in this range are from 14-42. Anxiety scores in this range are 10-42. Stress scores in this range are 19-42.

Figure 1

ANOVA Summary



Note. Margin bars represent ±5% of the mean score.

($p < .01$). *($p < .001$).

Mediation Analyses

Mediation analyses were performed using PROCESS v3.5 in SPSS. The long-term and intermittent groups were compared to the no experience group only. The no experience group was coded as “0” and the long-term and intermittent groups were coded as “1”. These

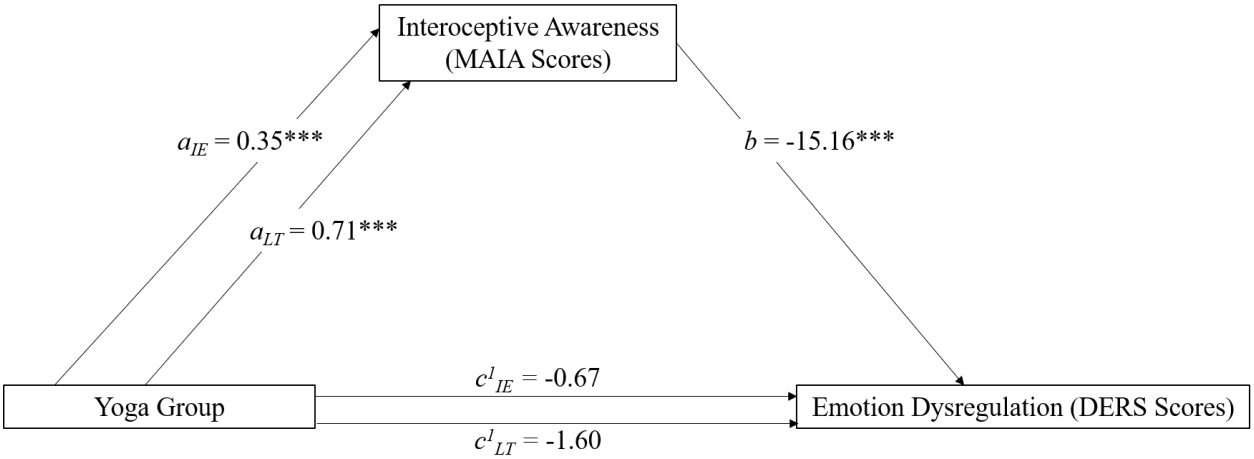
comparisons were used to understand whether the mechanisms of yoga's benefits are the same for both long-term and intermittent practitioners.

More broadly, mediation was used to investigate what aspects of a yoga practice (trait mindfulness, interoception, self-compassion) contribute to health benefits (reducing emotion dysregulation). Five mediation models were tested, each representing separate hypotheses. Yoga group represented the predictor variable for each model, whereas the mediators and outcomes varied. Yoga group was dummy coded in PROCESS to account for the categorical nature of this variable. Comparisons were between the no experience group and the intermittent group, and between the no experience and the long-term group. These comparisons are delineated with separate paths and coefficients (IE representing the intermittent experience group and LT representing the long-term practitioner group).

The first model tested our hypothesis that interoceptive awareness (MAIA total score) would mediate the relationship between yoga practice (group) and emotion dysregulation (DERS total score). That is, the relationship between yoga practice (intermittent and long-term) and emotion dysregulation would show lesser or no significance when introducing interoceptive awareness as a variable that explains this relationship. Model 4 in PROCESS was used. Models for both the intermittent (Indirect effect = -0.19; SE = 0.047; 95% CI[-0.29, -0.11]) and long-term (Indirect effect = -0.38; SE = 0.064; 95% CI[-0.52, -0.26]) groups were significant (Figure 4).

Figure 2

Mediation Model Featuring Yoga Practice (Predictor), Emotion Dysregulation (Outcome), and Interoceptive Awareness (Mediator)



Note. Variables with subscript IE represents a comparison between the no experience and intermittent experience (IE) group. Subscript LT represents a comparison between the no experience and the long-term (LT) group. This model demonstrates that the relationship between intermittent and long-term yoga practice and emotion dysregulation is mediated by interoceptive awareness.

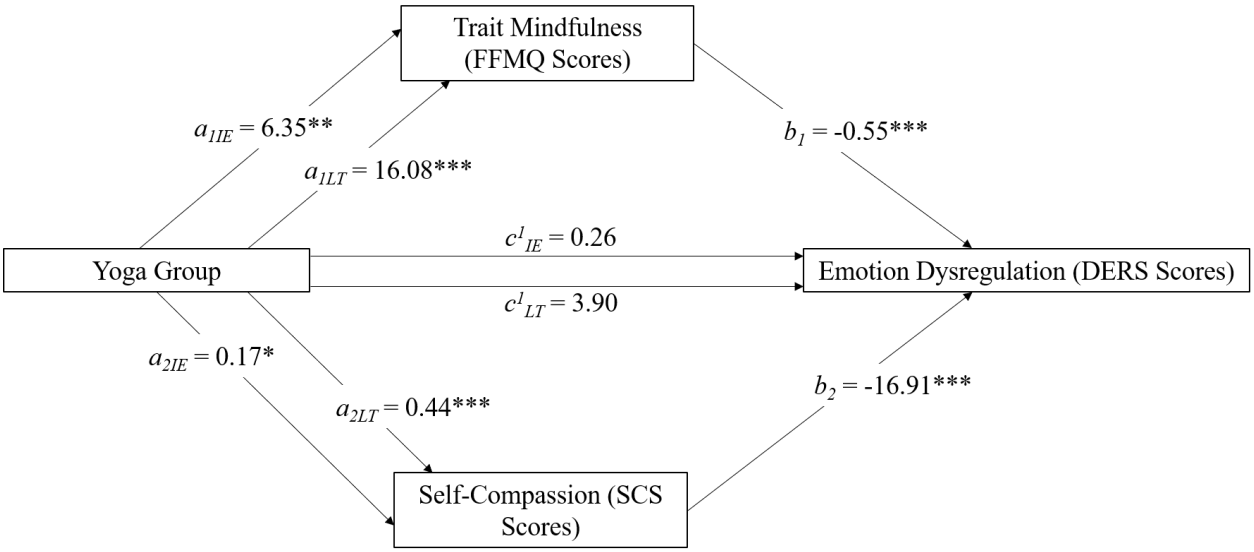
***$p < .001$.

Our second hypothesis was that self-compassion (SCS total score) and trait mindfulness (FFMQ total score) would *concurrently* mediate the relationship between yoga experience (group) and emotion dysregulation (DERS). Model four in PROCESS was used. Comparisons between the no experience and intermittent group (FFMQ Indirect effect = -3.49; SE = 1.28; 95% CI[-6.07, -1.00]; SCS Indirect effect = -0.12; SE = 0.046; 95% CI[-0.36, 0.22]) and the no

experience with the long-term group (FFMQ Indirect effect = -8.83; SE = 1.60; 95% CI[-12.09, -5.83]; SCS Indirect effect = -0.31; SE = 0.06; 95% CI[-0.43, -0.21]) were significant (Figure 5).

Figure 3

Mediation Model Featuring Yoga Practice (Predictor), Emotion Dysregulation (Outcome), and Two Mediators (Self-Compassion and Trait Mindfulness)



Note. Variables with subscript IE represents a comparison between the no experience and intermittent experience (IE) group. Subscript LT represents a comparison between the no experience and the long-term (LT) group. This model demonstrates that the relationship between intermittent and long-term yoga practice and emotion dysregulation is mediated by trait mindfulness and self-compassion.

*($p < .05$). **($p < .01$). ***($p < .001$).

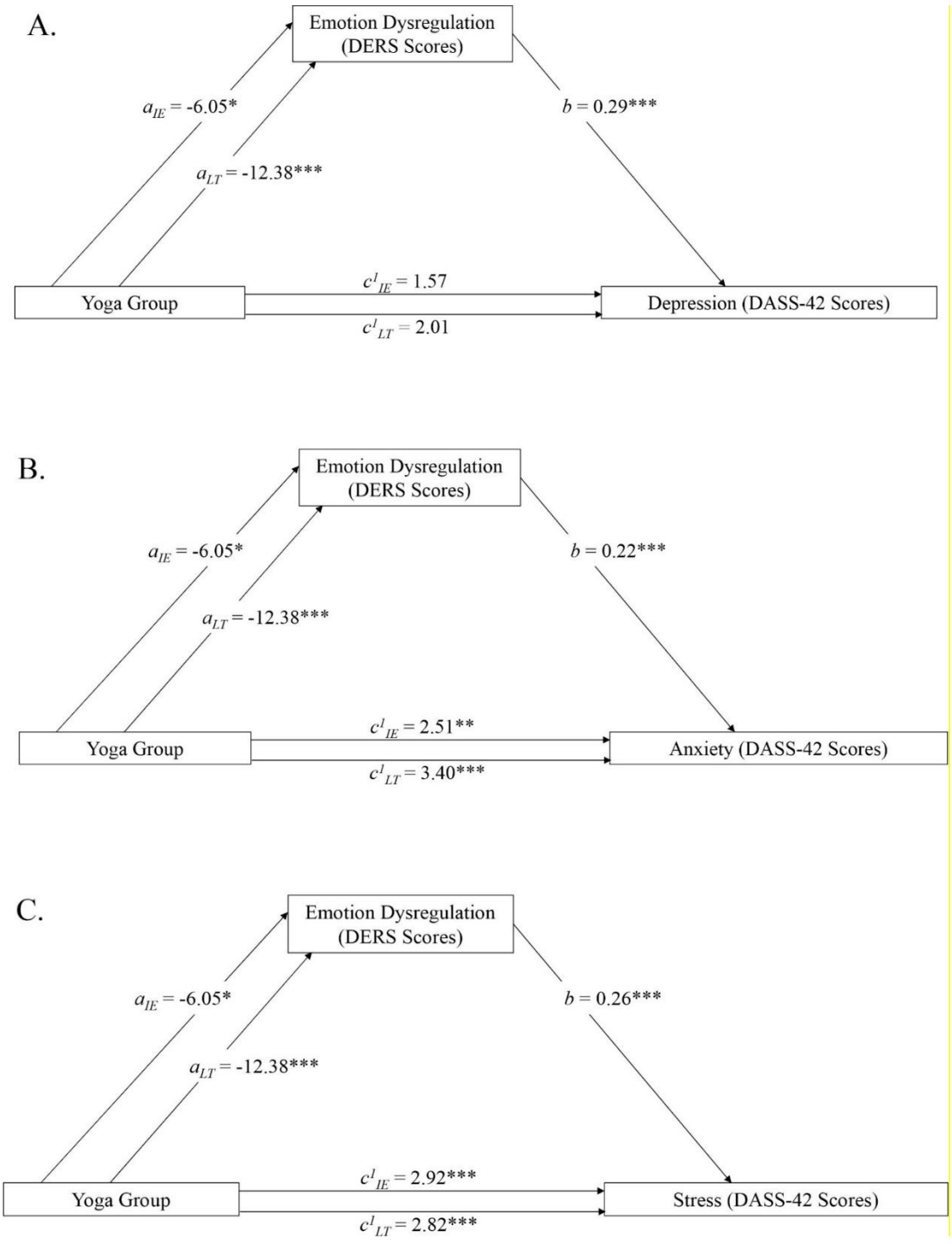
The remaining three hypotheses were that emotion dysregulation (DERS total score) would mediate the relationship between yoga experience and depression, anxiety, and stress. All models were significant (Figure 4). The model for depression was significant for both the

intermittent (Indirect effect = -1.74; SE = 0.87; 95% CI = [-3.41, -0.37]) and long-term (Indirect effect = -3.57; SE = 0.97; 95% CI = [-5.48, -1.64]) groups. The model for anxiety was significant for both the intermittent (Indirect effect = -1.36; SE = 0.68; 95% CI = [-2.68, -0.17]) and long-term (Indirect effect = -2.78; SE = 0.75; 95% CI = -4.26, -1.30]) groups. The model for stress was significant for the intermittent (Indirect effect = -1.59; SE = 0.79; 95% CI = [-3.14, -0.48]) and long-term (Indirect effect = -3.24; SE = 0.87; 95% CI = [-5.02, -1.59]) groups.

Exploratory mediation analyses were also conducted. The initial analyses used model four in PROCESS. First, we tested the hypothesis that interoceptive awareness (MAIA) would mediate the relationship between yoga experience and spiritual intelligence (SISRI). This relationship was significant for both the intermittent (Indirect effect = 0.22; SE = 0.052 95% CI[0.12, 0.32]) and long-term (Indirect effect = 0.42; SE = 0.065; 95% CI[0.29, 0.55]) groups. This initial analysis was a precursor to the following analyses. Because interoceptive awareness mediated the relationship between yoga experience and both spiritual intelligence and emotion dysregulation, we conducted a second analysis to see if spiritual intelligence would mediate the relationship between yoga experience and emotion dysregulation. This mediation model was also significant for the intermittent (Indirect effect = -1.82; SE = 0.77; 95% CI = [-3.48, -0.45]) and long-term (Indirect effect = -3.43; SE = 1.35; 95% CI[-6.31, -0.93]) groups (Figure 6). These analyses demonstrate that the pathways for yoga producing benefits are the same for long-term and intermittent practitioners with interoceptive awareness, mindfulness, self-compassion, and spiritual intelligence being important mediators for emotion dysregulation. A summary of the mediation analyses is provided in Table 6.

Figure 4

Mediation Model Featuring Yoga Practice (Predictor), Emotion Dysregulation (Mediator), and Depression, Anxiety, and Stress (Outcomes)

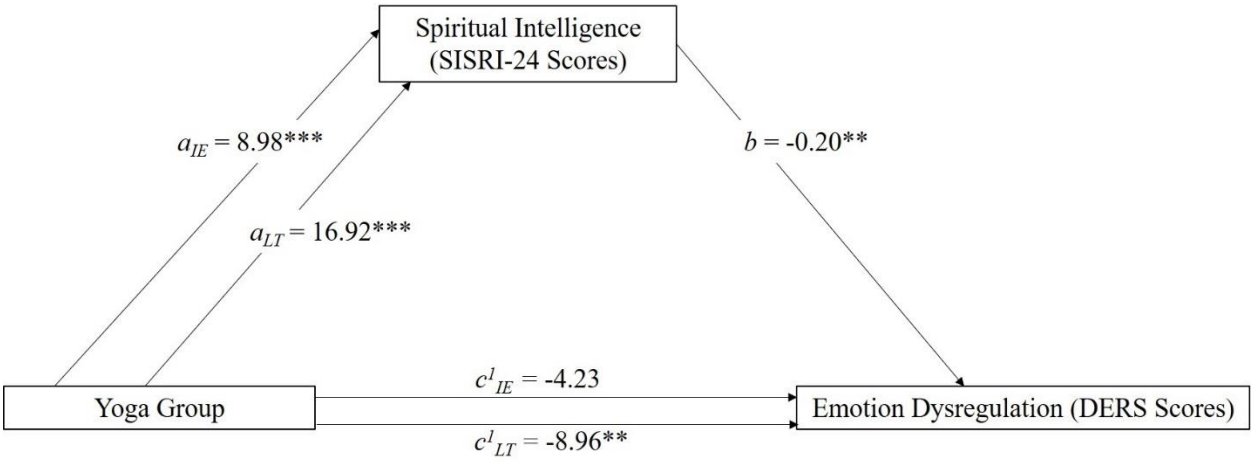


Note. Variables with subscript IE represents a comparison between the no experience and intermittent experience (IE) group. Subscript LT represents a comparison between the no experience and the long-term (LT) group.

*($p < .05$). ***($p < .001$)

Figure 5

Mediation Model Featuring Yoga Practice (Predictor), Emotion Dysregulation (Outcome), and Spiritual Intelligence (Mediator)



Note. Variables with subscript IE represents a comparison between the no experience and intermittent experience (IE) group. Subscript LT represents a comparison between the no experience and the long-term (LT) group.

** ($p < .01$). ***($p < .001$).

Table 6

Mediation Analysis Summary

		Total Effect	Direct Effect	*p*-value	Indirect Effect	95% CI
Analysis 1	Intermittent	-6.1	-0.7	.05	-0.2	-0.3, -0.1
	Long-Term	-12.4	-1.6	.0002	-0.4	-0.5, -0.3
Analysis 2	Intermittent	-6.1	0.3	.9	-3.5 (FFMQ)	-6.1, -1.2 (FFMQ)
					-2.8 (SCS)	-12.2, -5.8 (SCS)
	Long-Term	-12.4	3.9	.05	-2.9 (FFMQ)	-5.7, -0.04 (FFMQ)
					-7.4 (SCS)	-10.5, -4.5 (SCS)
Analysis 3	Intermittent	-0.2	1.6	.1	-1.7	-3.4, -0.4
	Long-Term	-1.6	2.0	.06	-3.6	-5.5, -1.6
Analysis 4	Intermittent	1.2	2.5	.004	-1.4	-2.7, -0.2
	Long-Term	0.6	3.4	.0003	-2.8	-4.3, -1.3
Analysis 5	Intermittent	1.3	2.9	.001	-1.6	-3.1, -0.5
	Long-Term	-0.4	2.8	.003	3.2	-5.0, -1.6
Analysis 6	Intermittent	9.0	3.1	.06	5.9	3.1, 8.7
	Long-Term	16.9	5.2	.005	11.7	8.2, 15.3
Analysis 7	Intermittent	-6.1	-4.2	.2	-1.8	-3.5, -0.5
	Long-Term	-12.4	-9.0	.009	-3.4	-6.4, -1.0
Analysis 8	Intermittent	-6.1	-1.6	.6	1.7	0.6, 3.1
	Long-Term	-12.4	-3.1	.3	3.3	1.4, 5.8
Analysis 9	Intermittent	-6.1	-1.6	.6	-4.4	-6.7, -2.4
	Long-Term	-12.4	-3.1	.3	-8.3	-11.4, -5.6

Note. Analysis 1 consisted of the MAIA (mediator) and DERS (outcome). Analysis 2 consisted of the SCS and FFMQ (concurrent mediators) and DERS (outcome). Analysis 3 consisted of the DERS (mediator) and DASS-42 Depression scale (outcome). Analysis 4 consisted of the DERS (mediator) and DASS-42 Anxiety scale (outcome). Analysis 5 consisted of the DERS (mediator)

and DASS-42 Stress scale (outcome). Analysis 6 consisted of the MAIA (mediator) and SISRI-24 (outcome). Analysis 7 consisted of the SISRI-24 (mediator) and DERS (outcome). Analysis 8 consisted of the MAIA and SISRI-24 (sequential mediators) and DERS (outcome. Analysis 9 consisted of the SISRI-24 and MAIA (sequential mediators) and DERS (outcome).

Discussion

The current study demonstrates that long-term yoga practice is associated with a number of positive outcomes. Relative to non-practitioners, long-term practitioners showed higher levels of self-reported trait mindfulness, interoceptive awareness, self-compassion, emotional regulation abilities, and spiritual intelligence. The diversity of these benefits is noteworthy and suggests that yoga *may* enhance not only body awareness, but also some executive functions (e.g., mindful attention, emotional regulation). Importantly, many of these benefits were not limited to long-term practitioners of yoga—intermittent practitioners also showed higher levels of interoceptive awareness and spiritual intelligence compared to non-practitioners. These results suggest that even inconsistent yoga practice can lead to positive outcomes. It is important to note, however, that the design of the current study does not allow us to make claims about causality; the presence or absence of yoga was not manipulated in an experimental design. It is possible that our results indicate which cluster of personality traits increase the likelihood that someone will consistently practice yoga rather than reflecting the benefits of having practiced yoga. Therefore, for the subsequent discussion of these data, we will focus on traits *associated with* yoga practice. Any discussion of causality will be identified as being speculative.

A key result of the current study related to emotion dysregulation; long-term practitioners had lower scores on the DERS than the intermittent and non-practitioner groups. Our findings are consistent with previous research that reported improvements in emotional regulation following two weeks of yoga-based meditation (Patel et al., 2018), short-term yoga interventions for adolescents (Daly et al., 2015; McMahon et al., 2021), six weeks of yoga for incarcerated individuals (Willy-Gravley et al., 2021), and a minimum of one year of yoga practice (Kobylińska et al., 2018). Given that many of these earlier studies involved improvements arising from yoga training, it is likely that the group differences observed in the current research represent a benefit associated with long-term yoga practice. Importantly, the benefits to emotional regulation do not appear to be due to physical activity alone (Daly et al., 2015). One possible mechanism of emotional regulation through yoga practice is cognitive reappraisal (Kobylińska et al., 2018; Menezes et al., 2015). Menezes and colleagues (2015) suggested that yoga teaches attention allocation and acceptance, antidotes to rumination and impulsive reactivity that may contribute to cognitive reappraisal. Future studies could address this possibility by specifically examining cognitive reappraisal—along with other emotional regulation strategies (see McRae & Gross, 2020, for a review)—before and after a yoga training program.

Long-term practitioners also differed from the intermittent and non-practitioner groups on a measure of trait mindfulness. These data are consistent with earlier research showing that the number of months participants practiced yoga positively correlated with FFMQ scores (Snaith et al., 2018). Importantly, our data are also consistent with experimental studies in which participants were measured before and after yoga training. For example, Erkin and Aykar (2020) reported greater scores on the FFMQ in nursing students following 14 weeks of yoga practice.

Another study reported improved mindful attention as measured by the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) following two weeks of daily yoga-based meditation practice (Patel et al., 2018). Taken together, the current study, along with these previous investigations, suggests that yoga practice can enhance trait mindfulness.

The results of our measure of interoceptive awareness were particularly interesting given the key role that bodily awareness plays in most forms of yoga. In our study, long-term practitioners reported higher interoceptive awareness (as shown by scores on the MAIA) than the intermittent and non-practitioner groups. Intermittent practitioners also reported higher interoceptive awareness scores compared to non-practitioners, suggesting that even inconsistent yoga practice may improve awareness of internal bodily sensations. This beneficial effect of yoga is consistent with the results of previous studies using clinical populations. For example, the combination of breath work, mindfulness, and mindful movement contributed to greater MAIA scores in war veterans diagnosed with Post-Traumatic Stress Disorder (PTSD; Mehling et al., 2017). Mindful meditation also contributed to greater MAIA scores and lower scores on the Dissociative Experiences Scale 2 in graduate and undergraduate students (D'Antoni et al., 2021). Future research could investigate the relationships between specific elements of yoga (e.g., breathing or postures) on specific subcomponents of interoceptive awareness. These studies could also examine whether yoga practice influences interoception on objective measures such as heartbeat detection rather than self-report measures such as the MAIA.

Similar to interoceptive awareness, self-compassion scores were higher in the long-term practitioner group, but also significantly higher in the intermittent group than in the non-practitioner participants. These results are consistent with other studies incorporating self-compassion as a construct, including a study of the effects of a three-day residential yoga

program on professional educators (Dyer et al., 2020), an examination of the effects of a two-week yoga-based meditation program (Patel et al., 2018), a study of nursing students following 14 weeks of yoga practice (Erkin & Aykar, 2020), and an examination of regular yoga practitioners (Snaith et al., 2018). Together, these studies suggest that self-compassion scores may improve with either short- or long-term practicing of yoga. The results of the current study are consistent with this conclusion.

Spiritual intelligence also produced this "graded" pattern of benefits. As with interoceptive awareness and self-compassion, long-term practitioners had greater spiritual intelligence scores on the SISRI-24 compared to intermittent and non-practitioners, and the intermittent practitioners reported greater spiritual intelligence compared to non-practitioners. Few yoga studies have incorporated a quantitative measure of spirituality and compared it to psychological functioning, although there is evidence that spirituality is an important construct for yoga practitioners (Cartwright et al., 2020). The challenge for researchers is to identify the cognitive and emotional components associated with spirituality that may be influenced by yoga practice. Kelly and Moritz (2009) reported that individuals who received lectures and stories on topics of spirituality described feeling a greater sense of connection with themselves, others, and the world while also showing improved self-compassion and mood. Other researchers have suggested an important role for spiritual teachings in emotion reappraisal strategies (Menezes et al., 2015). It is possible that yogic spirituality helps enhance self-compassion, improve one's mood, and develop emotional regulation strategies that assist with a practitioner's motivation. Additional research is necessary to investigate these possibilities.

A somewhat surprising result from the current study was that the three groups did not differ on measures of depression, anxiety, or stress. This study took place during the COVID-19

pandemic and it is possible that participants exhibited elevated depression, anxiety, and stress levels. However, other studies have reported no significant differences in these, and similar, constructs prior to the pandemic (Kiecolt-Glaser et al., 2010; Papp et al, 2019; Vollbehr et al., 2018). These results stand in contrast with those that showed decreased depression and anxiety scores in individuals who practice yoga (e.g., Khalsa et al., 2009; Snaith et al., 2018; Telles et al., 2015). Additionally, in a review of 12 clinical trials, Cramer and colleagues (2013) concluded that yoga may be considered as an adjunct treatment for depression. It is unclear what accounts for these differences across studies, although a variety of measures may be factors such as difference in scales, research methodology, or differences in participant demographics. A longitudinal study that includes measures of depression, anxiety, and stress may be useful in delineating the potential protective effects of yoga practice on mental health.

The current study is one of few to investigate a mechanistic model of yoga using mediation analyses (see Boni et al., 2018). These mediation models highlight two main findings. First, they demonstrate that yoga plays a role in reducing emotion dysregulation through two separate paths - a bodily (interoceptive awareness) and spiritual (spiritual intelligence) path. This notion is intriguing, because it suggests an important role for both interoceptive awareness and spiritual intelligence in improving emotional regulation through the practice of yoga for both long-term and intermittent practitioners. This is a unique finding in the literature and warrants further attention from researchers. One possible explanation is that practicing yoga improves interoceptive awareness due to its bodily focus (Emerson, 2015). Practicing yoga may enhance a sense of connection with the Self, others, and the world, contributing to a sense of spirituality (Feuerstein, 2008) and seeing life as more connected and greater than the Self alone (McGonigal, 2019). McGonigal (2019) describes the importance of synchronous movement in generating a

transcendent state in which people feel connected to others and something greater than themselves. She explained that collective movement helps people combat loneliness, reduce pain, and enhance trust, belonging, and cooperation (McGonigal, 2019). Yoga classes that incorporate collective movement are thus likely to contribute to the aspect of spirituality related to a sense of connection with others and, possibly, the Self.

Traditional yoga philosophy supports these models. In yoga philosophy, one achieves enlightenment through penetration of the *koshas*, five sheaths that surround the Self (Feuerstein, 2008). As an individual penetrates each sheath, from the outermost to the innermost, they may eventually reach the Self and thus achieve a state of enlightenment (Feuerstein, 2008). Thus, our spiritual mediation model may be consistent with this traditional yoga philosophy if we interpret that penetrating the *koshas* enhances spirituality and could lead to improved emotional well-being. We may also interpret this traditional philosophy in another context, where penetrating each sheath is a spiritual practice in and of itself. These mediation models suggest a prominent role for traditional yoga philosophy in the interpretation of spiritual findings.

An additional noteworthy result was that yoga may operate through a cognitive path using trait mindfulness and self-compassion for both long-term and intermittent practitioners. This study suggests that trait mindfulness and self-compassion concurrently mediate the relationship between yoga experience and emotion dysregulation. In the absence of these mediators, the relationship between yoga experience and emotion dysregulation was significant, although when these mediators were added to the model, yoga experience became non-significant. This suggests that part of yoga's mechanism for improving emotion dysregulation may be through the incorporation of mindfulness and self-compassion. Consistent with this hypothesis, Wisener and Khoury (2022) reported that trait mindfulness and self-compassion

mediated the relationship between emotional regulation and eating as a coping strategy. Additionally, Per and colleagues (2021) demonstrated that the relationship between emotional regulation and non-suicidal self-injury was mediated by mindfulness and self-coldness (the opposite of self-compassion). When taken together with the first finding, these results highlight the potential importance of physical, mental, and spiritual influences for improving emotional regulation.

An interesting finding from our mediation analyses suggests that emotion dysregulation influenced mood. Emotion dysregulation mediated the relationship between yoga experience and depression, anxiety, or stress for both long-term and intermittent practitioners. This finding is consistent with clinical theoretical orientations that emphasize emotional regulation skills (i.e., Dialectical Behaviour Therapy; Linehan, 2014) and emotional processing (i.e., Emotion-Focused Therapy; Greenberg, 2017) for improving mental health. Our finding is also consistent with other studies. Behrouian and colleagues (2020) found that emotional regulation training in caregivers reduced DASS-21 scores at one-month follow-up. Patients receiving treatment intervention demonstrated reduced depression and anxiety scores, with emotional regulation as a predicting factor (Khakpoor et al., 2019). Emotional regulation was found to be a mediator between scores on the Adverse Childhood Experiences Scale (ACE) and depression (Cloitre et al., 2019). This finding appears to be robust clinically and in research, suggesting an important role for emotional regulation in influencing mood in a yoga context.

Limitations

The current study has several limitations that must be addressed in future research. First, the cross-sectional design limits the conclusions that can be made from the findings, specifically with regard to causality. For instance, it is possible that individuals with higher adaptive

psychological functioning might be more inclined to engage in a yoga practice. There is also a possibility that certain personality features may predispose an individual to practice yoga, and the findings here are more indicative of personality traits than yoga. A similar impact may also be found due to sampling from a market research panel. The use of an RCT experimental design would help address this issue in future research. Second, the solely American sample impedes cross-cultural comparisons; this limitation is important because yoga can serve different functions not only for individuals, but also in different cultures (Feuerstein, 2008). Future research should investigate whether practitioners' intentions and culture of practice influence the magnitude of yoga's benefits. Third, because the data were conducted in an online survey, participants did not undergo clinical screening for mental health or medical conditions. Fourth, our study did not investigate whether individuals experiencing psychological distress (or a diagnosed mental health disorder) would be more or less likely to engage in a yoga practice. This possibility could be addressed in future research by including additional questions about practitioners' motivations for practicing yoga. Fifth, most participants in this study were female, which precludes understanding if these findings are generalizable to other genders. Sixth, the no experience group had experience with meditation. Because meditation is considered an aspect of yoga practice, it is possible that this impacted our findings. Finally, the division of participants into categories (i.e., non-practitioners, intermittent practitioners, and long-term practitioners) prevented us from using yoga experience as a continuous variable. That said, the use of categories *did* allow us to show the difference between long-term and intermittent practitioners in a simple manner, thus allowing the general public to easily understand the key findings from this study. Furthermore, the purpose of this categorization was to isolate consistency of practice as a variable. It is common for people to engage in yoga casually; however the impact of an

intermittent practice has not been analyzed in previous research and thus may affect how yoga might be recommended.

Conclusion

The results of this study support the continued investigation of how yoga may exert its benefits and, specifically, how the length of yoga practice influences these positive effects. The findings suggest that yoga may enhance emotional regulation, trait mindfulness, interoceptive awareness, self-compassion, and spiritual intelligence for long-term practitioners. Intermittent practitioners also see some benefits, although fewer compared to long-term practitioners. Furthermore, two mediation models from this study provide novel evidence that the relationship between yoga experience and emotion dysregulation is mediated by interoceptive awareness, spiritual intelligence, trait mindfulness, and self-compassion. Three mediation models suggest that the relationship between yoga experience and depression, anxiety, and stress are mediated by emotion dysregulation. These models bring an important mechanistic consideration for yoga that may influence future research designs. Studies using pre/post methodology and long-term interventions would be helpful in identifying the specific length and intensity of practice needed to achieve these benefits. Cross-cultural study comparison would also be essential to clarify the generalizability of these models of yoga's potential benefits.

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The authors declare no competing financial interests or other conflicts of interest.

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Author Contributions

Both authors designed this study. The first author collected the data, performed the data analyses, and wrote the first draft of the manuscript. Both authors edited the manuscript in preparation for publication.

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Chapter III: Study Transition

My first study demonstrated several intriguing outcomes that both corroborated existing research and contributed new findings. Not surprisingly, long-term yoga practice was associated with more benefits compared to intermittent practitioners. One mediation model showed that interoceptive awareness and spiritual intelligence mediated emotion dysregulation through yoga experience. Spiritual intelligence being involved in this model was surprising, although is conceptually consistent with traditional yoga philosophy. In another model, mindfulness and self-compassion were shown to be mediators for emotion dysregulation through yoga experience. Thus, these could be constructs that explain how yoga reduces emotion dysregulation. My goal for my second study was to investigate similar constructs using a more stringent protocol. Other goals were to identify the contribution of *asanas* specifically and see what benefits may be detected using a short-term intervention.

The cross-sectional design of Study 1 means that we cannot attribute the benefits found to yoga experience. It is possible that other factors impacted the results and there is no way to identify if this is the case for this particular study. In an effort to determine if my Study 1 findings would be consistent with a more robust research design, my second study featured a randomized control trial (RCT).

The use of an RCT design allowed me to reduce the heterogeneity of yoga experiences in the sample being tested. In Study 1, participants engaged in a variety of elements associated with yoga, which may have included any traditional or modern components such as *asanas*, *pranayama*, meditation, amongst others. For this reason, Study 2 isolated *asanas* as a feature to identify what benefits from yoga may be expected from a movement-focused practice. An additional source of variability was the age of the population being tested. In Study 1, the sample

included individuals from young to older adulthood. For Study 2, the age range was reduced to adults under 32 years of age. These changes allowed me to better isolate the effects of yoga on multiple measures of psychological well-being.

The results of Study 1 and 2 will provide an interesting timeline for the beneficial effects of yoga practice. From Study 1, we see that long-term practitioners may expect more benefits compared to intermittent practitioners, and intermittent yoga practice is associated with benefits compared to no practice at all. Study 2 compared participants engaged in a short-term (eight week) yoga program to an education group. When the two experiments are looked at as a larger research program, I could compare any benefits associated with short-term, intermittent, and long-term yoga practice. These data would allow me to provide suggestions for future research, clinicians considering incorporating yoga into treatment programs, and prospective practitioners of yoga.

Chapter IV: Study 2

A Randomized Control Trial of the Effects of a Hatha Yoga Program on Psychological and Attentional Measures

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Abstract

The current study used a randomized control trial (RCT) to investigate whether completing an eight-week posture-based *Hatha* yoga program would lead to greater psychological benefits than taking part in an eight-week lecture series about the history and philosophy of yoga. Participants completed five self-report measures related to their affective state (depression, anxiety, and stress), emotion dysregulation, interoceptive awareness, trait mindfulness, and self-compassion. Participants also completed an Attention Networks Task (ANT). When comparing post-scores with participant pre-scores, results indicated that those in the yoga program, but not in the education program, showed significant improvement on measures of stress, mindfulness, and interoception; this group also showed an overall reduction in reaction time on the ANT. Change scores demonstrated improved differences on all measures for the yoga group. Mediation analyses revealed that mindfulness was a mediator between yoga program and depression, anxiety, and stress. Emotion dysregulation was a mediator between yoga program and both depression and stress. Finally, interoceptive awareness was a mediator between yoga program and depression. These results suggest that a short, posture-based yoga practice produces benefits in multiple areas of functioning with underlying mechanisms highlighting the importance of mindfulness, interoceptive awareness, and emotional regulation.

Keywords: Yoga; Emotional Regulation; Self-Compassion; Mindfulness; Interoception; Attention

Yoga is a mind-body practice that originated in India approximately 5000 years ago (Cope, 2007; Feuerstein, 2003). In the past decade, yoga has received considerable interest from researchers investigating potential physical and psychological benefits of yoga practice. Several of these studies have been randomized control trials (RCTs), a research design in which participants are randomly assigned to an experimental condition (e.g., yoga classes) or a control condition (e.g., an exercise program). This form of design allows researchers to infer that any group differences were *caused* by the experimental manipulation (i.e., yoga) rather than by previously existing characteristics such as personality traits. For example, a recent study using a 12-week Kripalu yoga intervention that included *asanas* (physical postures), *pranayama* (breath regulation), meditation, relaxation, and didactic sessions on yoga philosophy found that interoceptive awareness and spiritual well-being improved eight weeks into the intervention; stress reactivity and mindfulness improved after 12 weeks (Park et al., 2020). Other RCT-based experiments have demonstrated that yoga leads to reduced depression (de Manicor et al., 2016; Schuver & Lewis, 2016), anxiety (Gothe et al., 2016; Khalsa et al., 2009) and perceived stress (Danucalov et al., 2017; Gard et al., 2012; Harkness et al., 2016), and increased interoceptive awareness (Mehling et al., 2017), mindfulness (Brunner et al., 2017; Butzer et al., 2016; Gard et al., 2012; Hylander et al., 2017; Shelov et al., 2009), emotional regulation (Brennan et al., 2020; Daly et al., 2015; Willy-Gravley et al., 2021), self-compassion (Brennan et al., 2020; Gard et al., 2012), and quality of life (Gard et al., 2012). These studies suggest that relatively brief yoga programs can produce a variety of psychological and physical benefits.

Given that the psychological benefits of yoga practice are well-established, researchers are now able to examine more specific and sophisticated research questions. One important issue is determining how the different variables that are affected by yoga *interact.* More specifically, is

the link between yoga practice and psychological wellbeing *direct*, or are other factors mediating this relationship? Recently, researchers have begun using mediation analyses to examine the relationships between the different variables affected by yoga. For example, Boni and colleagues (2018) demonstrated that mindfulness mediates the relationship between practicing yoga and anxiety. In another study, Gard and colleagues (2012) reported that the relationship between yoga intervention and both quality of life and perceived stress were mediated by self-compassion (Gard et al., 2012). Quality of life was also mediated by trait mindfulness (Gard et al., 2012). These initial mediation studies suggest that the influence of yoga practice on mental health is complex and highlights the need for additional multivariate studies that utilize mediation models.

Adding to the complexity of the relationship between yoga and mental health is the fact that the mechanisms underlying yoga's beneficial effects may vary based on the components of yoga being practiced. Current Western interpretations of yogic practices commonly incorporate three traditional features – physical postures (Sanskrit: *asanas*), breath regulation (*pranayama*), and meditation. Studies incorporating all three of these features boast myriad benefits (Daly et al., 2015; Gothe et al., 2016; Kerekes et al., 2017). However, many Western yoga practitioners take part in yoga classes that focus primarily on physical postures. The challenge for researchers, therefore, is to examine whether an *asanas*-based yoga practice could influence cognitive, emotional, and attentional variables independent of formal breath-regulation training or meditation.

The Current Study

The goal of the current study was to understand how the *asanas* of a yoga practice may contribute to benefits associated with mental health, well-being, and attention. Participants were randomly assigned to a *Hatha* yoga group or to an education group that learned about yoga, but

did not actually practice it. A *Hatha* yoga intervention was used due to its foundation in traditional yogic philosophy and its popularity of practice in Western countries (Feuerstein 2008; 2011a; 2011b). An eight-week intervention was chosen to remain within a similar time frame as the Mindfulness-Based Stress Reduction (MBSR) program (Kabat-Zinn, 1994); this duration was also consistent with previous research suggesting a minimum of eight weeks of a yoga intervention is required to detect changes (i.e., Auty et al., 2017; Brinsley et al., 2020; Chimiklis et al., 2018; Park et al., 2020; Taylor et al., 2020).

The measurement of multiple psychological variables before and after a yoga intervention allowed us to determine whether practicing yoga would lead to improvements in participants' self-reported mental health, well-being, and attention. Self-reported mental health was measured with the Depression, Anxiety, and Stress Scale (DASS-42) (Lovibond & Lovibond, 1995). Four additional questionnaires associated with well-being were included in order to examine how emotion dysregulation (Gratz & Roemer, 2004), trait mindfulness (Baer et al., 2006), interoceptive awareness (Mehling et al., 2012), and self-compassion (Neff, 2003) changed following eight weeks of practicing yoga *asanas*. A measure of spiritual intelligence was not used in this study because it was conducted prior to Study 1. Scores from these measures were also used in additional analyses to determine if these constructs mediated the relationship between yoga practice and mental health (i.e., DASS-42 scores).

Attention is a core process used in yoga – sustained, present moment focus is emphasized and required to practice *asanas*, *pranayama*, and meditation. The Attention Networks Task (ANT; Fan et al., 2002) was used to measure changes in attentional processes occurring as a result of our yoga and educational interventions. The ANT provides measures of attentional alerting (i.e., stimulus detection and attentional vigilance), orienting, and executive attention

(Fan et al., 2002). In the context of yoga, alerting is required to maintain focused attention on the body (*asanas* or meditation), breath (*pranayama* or meditation), or any other chosen object (meditation). Executive attention is required to control where attention should be focused as well as to resolve attentional conflicts. An example may be choosing to attend to the breath during a posture rather than thinking about tasks that need to be completed once the class has ended. Orienting attention is reflexive and unlikely to be used in a yoga context.

To summarize, the RCT design used in the current study made it possible to quantify a number of psychological and attentional benefits associated with eight weeks of yoga practice. We hypothesized that the yoga classes, but not the educational workshop, would lead to improvements in depression, anxiety, stress, emotion dysregulation, mindfulness, interoceptive awareness, and self-compassion. For mediation analyses, we hypothesized that interoceptive awareness, trait mindfulness, and self-compassion would each be mediators for the relationships between yoga and depression, anxiety, stress, and emotion dysregulation. We also hypothesized a role for emotional regulation as a mediator for the relationships between yoga and depression, anxiety, and stress. Finally, on the ANT, we predicted that Alerting and Executive Attention scores would improve for participants in the yoga group, but not for individuals in the control condition.

Methods

Participants

A total of 64 participants were recruited for this experiment, with 55 participants completing the study. This sample size was based on power analysis for a repeated-measures ANOVA (Within-Between Interaction) with estimated effect size $f = 0.18$, power = 0.80, and $p =$

0.05. The demographic characteristics of the participants are presented in Table 1. Statistical analyses confirmed that the Yoga and Workshop groups did not differ on any demographic variable. Participants were randomly assigned to one of these two groups using computer-generated codes.

Participants were recruited by departmental emails distributed through the University of Manitoba, University of Winnipeg, University of Guelph, and University of Alberta. Electronic flyers were posted on social media platforms (Instagram and Facebook) through the University of Winnipeg Neuroscience Students' Association (UWNSA) and the University of Manitoba Science Students Association. Some participants were recruited through word-of-mouth by other participants in the study and through cascade distribution of the electronic flyer over social media platforms.

Participants had little-to-no experience practicing yoga, meditation, or any other mind/body practice. This was defined as no more than 10 formal or informal classes in their lifetime and no more than five formal or informal classes in the past year. One formal class was defined as an in-person or live online session that was 60 minutes in length. One informal class included practicing yoga or meditation independently, watching videos, or following along with podcasts or apps for a 60-minute period. Participants were not taking psychiatric medication at the time of the study and were fluent in English.

This study was held during peak pandemic periods. For this reason, the study was offered in an entirely online format. Online insurance was acquired to teach yoga to individuals across Canada in a remote fashion. This study received ethics approval from the University of Manitoba Human Research Ethics Board.

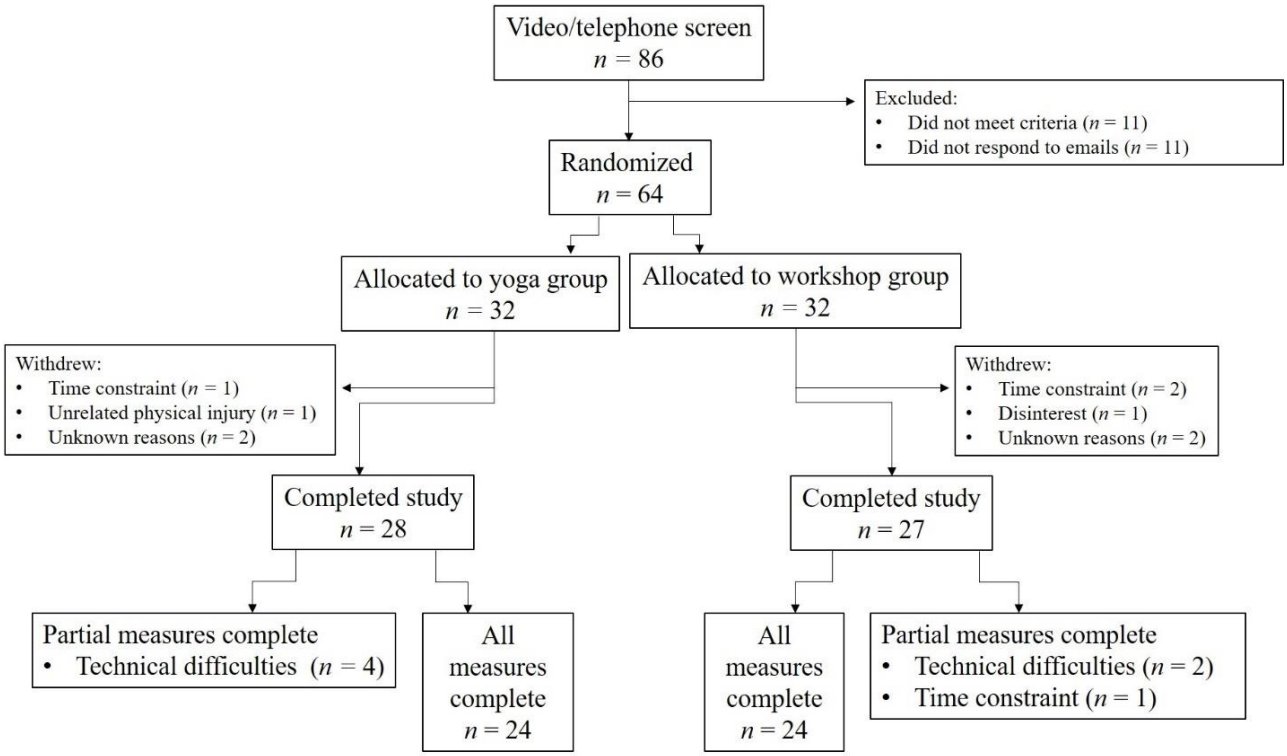
Table 1

Participant Demographic Information

	Workshop Series	Yoga Program
Age: Mean ± SD (Range)	23.7 ± 4.1 (19-32)	22.0 ± 2.8 (18 – 30)
Gender	20 Female	22 Female
	7 Male	5 Male
		1 Agender
Ethnicity	1 Arab/West Indian	5 Chinese
	1 Black	2 Filipino
	2 Chinese	1 Korean
	3 Filipino	2 Latin-American
	2 Latin-American	2 Other
	2 Other	5 South Asian
	1 South East Asian	2 South East Asian
	15 White	9 White
Yoga Experience in Lifetime: Mean Hours ± SD (Range)	6.6 ± 5.9 (0 – 25)	5.7 ± 5.9 (0 – 25)
Yoga Experience in Past Year: Mean Hours ± SD (Range)	1.0 ± 2.7 (0 – 10)	1.5 ± 4.0 (0 – 20)
Meditation Experience in Lifetime: Mean Hours ± SD (Range)	2.2 ± 3.0 (0 - 12)	2.7 ± 3.7 (0 – 15)
Meditation Experience in Past Year: Mean Hours ± SD (Range)	0.9 ± 1.5 (0 – 5)	0.7 ± 1.7 (0 – 8)

Figure 1

Flow of Participant Recruitment, Randomization, and Study Completion



Study Flow

A summary of participant recruitment and experimental procedures is provided in Figure 1. Following recruitment, participants were sent a Qualtrics link (Qualtrics, Inc., Provo, UT) with the consent form and an option to agree or not agree to participate. Participants who agreed to participate in the study were then sent another Qualtrics link to complete five questionnaires online (see following section). The order in which the questionnaires were administered was randomized for each participant. Finally, participants were sent a link to complete the ANT

online. Following completion of the five questionnaires and the ANT, participants were randomly assigned to either the workshop or yoga group.

Thirty-two participants were assigned to the workshop series and the other 32 participants were assigned to the yoga group. These groups consisted of eight weekly, 60-minute sessions on either practicing yoga (yoga group) or learning about yoga (workshop group). Participants were blind to their group assignment until all pre-measures were complete. Participants were instructed not to engage in any other yoga, meditation, or mindfulness practice during the study until its completion. Following the completion of the final class, participants were sent the same questionnaires and ANT through Qualtrics links. This online format ensured that the PI was blind to assessment outcomes during the experiment.

Workshop and Yoga Programs

Both the workshop and yoga programs were designed and taught by the first author whose teaching qualifications include a Bachelor of Education (University of Winnipeg, 2013) and certification as a Registered Yoga Instructor (RYT-200, Chandra Yoga International, 2016). All classes were taught online using the Zoom video conferencing platform (Zoom Video Communications, Inc., San Jose, CA). Videos were enabled and remained on for every class for both groups. All yoga classes were recorded to maintain insurance standards in teaching online yoga classes. This information was relayed to all participants verbally during the recruitment phase and also included in the consent form. Workshop classes were only recorded in the event a participant was unable to attend a class. In the event this occurred, the recording was sent to them. The same was performed for participants in the yoga group. Participants were given seven days to watch the video prior to their next class, after which they were no longer provided access. Data was collected in two stages, between February and April, 2021 and between April

and June, 2021. To accommodate the varying schedules of participants, multiple sections of each class were offered each week.

The yoga classes consisted of eight, one-hour classes of *Hatha* yoga. Each class had the same format. Classes began with a verbal introduction of the theme and a description on how it would relate to the *asanas*. Participants were then instructed to set their own personal intention for the class. The rest of the class was subdivided into four parts. The first part included 12 *asanas* from *Pawanmuktasana* Series I, a group of simple *asanas* designed to develop body awareness, warm up joints, release bodily tension, and connect breath control with bodily movements. The second part included four rounds of *Suriya Namaskar*, a flow series of 10 *asanas* designed to warm up the body and link breath control with bodily movements. The third part consisted of the main *asanas* for the class that related to the theme. Specific instruction was provided on body positioning, entering and exiting each posture safely and appropriately, and providing alternatives for individuals with injuries or difficulties. This aspect of the class was designed to focus on body positioning, learning self-compassion and acceptance for limitations, developing meditative awareness on the body, and learning to breathe calmly while holding postures. The fourth part of the class consisted of the same final posture, corpse pose (Sanskrit: *savasana*). During this posture, participants were instructed to lay on their backs, with eyes open or closed, and breathe. Following *savasana*, participants were instructed to come to a seated position. A closing statement was made, which included gratitude to participants for attending and illustrating a yoga tradition by bowing while saying "*namaste*". Additional information about the yoga class curriculum can be found in the Supplemental Materials.

The workshop series consisted of eight, one-hour classes on the history and philosophy of traditional yoga, with comparisons to modern interpretations (see Supplemental Materials for a

more detailed description of the lecture series). Each class had the same format. A PowerPoint presentation on the topic was given, with videos, websites, and photographs incorporated to corroborate the concepts. At the end of each presentation, participants were instructed to reflect on the class by identifying what stood out most for them.

Questionnaires

Participants were provided a link to complete five different self-report questionnaires through Qualtrics. These questionnaires included the Depression, Anxiety, and Stress Scale (DASS-42; Lovibond & Lovibond, 1995), Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006), Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012), and Self-Compassion Scale (SCS; Neff, 2003). Although four of these questionnaires contain subscales, only the total scores were used in the present investigation.

The DASS-42 provides a measure of depression (e.g., “I couldn’t seem to experience any positive feelings at all”; McDonald’s omega (ω) = 0.96), anxiety (e.g., “I was aware of dryness of my mouth”; ω = 0.92), and stress (e.g., “I found myself getting upset by quite trivial things”; ω = 0.92) an individual’s experiences from the past week. This 42-item questionnaire asks participants to rank their responses on a 4-point Likert scale, from 0 (“Did not apply to me at all”) to 3 (“Applied to me very much, or most of the time”). Higher scores are consistent with greater severity of symptoms (Lovibond & Lovibond, 1995).

The DERS provides a measure of emotion dysregulation (ω = 0.94). For each of the 36 items, participants indicate the degree to which each statement applies to them using a 5-point Likert scale. The DERS includes six subscales: Nonacceptance of Emotional Responses (e.g.,

"When I'm upset, I become angry with myself for feeling that way"), Difficulties in Engaging in Goal-Directed Behaviour (e.g., "When I'm upset, I have difficulty getting work done"), Impulse Control Difficulties (e.g., "I experience my emotions as overwhelming and out of control"), Lack of Emotional Awareness (e.g., "I pay attention to how I feel"), Limited Access to Emotion Regulation Strategies (e.g., "When I'm upset, I believe that I will remain that way for a long time"), and Lack of Emotional Clarity (e.g., "I have no idea how I am feeling"). Greater scores on the DERS indicate greater emotion dysregulation (Gratz & Roemer, 2004).

The FFMQ provides a measure of trait mindfulness, the tendency for an individual to pay attention with an open curiosity to the present moment. This 39-item questionnaire asks participants to rank each item on a 5-point Likert scale and provides an overall score for trait mindfulness ($\omega = 0.90$) as well as scores for five subscales or facets. The five facets include Observing (e.g., "I notice the smells and aromas of things") , Describing (e.g., "I am good at finding words to describe my feelings"), Acting with Awareness (e.g., "I find myself doing things without paying attention"; reverse scored), Non-Judgment of Inner Experience (e.g., "I think some of my emotions are bad or inappropriate and I should not feel them"; reverse scored), and Non-Reacting to Inner Experience (e.g., "I perceive my feelings and emotions without having to react to them"). Greater scores on the FFMQ are indicative of greater self-reported trait mindfulness (Baer et al., 2006).

The MAIA provides a measure of interoceptive awareness, one's sensitivity to internal signals from the body. This 32-item questionnaire asks participants to rank on a 6-point Likert scale the degree to which each statement applies, providing an overall score ($\omega = 0.86$) along with eight subscales. The subscales include Noticing (e.g., "When I am tense I notice where the tension is located in my body"), Not-Distracting (e.g., "I distract myself from sensations of

discomfort"), Not-Worrying (e.g., "I can notice an unpleasant body sensation without worrying about it"), Attention Regulation (e.g., "I can pay attention to my breath without being distracted by things happening around me"), Emotional Awareness (e.g., "I notice how my body changes when I am angry"), Self-Regulation (e.g., "When I feel overwhelmed I can find a calm place inside"), Body Listening (e.g., "I listen for information from my body about my emotional state"), and Trusting (e.g., "I am at home in my body"). Greater scores on the MAIA indicate greater interoceptive awareness (Mehling et al., 2012).

The SCS provides a measure of self-compassion. This 26-item questionnaire asks participants to rank on a 5-point Likert scale the degree to which each statement applies, providing an overall measure of self-compassion ($\omega = 0.91$) and scores on six subscales. The six subscales include Self-Kindness (e.g., "I try to be loving towards myself when I'm feeling emotional pain"), Self-Judgment (e.g., "I'm disapproving and judgmental about my own flaws and inadequacies"; reverse scored), Common Humanity (e.g., "When things are going badly for me, I see the difficulties as part of life that everyone goes through"), Isolation (e.g., "When I'm feeling down, I tend to feel like most other people are probably happier than I am"; reverse scored), Mindfulness (e.g., "When something upsets me I ty to keep my emotions in balance"), and Over-Identification (e.g., "When I'm feeling down I tend to obsess and fixate on everything that's wrong"; reverse scored). Greater scores on the SCS indicate greater self-compassion (Neff, 2003).

Attention Networks Task (ANT)

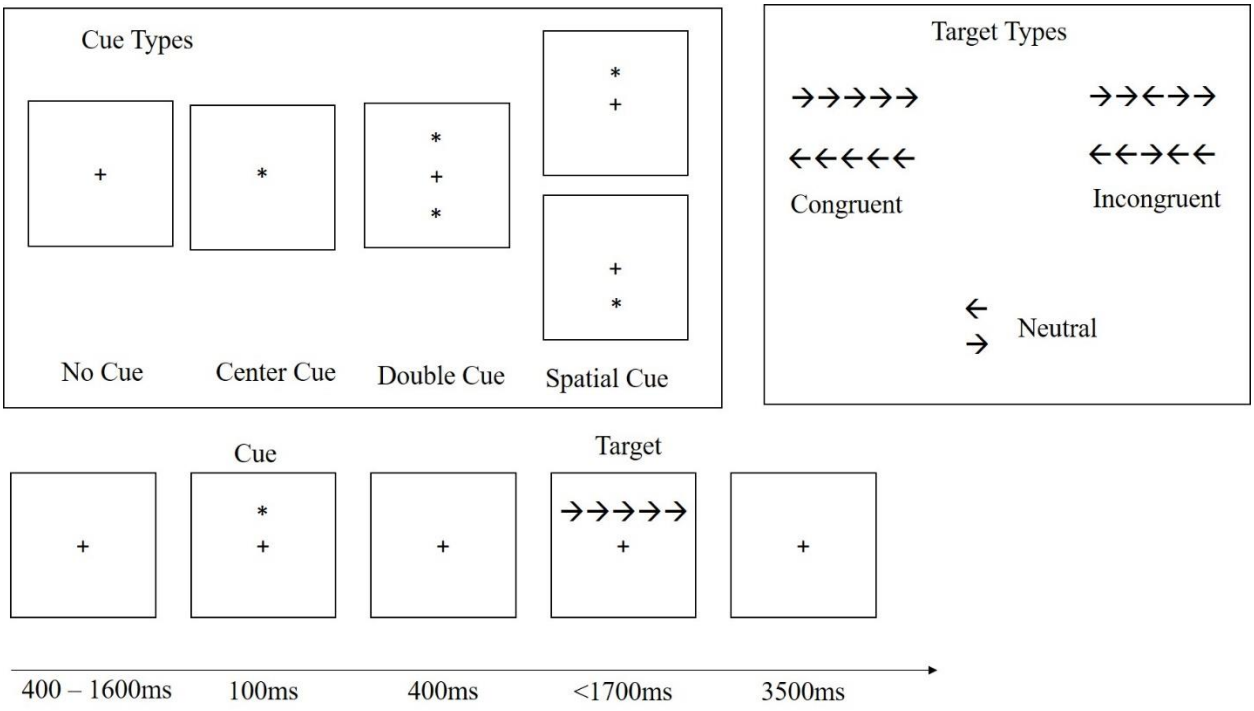
Participants were sent a link to complete the ANT using E-Prime Go (Psychology Software Tools, Inc., Pittsburgh, PA) software from an updated version of the ANT task (Fan et al., 2005). However, this software was incompatible with many of the participant's computer

operating systems. As a result, 49 participants completed the version of the ANT that is part of the Inquisit 6 software package (i.e., Fan et al., 2002). The data from six participants who completed the E-Prime Go version were not included in the analyses due to differences between the two versions.

On each trial of the ANT, a single fixation cross located in the centre of the screen was presented for a variable duration of 400 to 1600 ms (see Figure 2). Following this fixation cross, one of five different cues were presented: a single fixation cross in the centre of the screen (no cue), a single asterisk in the centre of the screen (center cue), a fixation cross in the centre of the screen with an asterisk either above or below it (spatial cue, which always correctly predicted the eventual location of the target), or a single fixation cross in the centre of the screen with one asterisk both above and below it (double cue). These cues were presented for 100ms followed by a fixation cross presented for 400ms. Next, one of six possible targets appeared. Two targets consisted of one single arrow pointing left or right. On these trials, participants pressed the "<" or ">" keys to indicate the direction the arrows were pointed. Because these targets did not contain flanking items, they were considered "neutral". The remaining four targets consisted of five arrows. On these trials, participants were asked to indicate the direction of the central arrow. Two of these targets consisted of all five arrows pointed in the same direction (e.g., > > > > >). These were congruent targets. The remaining two targets were incongruent and consisted of flanking items that pointed in the opposite direction to the central arrow (e.g., > > < > >). Target stimuli were presented above, below, or in the centre of the screen. The target was presented for 1700ms, or less if a participant had responded prior to this point. Finally, a single fixation cross presented in the middle of the screen appeared for 3500ms. This task consisted of four blocks of trials, approximately 6.7 minutes each, for a total of 26.8 minutes.

Figure 2

ANT Procedure Modified from Fan and Colleagues (2002)



Note. This version of the ANT was completed by most participants (n = 49) through Inquisit 6.

The ANT data included accuracy and reaction time. Only correct responses were included in reaction-time calculations. Three different measures of attention were provided for the ANT: alerting, orienting, or executive attention (Fan et al., 2002; 2005). The calculations for these components of attention were as follows:

$$\text{Alerting} = RT_{\text{no cue}} - RT_{\text{double cue}}$$

$$\text{Orienting} = RT_{\text{center cue}} - RT_{\text{spatial cue}}$$

$$\text{Executive attention} = RT_{\text{incongruent}} - RT_{\text{congruent}}$$

Eight reaction time scores were calculated for each group: an average reaction time of correct responses across all trial types as well as scores for *alerting, orienting,* and *executive attention*; these four values were calculated for both pre- and post-intervention test sessions. Accuracy scores were also calculated. Test-retest reliability for the ANT have been reported as moderate to high in health populations (Hahn et al., 2011) and in the similar Dalhousie Computerized Attention Battery (Jones et al., 2016), but has not been recommended for some clinical populations including those diagnosed with schizophrenia (Hahn et al., 2011).

Data Analysis

All analyses were performed using IBM SPSS Statistics 28.0 software (IBM SPSS Software, Armonk NY). Three separate analyses were performed to analyze the data. Independent Samples *t*-Tests were used to determine if there were any significant differences between the workshop and yoga pre-program scores on each self-report measure. ANCOVAs were used to determine if differences between pre and post questionnaire scores were based on the program. Pre-program scores were used as a covariate. These were 2 (Group) ANCOVAs with pre-score as covariates. Paired Samples *t*-Tests were used to identify if any changes seen between the two time points (before and after the program) were significantly different from zero when considering each program independently from one another.

Assumptions were tested for the Independent Samples *t*-Tests using the Shapiro-Wilk test ($p > .05$) for normality, Levene's Test ($p > .05$) for homogeneity of variances, and outliers ($p > .05$). The test was performed regardless of distribution due to the robustness of the test to this assumption. The non-parametric equivalent of this test, the Mann-Whitney *U* Test, was used if more than one outlier was present. Outliers were not eliminated from the dataset due to unlikelihood of measurement error.

Assumptions were tested for each ANCOVA. These included homogeneity of regression slopes, normal distribution for standardized residuals for the programs and overall model, homoscedasticity (determined by visual inspection of standardized residuals plotted against predicted residuals), homogeneity of variances (Levene's test, $p > .05$), outliers (identified if standardized residuals were greater or lesser than three standard deviations), and linearity (visual inspection of scatterplots).

Assumptions for the Paired Samples *t*-Tests were also tested including normal distribution (Shapiro-Wilk test, $p > .05$) and outliers. Outliers were not modified or deleted from the questionnaire data because it is likely that they represented genuine variation in the data rather than being due to measurement error.

Results

A total of 55 participants completed the study (Workshop group $n = 27$; Yoga group $n = 28$). Fifty-four participants completed the questionnaires (Workshop group $n = 26$; Yoga group $n = 28$). The one participant who did not complete the questionnaires cited time constraints.

Three adverse events occurred throughout the study in the yoga group only. One participant reported a physical injury that was unrelated to practicing yoga. This participant withdrew from the study after two classes due to an inability to engage in most of the postures. A second participant reported neck pain while practicing one specific posture. After a conversation with this participant, additional neck modifications were provided discreetly to all participants in all yoga classes. This was done to address possible similar concerns with other participants and also to maintain confidentiality of the individual who experienced the difficulty. A third participant reported emotional difficulties during a specific posture. These difficulties were

validated and normalized, and detailed recommendations were provided for this participant confidentially.

In the yoga group, 100% of participants attended and/or watched the video of a minimum of six classes; one participant was unable to attend or watch the videos of two classes. In the workshop group, 74.7% of participants attended and/or watched the video of a minimum of six classes. No participants in this group missed both a class and video. Independent Samples *t*-Test was used to determine if there were any significant differences in class attendance between the two groups. The yoga group attended more classes than the workshop group ($t(53) = -2.688$; $p = .010$) and the workshop group watched significantly more videos than the yoga group ($t(53) = 2.946$; $p = .005$). Importantly, there was no significant difference in absenteeism between the yoga and workshop group ($t(53) = -1.00$; $p = .326$).

Questionnaire Analyses: Total Scores

Depression, Anxiety, and Stress

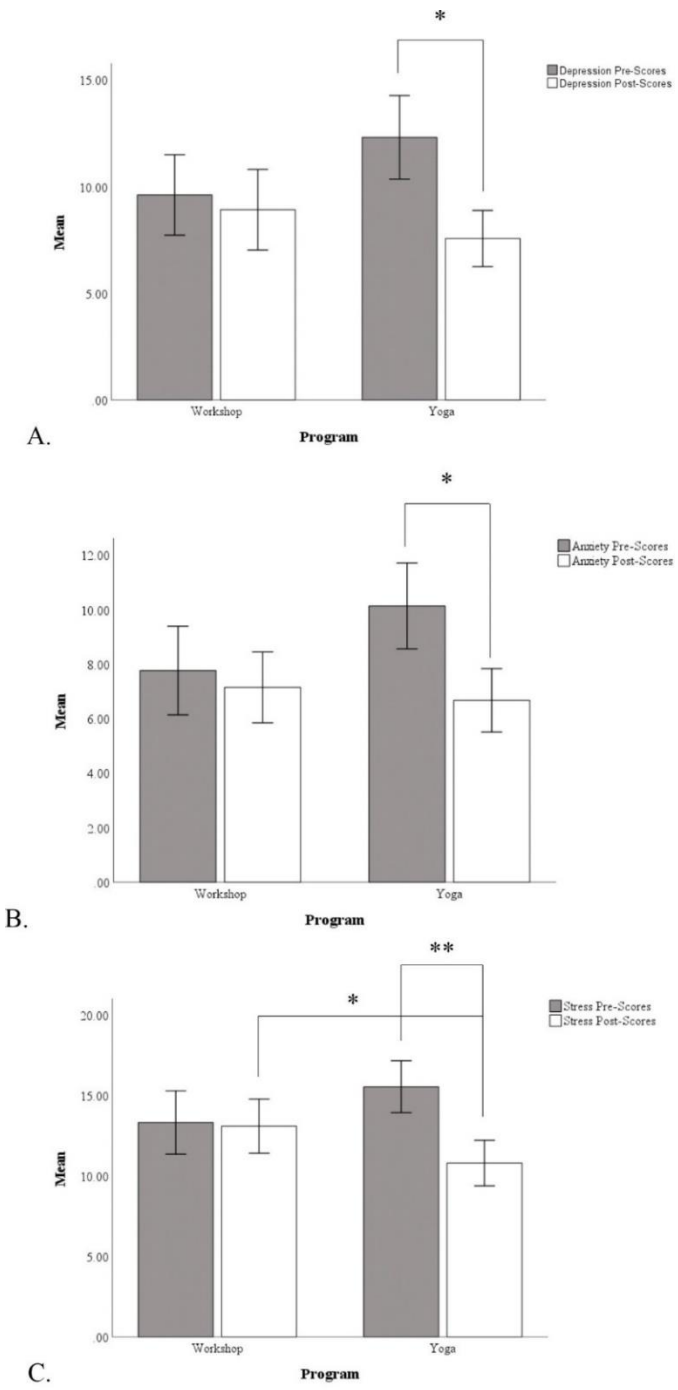
Results of the DASS-42 are depicted in Figure 3, including mean and standard deviation for both the yoga and workshop groups. Independent Samples *t*-Test demonstrated no statistically significant difference between the yoga and workshop group pre-scores on the Depression ($t(52) = -0.992$; $p = .326$), Anxiety ($t(52) = -1.047$; $p = .300$), or Stress ($t(52) = -0.877$; $p = .384$) scales. To determine if differences between pre and post DASS-42 Depression, Anxiety, and Stress scores were based on the program, three separate ANCOVAs were performed. Pre-program scores were used as a covariate. After adjustment for pre-program DASS-42 score, there was a significant effect for Stress ($F(1, 43) = 5.023$; $p = .029$; $\eta^2 = .090$) and a marginally significant difference in the predicted direction between the yoga and workshop

programs for Depression, ($F(1, 51) = 3.731$; $p = .059$; $\eta^2 = .068$). However, no significant difference was observed for Anxiety ($F(1, 43) = 1.803$; $p = .185$; $\eta^2 = .034$).

Paired Samples *t*-Tests were used to assess whether questionnaire scores changed after the Yoga program had finished. Participant Depression (M = -4.750; 95% CI [-7.411, -2.089]; $t(27) = -3.663$; $p = .001$; $d = -0.692$), Anxiety (M = -3.464; 95% CI [-6.187, -0.742]; $t(27) = -2.611$; $p = .015$; $d = -0.493$), and Stress scores (M = -4.750; 95% CI [-7.269, -2.231]; $t(27) = -3.869$; $p < .001$; $d = -0.731$) all significantly decreased post-program compared to their pre-program scores. In contrast, no significant differences were found in the pre- vs. post-program comparisons for the Workshop group (all *t*-values < 1; $p > .05$).

Figure 3

DASS-42 Mean Scores with Standard Error Bars



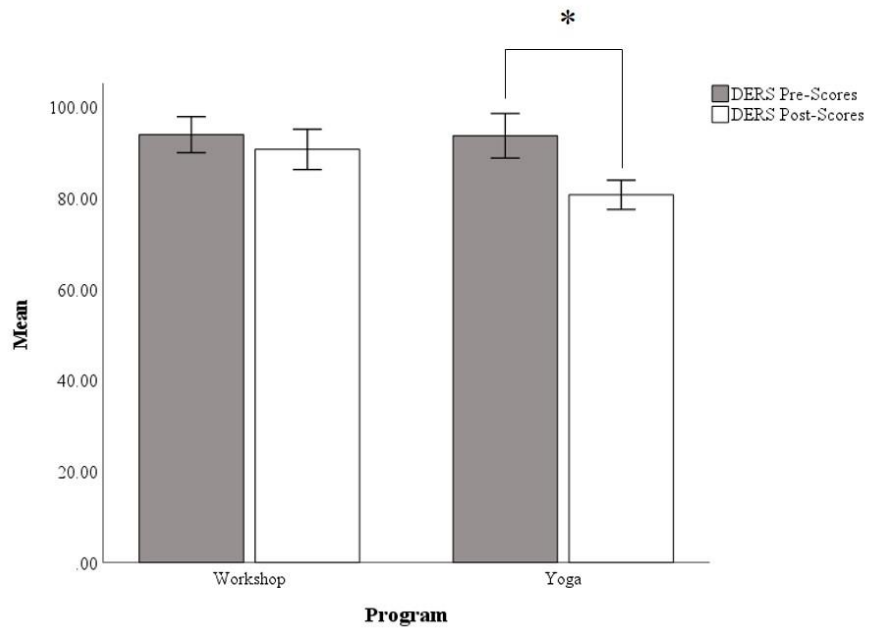
*($p < .05$). **($p < .001$).

Emotion Dysregulation

The overall scores on the DERS, including mean and standard deviation for both the yoga and workshop groups, are depicted in Figure 4. Independent Samples *t*-Test demonstrated no significant difference between the yoga and workshop group DERS pre-scores ($t(52) = 0.039$; $p = .969$). After adjustment for pre-program DERS scores, an ANCOVA demonstrated that there was no statistically significant difference between the yoga and workshop programs ($t < 1$; $p > .05$). Paired Samples *t*-Test showed that participant DERS scores significantly decreased post-Yoga program compared to their pre-program scores (M = -12.964; 95% CI [-23.190, -2.739]; $t(27) = -2.601$; $p = .015$; $d = -0.492$). For the Workshop group, post DERS scores did not significantly differ from their pre-program scores ($t < 1$; $p > .05$).

Figure 4

DERS Score Summary (Mean ± SE)



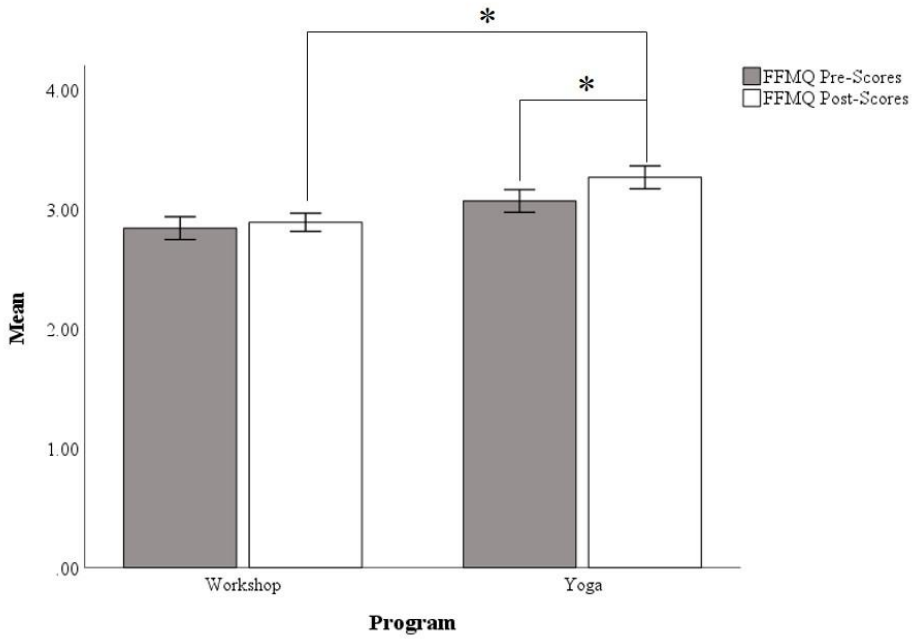
*($p < .05$).

Trait Mindfulness

The results for the FFMQ are depicted in Figure 5. There was no significant difference between yoga and workshop FFMQ Total pre-scores using an Independent Samples *t*-Test ($t(52) = -1.689$; $p = .097$). To identify if FFMQ overall scores were based on program, an ANCOVA was performed. After adjustment for pre-program FFMQ scores, there was a statistically significant difference between the yoga and workshop programs ($F(1, 51) = 6.528$; $p = .014$; $\eta^2 = .113$). Paired Samples *t*-Test for the Yoga group demonstrated that FFMQ scores significantly increased following the eight-week yoga program (M = 0.198; 95% CI [0.0495, 0.346]; $t(27) = 2.737$; $p = .011$; $d = 0.517$). No significant change was seen from pre to post program FFMQ scores in the workshop group ($t < 1$; $p > .05$).

Figure 5

FFMQ Score Summary (Mean ± SE)



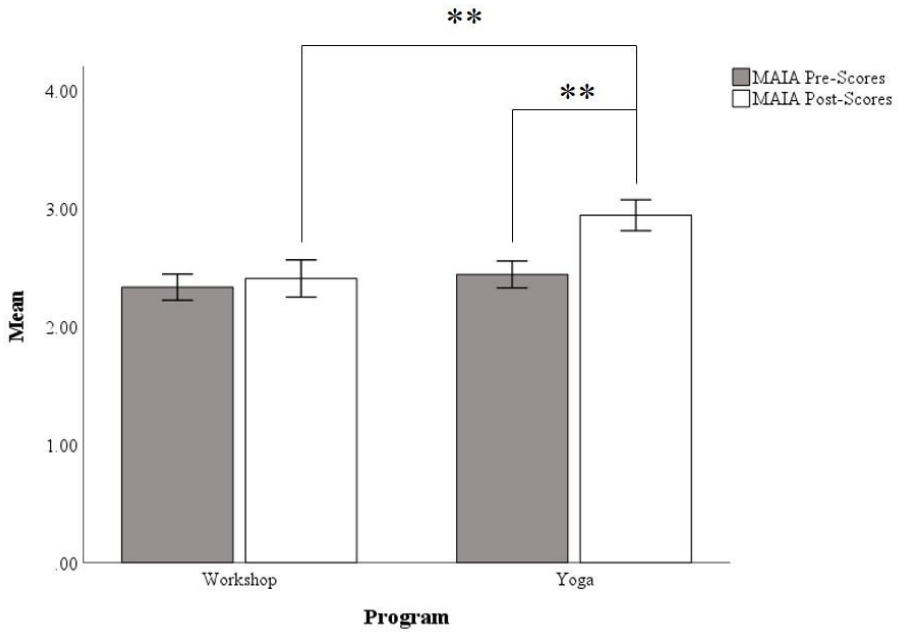
*($p < .05$). **($p < .01$).

Interoceptive Awareness

An Independent Samples *t*-Test was performed to compare the MAIA pre-scores between the yoga and workshop group (see Figure 6). No significant difference was found between groups on MAIA total pre-scores ($t(52) = -0.675$; $p = .502$). After adjustment for pre-program MAIA scores, an ANCOVA demonstrated a statistically significant difference between the yoga and workshop programs ($F(1, 51) = 9.541$; $p = .003$; $\eta^2 = .158$). Furthermore, participant MAIA scores in the Yoga group significantly increased post-program compared to their pre-program scores, as seen from a Paired Samples *t*-Test (M = 0.502; 95% CI [0.324, 0.679]; $t(27) = 5.820$; $p < .01$; $d = 1.100$). For the Paired Samples *t*-Test in the Workshop group, post MAIA scores did not significantly differ from their pre-program scores ($t < 1$; $p > .05$).

Figure 6

MAIA Score Summary (Mean ± SE)



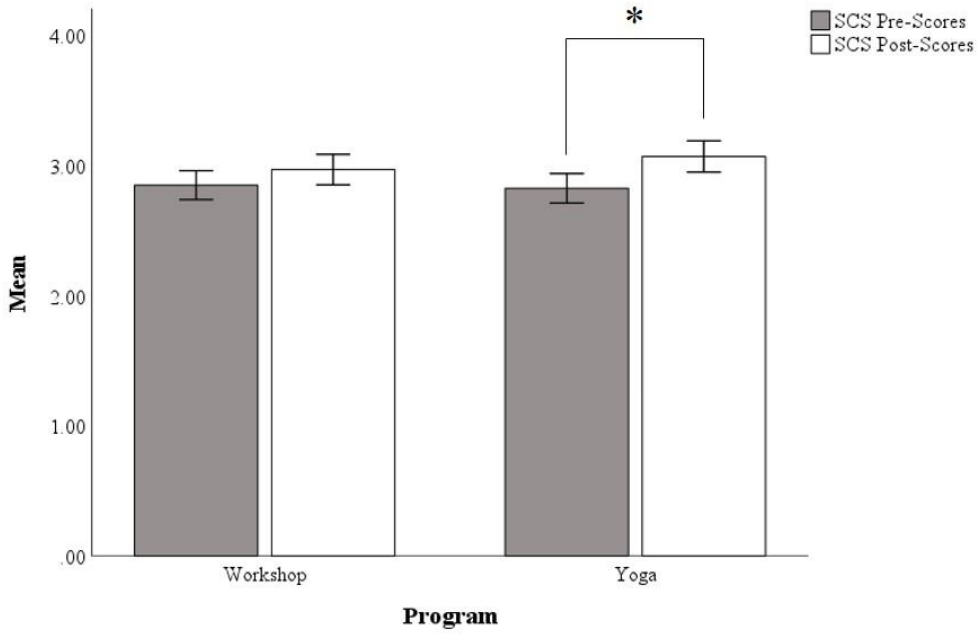
*($p < .05$). **($p < .01$).

Self-Compassion

The results for the SCS are depicted in Figure 7. An Independent Samples *t*-Test demonstrated no significant difference between groups on the SCS total pre-scores ($t(52) = 0.149$; $p = .882$). After adjustment for pre-program SCS scores, there was no statistically significant difference between the yoga and workshop programs using an ANCOVA ($F(1, 51) = 1.249$; $p = .269$; $\eta^2 = .024$). For the Yoga group Paired Samples *t*-Test, participant SCS total scores significantly increased post-program compared to their pre-program scores (M = 0.245; 95% CI [0.0944, 0.395]; $t(27) = 3.341$; $p = .002$; $d = 0.631$). For the Workshop group, post SCS scores did not significantly differ from their pre-program scores using Paired Samples T-Test ($t < 1$; $p > .05$).

Figure 7

SCS Score Summary (Mean ± SE)



*($p < .05$). **($p < .01$).

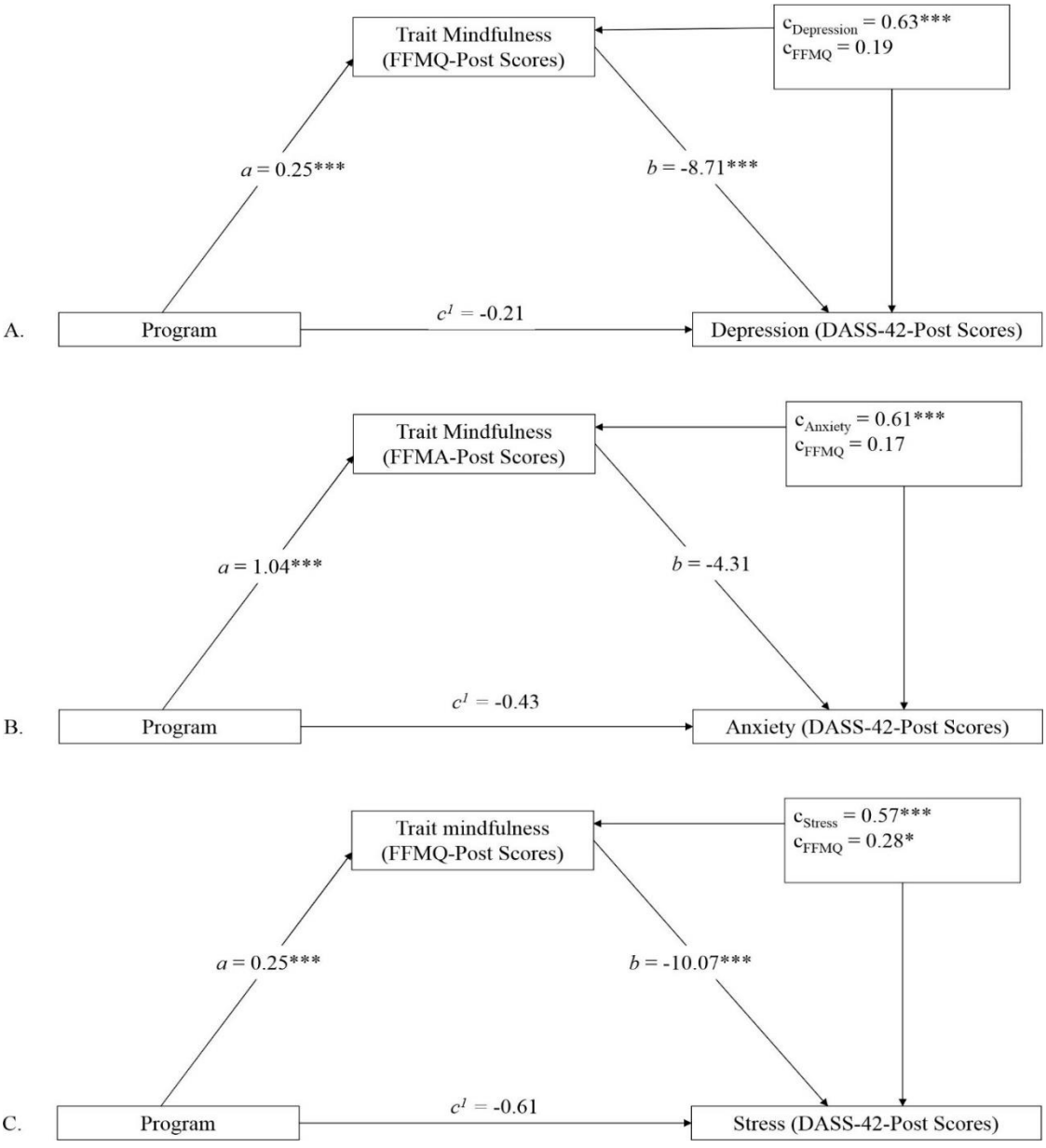
Mediation

Mediation analyses were performed using PROCESS v3.5 in SPSS. Mediation in this context sought to understand which components of yoga (i.e., trait mindfulness, interoception, self-compassion) contributed to its benefits (i.e., reducing depression, anxiety, and stress, and improving emotional regulation). Fifteen mediation models were tested. The education group was coded as, "0" and the yoga group as, "1". In each model, yoga program represented the predictor. The outcomes were depression, anxiety, stress, and/or emotion dysregulation, as indicated by scores on the DASS-42 or DERS. The mediator was trait mindfulness (FFMQ), interoception (MAIA), self-compassion (SCS), or emotion dysregulation (DERS). Pre-scores for the mediator and outcome were included as covariates. Seven of these models were significant.

The first three models investigated whether trait mindfulness mediated the relationship between yoga program and depression, anxiety, and stress (Figure 8). In the first model, yoga program represented the predictor, depression post-scores on the DASS-42 represented the outcome, and trait mindfulness total post-scores on the FFMQ represented the mediator. Depression pre-scores on the DASS-42 and total FFMQ pre-scores were used as covariates. The second and third models were identical to this model, but used anxiety and stress scores as outcomes. All models were significant and demonstrated mediation, indicating that trait mindfulness mediates the relationship between yoga intervention and depression (Indirect effect = -2.18; $p < .001$; $R^2 = 0.66$; 95% CI[-4.46, -0.52]), anxiety (Indirect effect = -1.17; $p < .001$; $R^2 = 0.51$; 95% CI[-2.58, -0.10]), and stress (Indirect effect = -2.50; $p < .001$; $R^2 = 0.64$; 95% CI[-5.06, -0.57]) scores.

Figure 8

The Relationship Between Program and Depression (A), Anxiety (B), and Stress (C) Fully Mediated by Trait Mindfulness

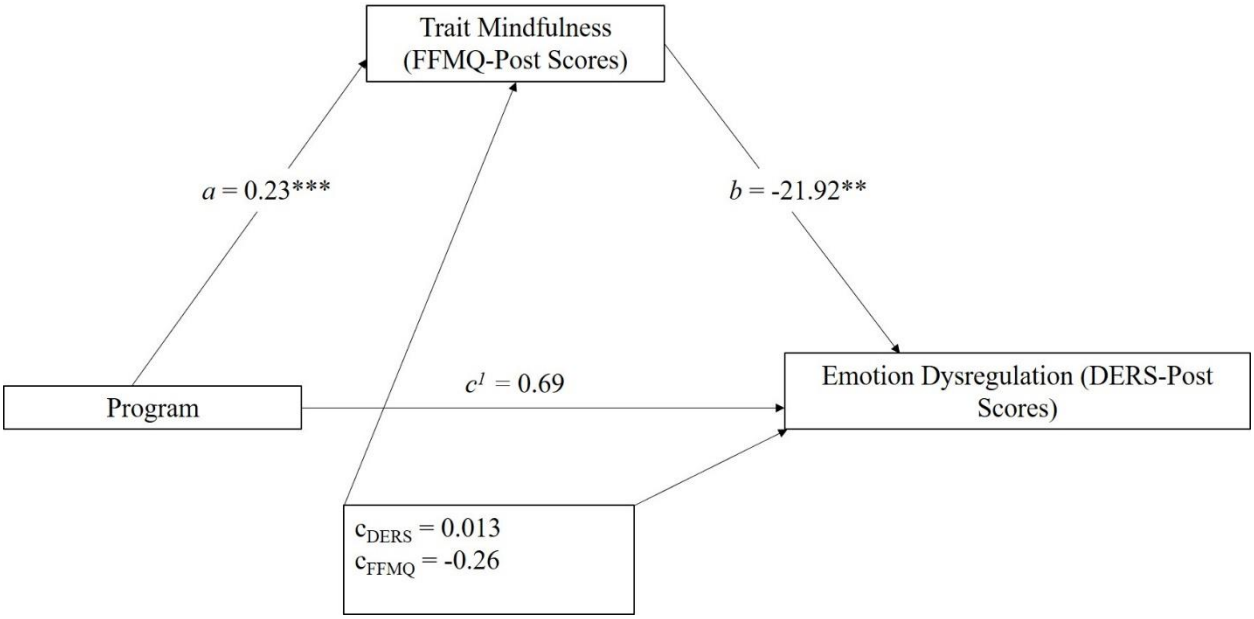


Note. Significance is indicated by * ($p < .05$), ** ($p < .01$), or *** ($p < .001$). No asterisk indicates a non-significant finding. Covariates are represented as, "$c_{depression}$", "$c_{anxiety}$", and "c_{stress}".

The next model investigated whether trait mindfulness mediated the relationship between yoga program and emotion dysregulation (DERS scores). This model was also significant (Indirect effect = -4.96; $p < .001$; $R^2 = 0.55$; 95% CI[-10.42, -0.83]). Similar to the first three models, pre-program scores for the mediator and outcome were used (Figure 9). This model suggests that trait mindfulness mediates the relationship between yoga intervention and emotion dysregulation scores.

Figure 9

The Relationship Between Program and Emotional Regulation Fully Mediated by Trait Mindfulness



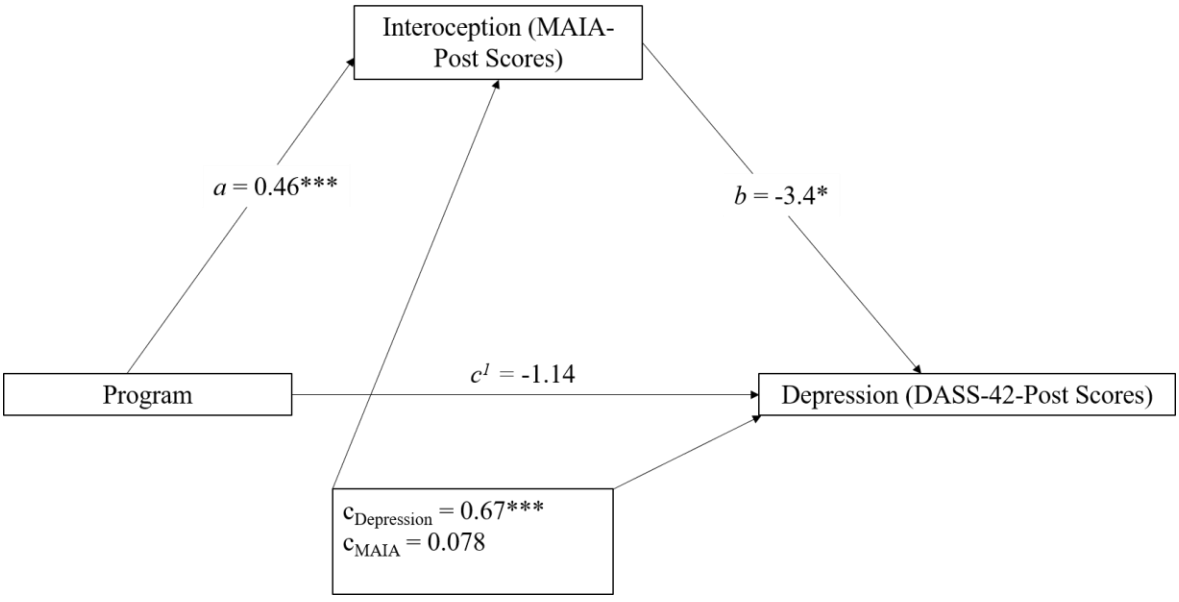
Note. Significance is denoted with ** ($p < .01$) or *** ($p < .001$). No asterisk indicates a non-significant finding.

The next four models investigated whether interoceptive awareness mediated yoga's effects on depression, anxiety, stress or emotion dysregulation scores. These models addressed

the possibility that interoceptive awareness is one of the mechanisms involved in improving mood and emotional regulation. In these models, interoceptive awareness was used as the mediator using MAIA post-scores. The four models used one of depression (DASS-42 Depression), anxiety (DASS-42 Anxiety), stress (DASS-42 Stress), or emotion dysregulation (DERS) post-scores as outcomes. Pre-program scores for the mediator and outcome were used as covariates in each model. Only the first model, with depression scores as the outcome, was significant (Indirect effect = -1.55; $p < .001$; $R^2 = 0.61$; 95% CI[-3.78, -0.020]). This model suggests that interoceptive awareness mediates the relationship between yoga and depression scores (Figure 10).

Figure 10

The Relationship Between Program and Depression While Holding Pre-Scores Constant is Fully Mediated by Interoceptive Awareness

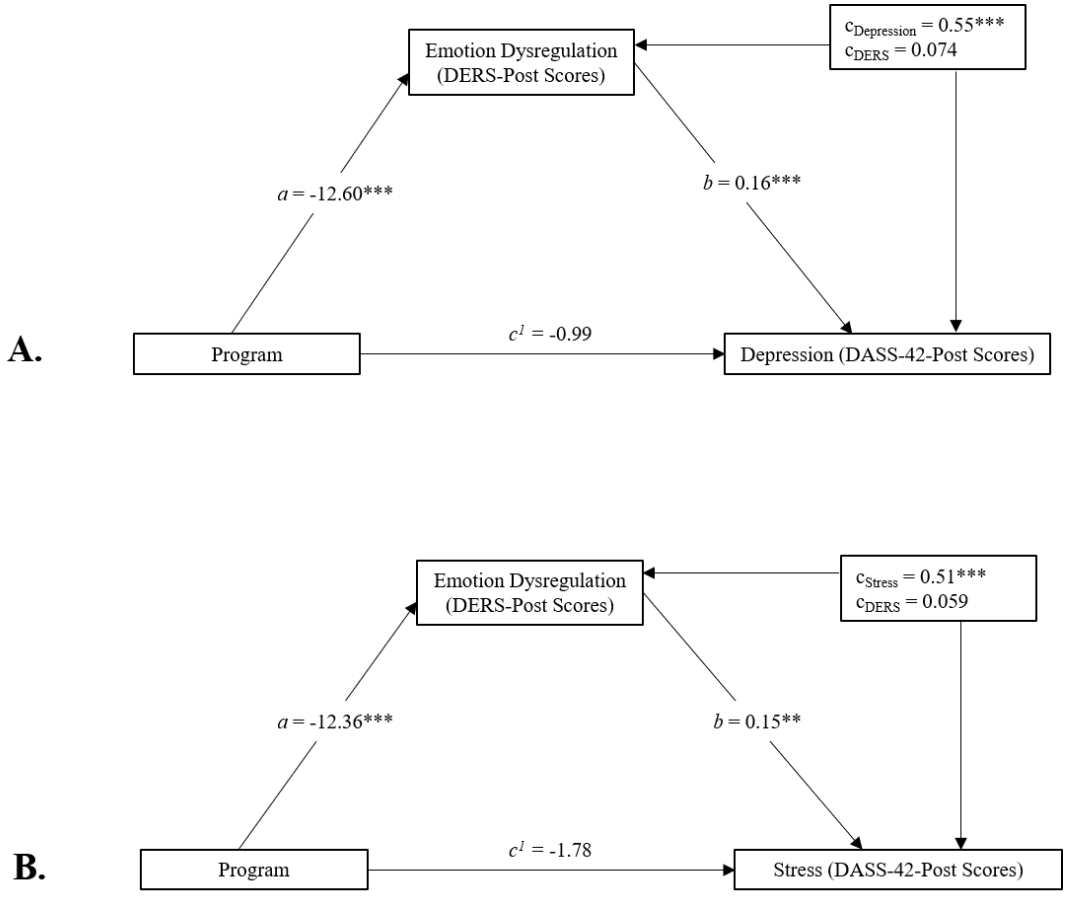


Note. Significance is denoted with * ($p < .05$) or *** ($p < .001$). No asterisk indicates a non-significant finding.

The last three models all used emotion dysregulation (DERS post-scores) as the mediator, with depression, anxiety, and stress as outcomes. The models with depression (Indirect effect = -2.01 ; $p < .001$; $R^2 = 0.67$; 95% CI[-3.91, -0.38]) and stress (Indirect effect = -1.83; $p < .001$; $R^2 = 0.60$; 95% CI[-3.59, -0.35]) for outcomes were significant and demonstrated mediation (Figure 11). The model with anxiety as an outcome was not significant (95% CI [-1.89, 0.15]).

Figure 11

The Relationship Between Program and Depression (A) and Stress (B) Fully Mediated by Emotion Dysregulation While Keeping Pre-Scores Constant



Note. Significance is denoted with ** ($p < .01$) or *** ($p < .001$). No asterisks indicate a non-significant finding.

The remaining four models all used self-compassion as a mediator (SCS total score). The outcomes were the same as listed for the previous models. Post-scores were used for the mediator and outcome and pre-scores were used as covariates. No mediation was observed in any of these models.

Attention Networks Task

Results of the ANT are depicted in Table 2, which include the mean and standard deviation for both the yoga and workshop groups. Independent Samples *t*-Tests were performed to identify if pre-scores were significantly different between the yoga and workshop groups. There was no significant difference in pre-scores between the yoga and workshop group on Percentage Correct, Mean Reaction Time, Alerting, Orienting, or Executive Attention (all *t*-values < 1.7; $p > .05$).

Table 2

ANT Summary (Mean and Standard Deviation (SD))

	Workshop Program				Yoga Program			
	Pre		Post		Pre		Post	
	M	SD	M	SD	M	SD	M	SD
Percentage Correct	96.7	3.2	95.8	5.5	96.1	3.7	96.6	3.0
Mean Reaction Time (msec)	443.40	53.37	461.68	78.81	440.68	42.36	433.05	49.07
Alerting	45.24	27.50	68.39	52.97	55.96	18.84	56.56	19.26
Orienting	22.81	17.77	22.71	23.03	21.63	11.16	21.17	17.34
Executive Attention	69.33	17.01	63.82	20.62	63.95	20.89	63.24	24.14

To determine if the differences in post-program ANT scores between the yoga and workshop group were based on the program, ANCOVAs were performed (Table 3). Pre-scores were used as covariates. After adjustment for pre-scores, there was a statistically significant difference between the yoga and workshop programs for mean reaction time and Alerting. Mean reaction times were longer post-program in the Workshop group compared to the Yoga group. The Workshop group had higher Alerting post-scores (slower reaction times) compared to the yoga group. The remaining scores were not significant.

Table 3

ANT ANCOVA Summary

	Univariate $F(1, 46)$	p-value	η_p^2
Percentage Correct	2.48	.12	0.051
Mean Reaction Time (msec)	4.58	.038*	0.091
Alerting	9.23	.004**	0.17
Orienting	0.047	.83	0.001
Executive Attention	0.22	.64	0.005

Note. The *F*-statistic applies to the main effect of Group.

*$p < .05$. **$p < .01$

Paired Samples *t*-Tests were performed to identify if any changes in scores between the two time points (before and after the program) were significantly different than zero. For the Yoga group, there were no significant differences between pre and post program scores for any component of attention (all *t*-values < 1.10; $p > .05$). For the Workshop group, only Alerting change scores were significant. Alerting scores significantly increased from pre to post-program

(M = 23.15; 95% CI [8.27, 38.03]; $t(24) = 3.21$; $p = .004$; $d = 0.64$). For the remaining attentional components, post-program scores did not significantly differ from the pre-program scores for all variables (all t-values < 2.0; $p > .05$).

Discussion

The results of the current study indicate that eight weeks of an *asanas*-based online *Hatha* yoga practice leads to quantifiable improvements in mental health and well-being. When comparing participants within groups, the yoga participants demonstrated reduced depression, anxiety, stress, and emotion dysregulation, with enhanced trait mindfulness, interoceptive awareness, and self-compassion. In contrast, the workshop participants demonstrated no significant differences on these variables after the program. When comparing the yoga and workshop groups, participants in the yoga group demonstrated improved stress, trait mindfulness, and interoceptive awareness. Overall, these results suggest that engaging in a short-term *asanas*-based yoga practice produces benefits in multiple areas of psychological functioning and contributes to the growing body of literature that teleyoga interventions feasibly produce positive outcomes (Brosnan et al., 2021).

An important result from the current study was that participants within the yoga group demonstrated improvements in depression and anxiety following the eight-week yoga program. However, this result was not consistent when comparing the yoga with the workshop program. Although this result was consistent with our hypotheses, it is important to note that such improvements are not consistent across all studies. Decreased depression and anxiety scores have been reported in many instances (Falsafi, 2016; Khalsa et al., 2009; Lu et al., 2020; Lundt & Jentschke, 2019; Neukirch et al., 2018; Prathikanti et al., 2017; Snaith et al., 2018; Tekur et al., 2012; Telles et al., 2015); however, other studies have shown no effect of yoga practice (Kiecolt-

Glaser et al., 2010; Papp et al., 2019; Taso et al., 2014; Vollbehr et al., 2018). It is unclear what accounts for these differences. One possible explanation may be expectancy effects; Uebelacker and colleagues (2018) reported that the higher a participant's expectations for the effectiveness of yoga as a treatment for depression associated with lower scores of depressive symptomology. Pre-conceived beliefs about treatment efficacy may be a fascinating area of exploration in the context of yoga as an adjunct therapy. It is unclear whether this factor influenced the current results and what might account for the differences within the yoga group but not when comparing the workshop group.

The current study also suggests that a short-term yoga intervention reduces stress. This finding is consistent with other experiments demonstrating lower stress following a yoga intervention in an RCT. Previous research has noted reductions in perceived stress following yoga interventions featuring *asanas*, *pranayama*, and meditation (Berlowitz et al., 2020; Gard et al., 2012; Yüce & Muz, 2020); other studies have reported similar reductions in stress following interventions consisting only of *asanas* (Lindahl et al., 2016). Effects have also been reported after interventions of variable lengths including eight (Maddux et al., 2018; Neukirch et al., 2018) and 16 weeks (Maddux et al., 2018). Related studies have indicated that yoga provides benefits to individuals diagnosed with Post-Traumatic Stress Disorder (PTSD; Emerson, 2015; Neukirch et al., 2018; van der Kolk et al., 2015). Taken together, these results suggest that participating in an *asanas*-based yoga program contributes to stress reduction, and may be useful in the context of trauma treatment.

The current research indicated a reduction in emotion dysregulation within the yoga program although not when comparing the yoga and workshop groups. These results are consistent with other experiments demonstrating improved emotional regulation after yoga

programs (Daly et al., 2015; Dick et al., 2014; Kobylińska et al., 2018; McMahon et al., 2021; Patel et al., 2018; Rashedi et al., 2021; Willy-Gravley et al., 2021). However, it is unclear whether *asanas* have stronger influences on emotional regulation than other components of yoga. Indeed, Shastri and colleagues (2017) reported improvements in emotional regulation with *pranayama* only. Prior to recommending yoga for emotional regulation, it would be beneficial to determine whether these findings are robust with stricter statistical analyses (i.e., ANCOVAs instead of Paired Samples *t*-tests). Additionally, considering length of intervention and the elements of yoga (i.e., *asanas*, *pranayama*, meditation) that are most helpful to emotional regulation may also provide a more nuanced understanding.

Mediation analyses indicated that the improvements in emotion dysregulation mediated the relationship between intervention and both depression and stress. This finding is consistent with previous research demonstrating a relationship between improvements in emotional regulation and reduced depression (Boden & Thompson, 2015; Compare et al., 2014; Joormann & Gotlib, 2010; Joormann & Vanderlind, 2014; Moriya & Takahasi, 2013) and stress (Miklósi et al., 2014; Thoma et al., 2012). Clinically, emotional regulation strategies and processes are incorporated in Dialectical Behaviour Therapy (DBT; Linehan, 2015) and Emotion-Focused Therapy (EFT; Greenberg, 2004; Johnson, 2019) and have shown success for improving clinical outcomes (DeCou et al., 2019; Wiebe et al., 2016). These therapies incorporate somatic awareness (EFT) and mindfulness (DBT) to improve emotional regulation, two key components of a yoga practice.

The current study also suggests that trait mindfulness is a key factor in yoga's positive effects on mental health. In our experiment, trait mindfulness increased as a result of the yoga intervention. This result aligns with previous research (e.g., Cox & McMahon, 2019; Patel et al.,

2018). Mediation analyses demonstrated that trait mindfulness mediated the relationship between yoga and depression, anxiety, stress, and emotion dysregulation. These results were consistent with our hypotheses and are also in line with a recent finding that the relationship between yoga practice and anxiety was mediated by both mindfulness and avoidance (Boni et al., 2018). Other research has shown that state mindfulness mediates the relationship between mindfulness training and well-being (positive affect, perceived stress, and cortisol levels; Sousa et al., 2021). For example, using an examination of intercorrelations among measures, Park and colleagues (2020) reported that changes in mindfulness, interoceptive awareness, spiritual well-being, and self-compassion were strongly associated with reduced perceived stress in participants who completed a 12-week yoga intervention. Together, these studies suggest that non-judgmental, present-moment attention in a yoga practice assists in reducing anxiety and stress and improving well-being.

An interesting avenue for future research would be to examine whether the influence of mindfulness varies based on the components of yoga that are highlighted in the intervention. For example, Saoji and colleagues (2018) compared mindful attention in participants who completed eight one-hour weekly sessions of an *asanas*-based yoga intervention with participants who completed the same intervention with an additional 20 minutes of *pranayama* each class. These researchers reported that the *asanas* group demonstrated improvements in anxiety and mind wandering, whereas the *asanas* and *pranayama* group also improved mindful attention (Saoji et al., 2018). Combined with the present study, these findings suggest that *asanas* in a yoga practice contribute to mindfulness benefits, although breath regulation added to yoga practice might produce additional advantages.

The current results also indicate that awareness of interoceptive information improves over the course of a yoga intervention and that this increase plays a role in yoga's positive effects on depression. This finding is consistent with our hypothesis and with literature suggesting a direct relationship between interoception and depressive symptoms (Eggart et al., 2019; Emerson, 2015; Harshaw, 2015). That is, awareness of internal bodily processes connects the body with the brain and assists with self-regulation (Paulus & Stein, 2010). These results are also consistent with research indicating a potential therapeutic role for yoga in the treatment of trauma survivors. For example, Mehling and colleagues (2017) reported that practicing movement, breath regulation, and meditation in a 12-week intervention improved MAIA scores in veterans experiencing post-trauma symptoms. Other studies have shown improved interoceptive awareness in participants following a Trauma Sensitive Yoga Intervention (Neukirch et al., 2018) and that somatic interventions are effective in reducing PTSD symptoms (van de Kamp et al., 2019). Given the emphasis on somatic-based therapies to improve mental health outcomes for trauma survivors in clinical settings (Classen et al., 2021; Fisher, 2019; Ogden & Minton, 2000; Payne et al., 2015), this is a valuable area for consideration in the research literature.

Self-compassion was another variable that showed improvement within the yoga group. Yoga typically emphasizes being compassionate and kind with oneself. Several studies have demonstrated improvements in self-compassion after yoga interventions (Alleva et al., 2020; Danucalov et al., 2017; Dyer et al., 2020; Erkin & Aykar, 2020; Patel et al., 2018). Research has also demonstrated that self-compassion derived from yoga practice can lead to clinical benefits. For example, Crews and colleagues (2016) reported improved self-compassion in women who experienced sexual violence following engagement in trauma-sensitive yoga. However, it must

be noted that not all of the above studies focused on *asanas.* Therefore, it is possible that other elements of yoga may contribute to improved self-compassion. Indeed, Falsafi (2016) reported that following eight weeks of mindfulness or yoga, only the mindfulness group significantly improved on self-compassion scores. Future research should investigate the differential contributions of *pranayama,* meditation, and/or a longer *asanas*-based practice on improvements in self-compassion.

Yoga is an attention-based practice; as such, we expected to see improvements in the yoga group. However, results from the ANT were varied. For this study, post-intervention reaction times were higher in the workshop compared to the yoga group. In contrast to this study, lower mean reaction times on attentional tasks following a yoga intervention are consistent with previous research (Cohen et al., 2018, Gothe et al., 2017). Improvements in sustained attention following a yoga intervention in participants with back pain have also been reported (Krishna et al., 2020). Additionally, yoga has been shown to reduce symptoms of Attention Deficit Hyperactive Disorder (ADHD; Chimiklis et al., 2018; Cohen et al., 2018; Jensen & Kenny, 2004). These studies suggest that yoga improves attention, although *asanas* specifically may not contribute to reducing reaction times on attentional tasks.

The results for the Alerting and Executive Attention scores did not support our hypotheses. For the Alerting data, participants in the Workshop group scored higher on Alerting (i.e., Alerting decreased for the Workshop group). This difference is interesting because this scale represents vigilance and alertness to the environment (Fan et al., 2002). The Workshop group demonstrated scores indicative of less alertness to the environment following the program. This result may be related to boredom or Zoom fatigue during the pandemic (particularly for the student participants in this study). Orienting and Executive Attention were not significant for

either group. Orienting represents reflexive attention to a cue; thus, the groups demonstrating no difference is not surprising. However, executive attention is required to resolve attentional conflicts, which is a process that is likely involved in a yoga practice. Furthermore, other studies have demonstrated improved executive attention and/or functioning related to practicing yoga (Gothe et al., 2014). That said, it is possible that other forms of yoga may have produced larger effects on executive functioning. Indeed, other studies have demonstrated improved executive functioning following a *Hatha* yoga intervention involving *asanas*, *pranayama*, and meditation for children, adults, and older adults (Gothe et al., 2016; Gothe et al., 2017: Luu & Hall, 2016). Other studies have indicated that *pranayama* (Schmalzl et al., 2018; Vineetha et al., 2018) and meditation alone (Ainsworth et al., 2013; Chan & Woollacott, 2007) have positive effects on different forms of attention. The current study did not include a formal *pranayama* or meditative component. The closest experience to *pranayama* was pairing inhalations and exhalations with postures and movements. The experience most similar to meditation was participants using present-moment, attentional focus on their own body postures. Therefore, we suggest that formal *pranayama* and/or meditation components may be more important for improvement in executive attention/functioning than *asanas*.

Limitations and Conclusion

There are several limitations to this study. The online format of the study (with all classes being held online during the pandemic) means the results may not generalize to in-person yoga classes. Social connection was not a measure used in the current study, although there is evidence that it is important in group yoga (Donnelly et al., 2019; Park et al., 2020). That said, there is evidence that tele-yoga can lead to improved mental health outcomes such as decreased stress, isolation, and emotion dysregulation (Günebakan & Acar, 2022; Jasti et al., 2020). It is

important to note, however, that these studies did not manipulate social interaction as a construct; therefore, it is unclear how tele-yoga's effectiveness compares to in-person sessions. Another limitation was that our study was not free from blinding or bias. The first author recruited participants, instructed all classes, and analyzed the data. It is possible that this lack of blinding produced bias. To assist with this known bias, participants were randomly assigned to their groups using computer-generated codes, they completed all measures remotely in an online fashion in their own time, and unique participant IDs were used to maintain confidentiality. With regards to the results, it is possible that any bias from myself as both the researcher and instructor regarding yoga's possible effects might have affected interpretation. Another potential limitation is related to the sample used in the study. Participants in this experiment were mostly undergraduate students under the age of 30; socioeconomic information was not collected. It is unclear if the benefits observed in the current research would be seen in other age brackets. It is also unclear whether socioeconomic factors should be a consideration. Additionally, this study did not include a measure of personality traits. It is possible that individuals who seek out and engage in a yoga practice have similarities in personality and that these personality traits influence the effects of yoga practice on mental health. Furthermore, this study had a small sample size, particularly for mediation analyses. Finally, the fact that participants completed the ANT on their own computers (due to COVID-19 restrictions on in-person testing) means that there were likely slight differences in the display characteristics across participants (e.g., differences in screen size). Although this would not affect comparisons of pre- and post-program data, the variability across participants likely affected the quality of the ANT data.

In summary, this study suggests that yoga *asanas* could play a promising role in improving mental health outcomes including depression, anxiety, stress, trait mindfulness,

interoceptive awareness, emotion dysregulation, and self-compassion. Furthermore, this study indicates that several different variables—trait mindfulness, interoceptive awareness, and emotion dysregulation—act as mediators between yoga practice and improvements in depression, anxiety, and stress. Together, these results suggest that several different mechanisms are at work when yoga reduces depressive symptoms, anxiety, and stress levels. Future studies should consider whether these relationships between variables occur when other elements of yoga are used in an intervention (i.e., *asanas*, *pranayama*, and/or meditation). Examining the mechanisms underlying yoga's beneficial effects – and delineating how these mechanisms vary across the different elements of yoga – will provide clinically relevant information for therapists considering yoga as a supplement to traditional psychological therapies.

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Chapter V: General Discussion

I conducted two studies to contribute to the growing body of research investigating the potential psychological benefits of long-term, intermittent, and short-term yoga practice. In this final chapter of my dissertation, I will first discuss the importance of the questionnaire-based results from Chapters 2 and 4. I will then examine the implications of the mediation analyses from both studies. Next, I will describe how this research could be applied to different types of therapy. Finally, I will highlight some of the limitations of my research and discuss future directions for yoga-based investigations.

Overview of Studies

My first study used a cross-sectional design to investigate the differences between long-term and intermittent yoga experience in depression, anxiety, stress, emotion dysregulation, trait mindfulness, interoceptive awareness, self-compassion, and spiritual intelligence. The results of this study indicated that there were benefits for long-term practitioners across all variables, while intermittent practitioners showed higher scores in interoceptive awareness and spiritual intelligence compared to individuals with no experience. Mediation analyses revealed that spiritual intelligence and interoceptive awareness mediated the relationship between yoga experience and emotion dysregulation. Another model demonstrated that trait mindfulness and self-compassion mediated the relationship between yoga experience and emotion dysregulation. These analyses suggest that trait mindfulness, self-compassion, interoceptive awareness, and spiritual intelligence are all factors in yoga's tendency to reduce emotion dysregulation.

My second study used an RCT design to investigate whether an eight-week, *asanas*-based *Hatha* yoga program would improve both psychological and emotional well-being as well

as different components of attention. The self-report questionnaires were the same as the first study, with the exception that no measure of spiritual intelligence was used; an attentional measure was added to this study to examine different components of attention. This study found that participants in the yoga group experienced benefits related to stress, trait mindfulness, interoceptive awareness, and reaction time compared to participants in the workshop group. The yoga program also led to improvements for all self-report variables compared to their pre-program scores. Mediation analyses suggested an important role for trait mindfulness in mediating the relationships between yoga and depression, anxiety, stress, and emotion dysregulation. Interoceptive awareness mediated the relationship between yoga program and depression scores. Finally, emotion dysregulation was a mediator for depression and stress in two separate models. Taken together, both studies suggest that short-term (8-week), intermittent, and long-term practicing of yoga provides psychological, emotional, and/or spiritual benefits. Furthermore, emotion dysregulation, trait mindfulness, interoceptive awareness, self-compassion, and spiritual intelligence appear to be important in understanding how yoga produces benefits related to depression, anxiety, and stress. Finally, trait mindfulness, interoceptive awareness, self-compassion, and spiritual intelligence appear to also be important in understanding how yoga improves emotion dysregulation.

Although the results of these two studies are largely consistent and suggest that yoga leads to improvements in mental health, there were some notable differences across the experiments. Specifically, anxiety and stress levels did not differ between the groups in the cross-sectional study, but the pre- vs. post-yoga program scores were significantly different in the RCT study. There are several possible explanations for the variation in study results. First, the type and length of intervention may be a factor. The RCT included a short-term intervention,

practice was consistent (once weekly), and measures were completed within a short time frame before and following the program. These variables were—by design—not controlled for in the cross-sectional study. However, the cross-sectional study included groups who reported practicing yoga for a minimum of one year (intermittent group) or three years (long-term group). These differences in experiment design could be important because RCTs are considered more robust and many studies, both RCTs and other designs, have suggested that longer practices are associated with greater benefits (Boni et al., 2018; Dunne et al., 2019; Lin et al., 2018; Park et al., 2020; Villemure et al., 2014). The limitations of the current studies (see section below) may have contributed to these differences.

Another difference involves the component(s) of yoga. The cross-sectional study included participants who practiced a variety of schools of yoga with different components. In the RCT study, participants only performed *asanas.* It is possible that other elements of yoga (i.e., *pranayama* and/or meditation) may be more responsible for decreasing depression, anxiety, and stress scores than *asanas*. Previous research has reported promising findings for both *pranayama* and meditation. Participants completing a 12-week intervention of *asanas*, *pranayama*, meditation, and relaxation scored lower on stress reactivity (Park et al., 2020). Participants who practiced breath regulation techniques *in addition to* maintaining a yoga practice had higher mindfulness scores and lower stress and mind wandering scores compared to participants maintaining a yoga practice only (Saoji et al., 2018). An eight-week yoga and compassion *meditation* program demonstrated greater scores on self-compassion, attention, and quality of life compared to no treatment (Danucalov et al., 2017). These studies suggest that *pranayama* and meditation are important parts of a yoga practice; their absence may partially account for the null findings in the RCT study.

Mechanisms and Mediation

Both of the current studies analyzed mechanisms of action for yoga using mediation models. The relationship between yoga practice/experience and depression, anxiety, stress, and emotion dysregulation were mediated by many of the same variables across the two studies. These data indicate that the relationship between yoga and mental health is nuanced.

Trait mindfulness was a mediator in both studies, suggesting it that acts as a mechanism for short, intermittent, and long-term practitioners. This conclusion is supported by previous research in which anxiety was mediated by trait mindfulness and avoidance (the opposite of mindfulness) through yoga practice (Boni et al., 2018) as well as by a study reporting that trait mindfulness (FFMQ scores) mediated the relationship between intervention (yoga vs. controls) and quality of life (Gard et al., 2012). Furthermore, greater mindfulness has been associated with lower emotion dysregulation (Hill & Updegraff, 2012; Sünbül & Güneri, 2019). Collectively, these studies suggest that trait mindfulness influences yoga's positive psychological outcomes at early stages and should be considered in models describing yoga's mechanisms.

Interoceptive awareness was also a mediator in both studies. At this time, I am unaware of literature that has examined the mediating effects of interoceptive awareness in a yoga context. Research with other interventions has shown that interoceptive awareness is an important aspect of self-regulation that may improve mood. For example, interoceptive awareness scores on the MAIA-2 mediated the relationship between somatic symptoms and treatment outcomes for individuals receiving therapy for depressive symptoms (Eggart & Valdés-Stauber, 2021). The authors of this study suggested that attentiveness to the body is important for improving self-regulation, which is used to improve outcomes for depression treatment (Eggart & Valdés-Stauber, 2021). Indeed, greater interoceptive sensitivity has been

linked with lower suppression and led to a superior use of reappraisal emotional regulation strategies (see Pinna & Edwards, 2020 for a review). In the clinical domain, Löffler and colleagues (2018) suggested that emotion dysregulation in people diagnosed with borderline personality disorder (BPD) is due to impaired interoception. Interoception was also reported as a mediator between attachment style and emotional regulation (Ferraro & Taylor, 2021). Taken together, these studies suggest that interoception is a key component in emotional regulation and should be considered in yoga studies.

Emotion dysregulation was both a mediator (RCT study only) and an outcome (both studies) in several mediation analyses. With regards to its role as a mediator in the RCT, other studies are consistent with emotional regulation playing a key role in yoga's ability to reduce depression, anxiety, and stress. This research highlights the importance of attending to and properly interpreting one's emotional responses as well as developing strategies to reduce the intensity of these reactions (Boden & Thompson et al., 2015; Moriya & Takahashi, 2013). Other experiments have shown that emotion reappraisal reduces stress, whereas *suppressing* emotions is an important factor in the development of depression (Compare et al., 2014). These studies suggest that yoga promotes the use of cognitive-based strategies—including accurate identification of one's feelings, generating regulation strategies, attending to emotions, and reappraising emotional reactions—that are aspects of emotional regulation that contribute to reducing depression, anxiety, and stress.

Interestingly, other researchers have found that emotional regulation was a mediator explaining the relationships between mindfulness and self-compassion, a pattern not investigated in the present studies. Emotional regulation mediated the relationship between insecure attachment and mindfulness (Pepping et al., 2013), self-compassion and mental health (Diedrich

et al., 2016; Inwood & Ferrari, 2018), self-compassion and resilience (Scoglio et al., 2015), and PTSD symptom severity and self-compassion (Scoglio et al., 2015). In addition, emotional regulation has been found to be a mediator for an indirect path to post-traumatic growth (Kira et al., 2020). Future research should investigate whether mindfulness and self-compassion are mechanisms that impact emotional regulation, if emotional regulation is a mechanism for improving mindfulness and self-compassion, or if the paths are bidirectional.

There was some evidence for self-compassion as a mediator, although only in the cross-sectional study. This difference between the cross-sectional and RCT studies suggests that it takes longer for yoga to influence self-compassion. Indeed, 12 weeks of Kripalu yoga (a school of yoga that emphasizes self-compassion) demonstrated no significant increases on SCS scores following the program (Park et al., 2020). It is also possible that *pranayama* and/or meditation are necessary for self-compassion to increase, given that this variable was not significant in the *asanas*-based eight-week RCT. Following a four-month residential yoga program including *asanas*, *pranayama*, meditation, and education on how to incorporate yoga into daily life, SCS scores were found to mediate the relationship between intervention and two outcomes, quality of life and perceived stress (Gard et al., 2012). This significant finding could be due to the length/intensity of intervention or the components of yoga included and suggests a key role for self-compassion in more intensive yoga practices. These studies suggest that self-compassion is likely a robust descriptor of yoga's mechanisms for *longer-term* practitioners or for practitioners who include more than *asanas* in their practice.

Finally, spiritual intelligence appears to play a role for intermittent and long-term practitioners, as seen in the cross-sectional study. This result is consistent with previous research indicating that spirituality and emotional regulation are related and influence one another

(Jowkar & Kamali, 2015; Poorakbaran et al., 2019). Indeed, many cultures believe the spirit to be essential to an individual's functioning, and without its consideration, balance can never be achieved (Varambally & Gangadhar, 2012). For example, in Indigenous cultures, the medicine wheel is taught to demonstrate balance, harmony, and connection (McCabe, 2008). When the physical, emotional, mental, and spiritual aspects of a person are in harmony with one another, that indicates that a person has achieved balance. Indigenous cultures use spirituality as part of a whole (mental, emotional, spiritual, physical) for the healing process (Dapice, 2006; McCabe, 2008). Traditional yoga philosophy includes spirituality as a firm foundation for its practice (Feuerstein, 2003; 2008). These philosophies support one of the mediation models in my cross-sectional study: that spiritual intelligence is involved in regulating emotions through practicing yoga.

Implications for Therapy

An increasing number of therapeutic techniques are incorporating somatic components rather than focusing entirely on cognitive and/or behaviour-based therapies. As such, it is possible that yoga could be used as a supplement to a number of different therapeutic orientations. This is particularly true for therapies for the treatment of trauma. Trauma-sensitive yoga (TSY) is a method of practicing yoga that was specifically designed to be used alongside psychotherapy for trauma (Emerson, 2015). In this section of my Discussion, I will describe TSY and discuss how yoga could be embedded within a number of different therapy orientations.

TSY is a type of yoga that focuses on providing open-ended choice for forms and/or breath work. It incorporates mindful attention to the body and language that is inviting rather than commanding (Emerson, 2015). TSY calls *asanas* "forms" to be sensitive to the fact that many trauma survivors have been exploited using poses or postures (Emerson, 2015). Breath

work and yoga forms are not prescribed; rather, they are organic and developed collaboratively in session, with the instructor understanding that people are differentially triggered (Emerson, 2015). Mindfulness in TSY is always directed to what is happening in the body rather than to any other focus of attention (Emerson, 2015). Language is an important consideration in TSY, with the idea that individuals who have experienced trauma have been in situations where there was little to no choice in the moment (Emerson, 2015). For this reason, TSY *invites* individuals to participate (e.g., I invite you to stand up), provides ample options, and allows individuals to lead their own practice when ready. TSY and other forms of trauma-informed yoga have been used successfully to reduce trauma symptoms (Crews et al., 2016; Cushing et al., 2018; Emerson, 2015; Neukirch et al., 2019; Nguyen-Feng et al., 2020; van der Kolk et al., 2014) and may be considered in future studies as a somatic-based therapeutic orientation or as an adjunct to other therapies, such as those described below.

Sensorimotor psychotherapy is a therapeutic approach that uses psychoeducation and body-based practices to teach an individual how to self-regulate and manage their behaviours (Ogden & Fisher, 2015). This orientation uses three main, but not necessarily sequential, phases: developing resources, integrating memories with the present, and attachment (Ogden & Fisher, 2015). The first phase, developing resources, focuses on teaching clients how to develop their own internal resources (i.e., grounding, body alignment, breath work) to use when feeling distressed. The second phase addresses traumatic memories, working to integrate the past with the present by recognizing specifically how the past has impacted their body. The third phase broadens the work from the second phase to identify how a person's past has impacted other areas of their life, such as in relationships (Ogden & Fisher, 2015). This form of therapy uses experiential bodily awareness with a foundation of empathy and a strong therapeutic

relationship, allowing practitioners to understand the body, learn how to self-regulate, reduce affect dysregulation, and generate behavioural changes (Fisher, 2019; Ogden & Fisher, 2015).

Sensorimotor psychotherapy focuses on somatic awareness, teaching people to listen and experience without the need for a verbal narrative (Ogden & Fisher, 2015). This therapeutic approach is attracting attention from researchers and clinicians and is particularly recommended for trauma (van der Kolk, 2015); indeed, this approach has been shown to reduce symptoms of PTSD (Gene-Cos et al., 2016). Improvements have also been reported for anxiety and body awareness (Classen et al., 2020) as well as for depression (Gene-Cos et al., 2016). It is likely that practicing experiential bodily awareness in an empathic environment develops interoceptive awareness, mindfulness, and self-compassion in much the same way the current studies suggest yoga operates. As such, there are many possibilities for incorporating yoga within this orientation. Yoga may be used as an adjunct to sensorimotor psychotherapy, practised alongside it or separately. Yoga may be integrated with some of the exercises already included in sensorimotor psychotherapy, including grounding, body alignment, breath work, and developing bodily awareness. The use of inviting language found in TSY could also be incorporated.

EMDR (Eye Movement Desensitization and Reprocessing) is a therapy that involves reprocessing traumatic memories to reduce or eliminate distress (Shapiro, 2018). The EMDR protocol varies depending on the needs of the client, although the main protocol includes client history (i.e., evaluating if the client is ready and suitable for the therapy), preparation (i.e., explaining the therapy and establishing a safe and calm place for the client), assessment (i.e., determining the target memory), desensitization (i.e., bilateral stimulation during memory recall), installation (e.g., integrating a positive cognition with the processed memory), a body scan, and closure (e.g., assessing safety, visualization of the future; Shapiro, 2018). EMDR has

been shown to be efficacious for children (Lewey et al., 2018; Rodenburg et al., 2009), adolescents (Moreno-Alcázar et al., 2017), and adults (Valiente-Gómez, 2017) and is recommend by the American Psychological Association (2017) for PTSD treatment. EMDR works by having an individual recall their traumatic memory while simultaneously taxing their working memory using bilateral eye movements, dual auditory or tactile stimulation, arithmetic, or calculations (van den Hout & Engelhard, 2012). These are essential to reduce the vividness and detail of the memory during processing. Concurrently, the client develops an association with the memory and a positive cognition (e.g., I am enough) to replace a previously held negative cognition (e.g., I am a failure; van den Hout & Engelhard, 2012). A body scan at the end of reprocessing is used because physical sensations are understood to be present as remnants of the unprocessed memory (Shapiro, 2018). Interestingly, body scans are used extensively in yoga and are referred to as *Yoga Nidra*; these scans involve paying deliberate attention to the body, one area at a time, in an open manner. Thus, a person receiving trauma therapy using EMDR may benefit from developing interoceptive awareness (i.e., through a practice such as yoga) to ensure full processing of their traumatic memories and to more likely improve their long-term outcomes. For instance, yoga may be practiced prior to EMDR to enhance the individual's sensitivity to interoceptive information; alternatively, *Yoga Nidra* may be used instead of EMDR's body scan. The degree to which yoga would be embedded within EMDR programs would be based on the needs of each client.

Emotion-Focused Therapy (EFT) uses an experiential approach to process emotions that emphasizes emotional awareness and acceptance in an effort to generate changes in behaviours (Greenberg, 2004). EFT has been shown to be effective for trauma survivors including individuals with a history of child abuse (Paivio et al., 2010; Paivio & Nieuwenhuis, 2001). An

essential aspect of EFT is focusing on the experience of emotions in the context of an empathic relationship with the therapist (Greenberg, 2017). An aspect of experiential therapy and emotion processing is paying attention to and feeling the bodily sensations associated with one's emotional experience. Yoga may be used in a similar manner with a therapist, where the intention is to engage in a felt experience using postures, breathing techniques, or meditations. Yoga could also be used as an adjunct to EFT to develop interoceptive awareness and emotional regulation skills in preparation for more intensive emotional processing, as typically occurs during the progression of this orientation. As with the aforementioned orientations, we see themes of using mindfulness and interoceptive awareness in processing emotions in an effort to learn self-regulation for individuals experiencing post-trauma symptoms.

Dialectical Behaviour Therapy (DBT) was developed for individuals with chronic suicidality and those diagnosed with BPD (Linehan, 1993). It has shown success in reducing self-harming behaviours and the use of crisis services (DeCour et al., 2019). This form of therapy consists of four main components that help people accept (mindfulness and distress tolerance) or change (emotional regulation strategies and interpersonal effectiveness) their reality (Linehan, 2015). A somatic focus is not emphasized in the therapy; however, mindfulness and explicit emotional regulation skills are taught and have been found to be effective in improving long-term outcomes, reducing distress, and learning self-regulation (Asarnow et al., 2021; Barnicot & Crawford, 2019). Yoga would be helpful in order to add a somatic aspect to the therapy, improving interoceptive awareness and offering another avenue to practice mindfulness. This would accompany the cognitive-based emotional regulation skills taught in DBT. Combined, these techniques may be considered complementary top-down (DBT) and bottom-up (yoga) approaches to treatment.

It should be emphasized that many other components are involved in healing, such as the therapeutic alliance, empathic attunement, culture, interpersonal dynamics, family, and social supports, to name a few (Greenberg, 2017; Ogden & Fisher, 2015). That said, the results of both previous research and this dissertation suggest that yoga could play an important role in many forms of therapy, particularly in the therapeutic treatment of trauma.

Contributions to the Literature

These studies highlight original contributions to the yoga research literature. First, these studies provide novel information on the mechanisms through which yoga may improve mood and emotional regulation. Both studies suggest important roles for trait mindfulness and interoceptive awareness for impacting depression, anxiety, stress, and emotion dysregulation. Second, my first study strongly suggests a role for spiritual intelligence in yoga practices, a construct new to the literature despite its importance to yoga since conception. Third, the RCT suggests that online yoga interventions produce benefits comparable to in-person studies. This finding has been corroborated in a systematic review of 10 studies of *Hatha* yoga (Brosnan et al., 2021) and indicates that teleyoga interventions are valuable for positive mental health outcomes. Lastly, my studies manipulated variables not seen in previous literature. The cross-sectional analysis provides evidence that consistency of practice matters, with greater consistency associated with more benefits. The RCT provides evidence that *asanas* only in a *Hatha* yoga practice are associated with improvements in trait mindfulness, interoceptive awareness, and stress. Together, these findings provide information on how yoga works to improve mood and emotional regulation, spirituality is a construct worth investigating, online interventions are valid considerations, consistency of practice is important, and a movement-focused practice may provide different results compared to other interventions that include other yoga limbs.

The studies in this dissertation corroborate some of Gard and colleagues' (2014) proposed model of yoga as a self-regulatory practice. The results of my studies suggest that yoga may provide a means for both bottom-up and top-down mechanisms (interoceptive awareness, trait mindfulness, and self-compassion) for self-regulation and improvement of psychological health (depression, anxiety, stress, and emotional regulation). It is important to note that the questionnaires in my studies did not differentiate between bottom-up and top-down mechanisms, with statements related to both being included in the same questionnaire. The authors proposed that yoga strengthens sensory experiences when attention is focused on the body, breath, or mind, allowing an individual to experience the Self as the body rather than separate (Gard et al., 2014). My studies did not investigate this possibility, although the results would support this explanation. This model may be improved by adding spirituality, because the cross-sectional analysis suggests it is important and beneficial for intermittent and long-term practitioners.

Limitations and Future Directions

Although my studies contribute novel information to the research literature on yoga, there were several limitations. The cross-sectional study, by design, did not manipulate yoga experience. Therefore, we must be cautious about assuming that any significant effects are due to yoga experience alone. Second, the RCT study in this dissertation did not include a measure of spiritual intelligence. It would have been interesting to determine whether spiritual benefits were seen after a relatively brief (eight-week) intervention. Another limitation was that both studies used self-report measures rather than objective measures of each variable. Future research could incorporate, for instance, heart rate detection for interoceptive awareness or cortisol levels for stress. A mixed-methods design should also be considered, using qualitative and quantitative measures. Studies including neuroimaging data would add comprehensiveness as well.

An additional limitation was that both studies were in an entirely online format due to the pandemic. It is possible that scores on the DASS-42 were elevated due to the pandemic. This issue would have been particularly noteworthy for the RCT study, where the participants were primarily university students. Recent research has shown that depression, anxiety, and stress scores in undergraduate students were significantly greater compared to pre-pandemic population means (Kaparounaki et al., 2020). In the RCT, if these scores were elevated due to the pandemic, a longer intervention may have been required to see differences. For the cross-sectional study, the pandemic likely reduced the opportunity for people to attend studio classes, and self-motivated at-home yoga practice may not be sufficient to counteract psychological difficulties from the pandemic. Alternatively, it is possible that a yoga intervention may have a greater effect during a pandemic, since mental health in yoga participants have been found to be higher and positively impacted by yoga interventions (Boni et al., 2018; de Manicor et al., 2016). Comparing data in this dissertation to post-pandemic in-person studies would allow us to determine if the results are generalizable.

An additional area requiring further investigation relates to top-down and bottom-up processes. Top-down processing is regulated by neural networks that control executive functioning, affective reappraisal, and the inhibition of maladaptive responses, (Gard et al., 2014). In contrast, bottom-up processing involves neural regions receiving input from ascending pathways, such as sensory and autonomic channels (Gard et al., 2014). The questionnaires used in the current research included statements related to both bottom-up and top-down processes, oftentimes within the same questionnaire. For example, item 23 on the MAIA states, “When I feel overwhelmed I can find a calm place inside” (Mehling et al., 2012), which is a cognitive, top-down strategy used to self-regulate one’s emotions. In contrast, item 24 states, “When

something is wrong in my life I can feel it in my body" (Mehling et al., 2012), which illustrates a felt sensory experience through a bottom-up process. It would be interesting to identify how bottom-up and top-down processes contribute to yoga's benefits independent of one another.

Furthermore, personality features were not included. Previous research found that participants with lower conscientiousness and extraversion benefited from one year or more of yoga experience compared to less than one year (Kobylińska et al., 2018). This suggests that personality traits may have an impact on the length of practice required for people to see benefits. Future research should therefore consider assessments of personality factors (e.g., the "Big Five"; McCrae & Costa, 1987) to further delineate how different personality traits influence the magnitude of yoga's benefits.

Additionally, each study was composed of different populations and sample sizes. Fifty-five adult Canadian participants under the age of 32 were included in the RCT and 454 adult American participants with mean age of 46 were included in the cross-sectional study. Identifying if these results translate across generations, from children to older adults, would be an interesting area to explore. Missing in both studies was a social measure to understand how interpersonal relationships and sense of community might affect outcomes. These are especially important when considering other cultures that highly value community, such as Indigenous cultures (McCabe, 2008). Finally, most participants in both studies identified as White, whereas yoga is an Eastern spiritual tradition. Yoga may be practiced under a variety of philosophical frameworks with a variety of intentions, which may have an influence on outcomes. Including other cultures or greater variation in the cultural background of participants would be helpful to determine whether my findings are generalizable.

Summary

In conclusion, these two studies suggest that yoga is beneficial for psychological health, interoceptive awareness, and spirituality. Both experiments indicated that yoga practice helps individuals improve mindfulness and interoceptive awareness. Longer-term practice also improved emotion dysregulation, self-compassion, and spiritual intelligence. My studies demonstrated that yoga may not necessarily be beneficial for anxiety at the outset, although improvements to depression and stress were detected in the RCT. Additionally, the results of the cross-sectional study suggest that spirituality may be an important factor to incorporate into future studies of yoga's benefits. Taken together, my studies highlight the complex underpinnings of yoga's benefits through a psychological and spiritual lens that honours its ancient traditions.

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Appendix A

Yoga Program

The yoga program consisted of eight classes, subdivided into four parts – *Pawanmuktasana* Series I (Table A), *Suriya Namaskar* (Table B), variable *asanas* (Tables C1 through C8), and *savasana* (end of Tables C1 through C8). The first two parts and the final part of each class were the same. The third part of the class varied each week. The fourth part of the class consisted of the same final posture, *savasana*, and is included at the end of Tables C1 through C8. Please note that minor variations were introduced in each class to accommodate student needs.

Table A

Pawanmuktasana *Series I*

Posture (English)	*Asana* (Sanskrit)	Description
Base position	*Prarambhik Stihi*	Seated position, legs outstretched
Toe bending	*Padanguli Naman*	Inhale to bend toes forward, exhale bending toes backward*
Ankle bending	*Goolf Naman*	Inhale to flex feet at the ankle, exhale to bend feet forward*
Ankle rotation	*Goolf Chakra*	Rotate ankles clockwise and counter clockwise*
Knee bending	*Janu Naman*	Inhale to straighten leg, exhale bend knee while holding thigh*
Ankle crank	*Goolf Ghoornan*	Rotate foot around ankle with your hand while resting ankle on thigh
Hip rotation	*Shroni Chakra*	Rotate hip at the knee in a circle while resting foot on thigh*
Full butterfly	*Poorna Titali Asana*	Bring soles of feet together
Hand clenching	*Mushtika Bandhana*	Inhale stretch hands, exhale make a tight fist*
Wrist bending	*Manibandha Naman*	Inhale to flex wrists upwards, exhale to bend wrists downwards*
Wrist rotation	*Manibandha Chakra*	Rotate wrists clockwise and counter clockwise
Elbow bending	*Kehuni Naman*	Inhale to bend arms at the elbows and touch shoulders, exhale extend arms*
Shoulder rotation	*Skandhas Chakra*	Touch hands to shoulders, rotate arms forwards and backwards*
Neck movements	*Greeva Sanchalana*	Various movements*

Note. Listed in the above table are the series of 14 simple *asanas* that served as a warm-up to each class. This series is considered anti-rheumatic in traditional yoga. Movements of the ankle, knee, hip, elbow, and shoulder joints were practiced in a manner that promotes relaxation and awareness on physical movement with integrated breathing (Saraswati, 2008). Yoga practitioners specifically recommend these *asanas* for beginners or individuals unable to engage in vigorous exercise. Sanskrit translations were obtained from Saraswati (2008).

*Indicates a movement that involved integrated breathing. Integrated breathing is a movement that is linked to breath control. For example, inhaling to flex the wrists and exhaling to bend the wrists downwards is considered a movement with integrated breathing.

Table B

Suriya Namaskar *Series (Translation: Sun Salutations)*

Posture (English)	*Asana* (Sanskrit)	Description
Mountain pose	*Tadasana/Samasthitihi*	Standing posture, arms at sides
Extended pose	*Utthita Tadasana*	Standing posture, arms above head
Standing forward bend	*Uttanasana*	Bend forward, touch toes
Half lift	*Ardha uttanasana*	Bend forward, lift halfway up
Four-limbed staff pose/Eight-point salute	*Chataranga Dandasana/Ashtanga Namaskar*	Plank position/plank with knees on mat
Upward-facing dog	*Urdhva Mukha Svanasana*	Backbend with palms and legs on mat
Downward-facing dog	*Adho Mukha Svanasana*	Forward bend with palms and feet on mat
Half lift	*Ardha Uttanasana*	Bend forward, lift halfway up
Standing forward bend	*Uttanasana*	Bend forward, touch toes
Extended pose	*Utthita Tadasana*	Standing posture, arms above head
Prayer pose	*Pranamasana*	Standing posture, palms at heart

Note. This traditional sequence is represented in a series of flow movements that were practiced following the *Pawanmuktasana* series. These series of postures were practiced three or four times in a row each class, serving as a warm up and traditional beginning to a yoga class. Sanskrit translations were obtained from Saraswati (2009).

Table C1

Class One Asanas *of The Yoga Program*

Posture (English)	*Asana* (Sanskrit)	Description
Mountain pose	*Tadasana/Samasthitihi*	Standing posture, arms at sides
Tree pose	*Vrikshasana*	Balancing posture, foot resting on leg
Standing forward bend	*Uttanasana*	Bend forward, touch toes
Downward facing dog	*Adho Mukha Svanasana*	Forward bend with palms and feet on mat
Warrior II pose	*Virabhadrasana II*	Standing posture for whole body strength, stamina, and flexibility
Cat/cow	*Marjari-asana*	Tabletop position with back warm-up movements
Bridge pose	*Setu Bandhasana*	Beginner backbend pose
Happy baby	*Ananda Balasana*	Counter pose for backbend
Universal spinal twist	*Shava Udarakarshanasana*	Reclined, restorative twist to relieve tension in spine and hips
Corpse pose	*Savasana*	Reclined restorative posture

Note. The theme for the first class was beginner's mind (Sanskrit: *Shoshin*). This Buddhist concept refers to the notion that approaching each moment with an open curiosity of newness promotes humility. Participants were encouraged to remember this concept as they progressed through the series.

Table C2

Class Two Asanas *of The Yoga Program*

Posture (English)	*Asana* (Sanskrit)	Description
Head to knee pose	*Janu Sirsasana*	Seated forward bend to stretch legs
Seated forward bend	*Paschimottanasana*	Seated forward bend to stretch legs
Chair pose	*Uttkatasana*	Standing posture to build muscle strength
Warrior II pose	*Virabhadrasana II*	Standing posture for whole body strength, stamina, and flexibility
Extended side angle pose	*Utthita Parsvakonasana*	Standing posture for whole body strength, stamina, and flexibility
Triangle pose	*Trikonasana*	Standing posture for core and leg strength
Standing wide-legged forward bend	*Prasarita Padottanasana*	Forward bend for flexibility and relaxation
Child pose	*Balasana*	Seated forward fold for restoration
Fish pose	*Matsyasana*	Reclined back bend for chest and shoulder opening
Happy baby	*Ananda Balasana*	Counter pose for backbend
Universal spinal twist	*Shava Udarakarshanasana*	Reclined, restorative twist to relieve tension in spine and hips
Corpse pose	*Savasana*	Reclined restorative posture

Note. The theme for the second class was the breath. Participants were encouraged to draw attention to their breath and focus on linking breath with body movements, or focusing on their breath when holding postures.

Table C3

Class Three Asanas *of The Yoga Program*

Posture (English)	*Asana* (Sanskrit)	Description
Mountain pose	*Tadasana/Samasthitihi*	Standing posture, arms at sides
Upward salute	*Urdhva Hastasana*	Standing posture for whole body stretching
Tree pose	*Vriksasana*	Balancing posture, foot resting on leg
Crocodile pose	*Makarasana*	Restorative reclined posture
Child's pose	*Balasana*	Seated forward fold for restoration
Reclined butterfly pose	*Supta Baddhakonasana*	Reclined hip-opening relaxation posture
Bridge pose	*Setu Bandhasana*	Beginner backbend pose
Happy baby	*Ananda Balasana*	Counter pose for backbend
Universal spinal twist	*Shava Udarakarshanasana*	Reclined, restorative twist to relieve tension in spine and hips
Legs up the wall	*Viparita Karani*	Reclined, restorative posture for relaxation (given as an option for students)
Corpse pose	*Savasana*	Reclined restorative posture

Note. The theme for the third class was self-compassion. Participants were encouraged to treat their bodies with compassion and acceptance by modifying postures, accepting limitations and differences in abilities, and practicing all movements with kindness and compassion.

Table C4

Class Four Asanas *of The Yoga Program*

Posture (English)	*Asana* (Sanskrit)	Description
Mountain pose	*Tadasana/Samasthitihi*	Standing posture, arms at sides
Warrior I pose	*Virabhadrasana I*	Standing posture for whole body strength, stamina, and flexibility
Standing goddess pose	*Utkata Konasana*	Standing posture for leg strength, stamina, and flexibility
Standing wide-legged forward fold	*Prasarita Padottanasana*	Forward bend for flexibility and relaxation
Dancer's pose	*Natarajasana*	Balancing posture for stamina, strength, and flexibility
Cat/cow	*Marjari-asana*	Tabletop position with back warm-up movements
Sphinx pose	*Salamba Bhujangasana*	Backbend warm-up
Locust pose	*Salabhasana*	Backbend for strength
Bow pose	*Dhanurasana*	Intense backbend for strength
Child pose	*Balasana*	Seated forward fold for restoration
Shoulder release	*No Sanskrit*	Reclined shoulder stretch
Bridge pose	*Setu Bandhasana*	Beginner backbend pose
Happy baby	*Ananda Balasana*	Counter pose for backbend
Universal spinal twist	*Shava Udarakarshanasana*	Reclined, restorative twist to relieve tension in spine and hips
Corpse pose	*Savasana*	Reclined restorative posture

Note. The theme for the fourth class was love. Participants were encouraged to show the same love to their selves as they would to someone they love.

Table C5

Class Five Asanas *of The Yoga Program*

Posture (English)	*Asana* (Sanskrit)	Description
Head-to-knee pose	*Janu Sirsasana*	Seated forward bend to stretch legs
Seated forward bend	*Paschimottanasana*	Seated forward bend to stretch legs
Tree pose	*Vriksasana*	Balancing posture, foot resting on leg
Warrior III pose	*Virabhadrasana III*	Standing posture for whole body strength, stamina, and flexibility
Standing wide-legged forward bend	*Prasarita Padotanasana*	Forward bend for flexibility and relaxation
Dancer's pose	*Natarajasana*	Balancing posture for stamina, strength, and flexibility
Sequence	*Chataranga*	Series of postures in *Suriya Namaskar* used to set up subsequent pose
Side plank	*Vasisthasana*	Arm balancing posture for strength and stamina
Child's pose	*Balasana*	Seated forward fold for restoration
Marichy (son of Brahma) pose III	*Marichyasana III*	Seated twist to relieve tension in shoulders, spine, and hips
Reclined butterfly	*Supta Baddakonasana*	Reclined hip-opening relaxation posture
Sequence	*No Sanskrit*	Rock knees side to side
Corpse pose	*Savasana*	Reclined restorative posture

Note. The theme for the fifth class was grounding. Participants were read an excerpt from Kabat-Zinn (1994) at the beginning of the class. To paraphrase, the half-page passage discusses being in the moment, which allows us to open possibilities and wake from a dream-like state full of "thoughts, fantasies, and impulses" (p. xv) to a mindful, grounded existence (Kabat-Zinn, 1994, p. xiv - xv).

Table C6

Class Six Asanas *of The Yoga Program*

Posture (English)	*Asana* (Sanskrit)	Description
Head to knee pose	*Janu Sirsasana*	Seated forward bend to stretch legs
Seated forward bend	*Paschimottanasana*	Seated forward bend to stretch legs
Warrior II	*Virabhadrasana II*	Standing posture for whole body strength, stamina, and flexibility
Dancer's pose	*Natarajasana*	Balancing posture for stamina, strength, and flexibility
Garland pose	*Malasana*	Balancing posture to open hips
Downward facing dog	*Adho Mukha Svanasana*	Forward bend with palms and feet on mat
Lizard/Dragon pose	*Utthan Pristhasana*	Posture to open hips
Downward facing dog	*Adho Mukha Svanasana*	Forward bend with palms and feet on mat
Royal pigeon	*Raja Kapotasana*	Seated pose to open hips
Child pose	*Balasana*	Seated forward fold for restoration
Frog pose	*Mandukasana*	Posture to open hips
Cow face	*Gomukhasana*	Seated counter pose to hip openers
Marichy (son of Brahma) pose III	*Marichyasana III*	Seated twist to relieve tension in shoulders, spine, and hips
Corpse pose	*Savasana*	Reclined restorative posture

Note. The theme for the sixth class was stillness. This class opened with a description on how stilling the mind comes when the themes from the previous five classes are practiced. Participants were read quotes by Lao Tzu and Haruki Murakami. To paraphrase, silence is considered a source of strength that when the noise of the mind is quieted, an individual is able to hear and listen deeply.

Table C7

Class Seven Asanas *of The Yoga Program*

Posture (English)	*Asana* (Sanskrit)	Description
Mountain pose	*Tadasana*	Standing posture, arms at sides
Tree pose	*Vriksasana*	Balancing posture, foot resting on leg
Warrior II pose	*Virabhdrasana II*	Standing posture for whole body strength, stamina, and flexibility
Triangle pose	*Trikonasana*	Standing posture for core and leg strength
Garland pose	*Malasana*	Balancing posture to open hips
Equestrian pose	*Ashva Sanchalanasana*	Standing posture similar to a lunge that strengthens the legs and lengthens the spine
Lizard pose	*Utthan Pristhasana*	Posture to open hips
Downward facing dog	*Adho Mukha Svanasana*	Forward bend with palms and feet on mat
Royal pigeon pose	*Raja Kapotasana*	Seated pose to open hips
Child's pose	*Balasana*	Seated forward fold for restoration
Cow face	*Gowmukhasana*	Seated counter pose to hip openers
Universal spine twist	*Shava Udarakarshanasana*	Reclined, restorative twist to relieve tension in spine and hips
Corpse pose	*Savasana*	Reclined restorative posture

Note. The theme for the seventh class was gratitude. This class served as a dedication to participants for completing the program. The concept was a lesson in the act of both giving and receiving gratitude towards and from others. Participants were read a quote from Oliver Sacks.

Table C8

Class Eight Asanas *of The Yoga Program*

Posture (English)	*Asana* (Sanskrit)	Description
Standing forward fold	*Uttanasana*	Bend forward, touch toes
Extended side angle pose	*Utthita Parsvakonasana*	Standing posture for whole body strength, stamina, and flexibility
Standing wide-legged forward bend	*Prasarita Padottanasana*	Forward bend for flexibility and relaxation
Dancer's pose	*Natarajasana*	Balancing posture for stamina, strength, and flexibility
Standing goddess pose	*Utkata Konasana*	Standing posture for leg strength, stamina, and flexibility
Downward-facing dog	*Adho Mukha Svanasana*	Forward bend with palms and feet on mat
Royal pigeon pose	*Raja Kapotasana*	Seated pose to open hips
Child's pose	*Balasana*	Seated forward fold for restoration
Cat/cow pose	*Marjari-asana*	Tabletop position with back warm-up movements
Cow face	*Gowmukhasana*	Seated counter pose to hip openers
Bridge pose	*Setu Bandhasana*	Beginner backbend pose
Happy baby	*Ananda Balasana*	Counter pose for backbend
Universal spine twist	*Shava Udarakarshanasana*	Reclined, restorative twist to relieve tension in spine and hips
Corpse pose	*Savasana*	Reclined restorative posture

Note. The theme for the eighth class was peace. Participants were read a quote from the Dalai Lama. Well wishes were sent to participants and gratitude for their participation, and a hope that some of the themes and concepts practiced throughout the series may generalize to other areas of their life.

Appendix B

Workshop Series

The workshop series consisted of eight classes, designed with a similar format. A PowerPoint presentation was given to participants over Zoom, which included pictures, videos, displaying websites, and verbal instruction. The content of each class differed and were based on translated Sanskrit texts (*The Bhagavad Gita*, 1983; *The Upanishads*, 2007), compilations of the history and philosophy of yoga (Feuerstein, 2003; 2008; 2011a; 2013), and explanations of the methods of yoga (Saraswati, 2008).

Table A

Workshop Series Overview

Class	Title	Content
1	What is Yoga?	• Semantic origins of the word, "yoga" • History of yoga's development including influences from shamanism, the pre-classical period, and the post-classical period • Overview of important Sanskrit text contributions • Description of traditional vs. modern yoga and their differing intentions
2	Patañjali's Eight Limbs of Yoga	• Description of Patañjali's Classical Yoga • Elaboration on the eight limbs comprising classical yoga and its underlying philosophy
3	"Happiness and the Moral Foundations of Yoga"	• Named after Chapter 4 in Feuerstein (2011a) • Explanation of how to obtain happiness according to traditional yoga • Detailed description on developing moral foundations through two ethical branches of Patañjali's yoga
4	"Principal Branches of Yoga"	• Named after Chapter 2 in Feuerstein (2011a) • Description of six Hindu branches of yoga from the pre-classical era and one modern interpretation
5	Yoga and the Body	• Description of various body practices in yoga including *asanas*, purification practices, bandhas, and mudras
6	Yoga and the Breath	• Philosophy behind the focus on breath control in yoga • Description of *koshas*, *pranayama*, *prana*, *nadis*, and techniques
7	Concentration and Meditation	• Explanation of concentration and meditation in a yogic context including *pratyahara*, *dharana*, *nada yoga, taraka-yoga*, visualization, creative meditation, and imagination • Description of obstacles to meditation, overcoming obstacles, and misleading experiences to discern from enlightenment
8	The Yogic Path to Self-Transcendence vs. Modern Yoga	• Based on Chapters 12 and 13 in Feuerstein (2011a)

Appendix C

Depression, Anxiety, and Stress Scales (DASS-42)

(*Lovibond & Lovibond, 1995*)

Please read each statement and select a number 0, 1, 2, or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any one statement. This assessment is not intended to be a diagnosis. If you are concerned about your results in any way, please speak with a qualified health professional.

0 = Did not apply to me at all

1 = Applied to me to some degree or for some of the time

2 = Applied to me to a considerable degree or for a good part of time

3 = Applied to me very much or most of the time

_____1. I found myself getting upset by quite trivial things.

_____2. I was aware of dryness of my mouth.

_____3. I couldn't seem to experience any positive feelings at all.

_____4. I experienced breathing difficulty (e.g., breathlessness or excessively rapid breathing in the absence of physical exertion).

_____5. I just couldn't seem to get going.

_____6. I tended to over-react to situations.

_____7. I had a feeling of shakiness (e.g., legs going to give way).

_____8. I found it difficult to relax.

_____9. I found myself in situations that made me so anxious I was most relieved when they ended.

_____10. I felt that I had nothing to look forward to.

_____11. I found myself getting upset rather easily.

_____12. I felt that I was using a lot of nervous energy.

_____13. I felt sad and depressed.

_____14. I found myself getting impatient when I was delayed in any way (e.g., lifts, traffic lights, being kept waiting).

_____15. I had a feeling of faintness.

_____16. I felt that I had lost interest in just about everything.

_____17. I felt I wasn't worth much as a person.

_____18. I felt that I was rather touchy.

_____19. I perspired noticeably (e.g., hands sweaty) in the absence of high temperatures or physical exertion.

_____20. I felt scared without any good reason.

_____21. I felt that life wasn't worthwhile.

_____22. I found it hard to wind down.

_____23. I had difficulty in swallowing.

_____24. I couldn't seem to get any enjoyment out of the things I did.

_____25. I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).

_____26. I felt down-hearted and blue.

_____27. I found that I was very irritable.

_____28. I felt I was close to panic.

_____29. I found it hard to calm down after something upset me.

_____30. I feared that I would be 'thrown' by some trivial but unfamiliar task.

_____31. I was unable to become enthusiastic about anything.

_____32. I found it difficult to tolerate interruptions to what I was doing.

_____33. I was in a state of nervous tension.

_____34. I felt I was pretty worthless.

_____35. I was intolerant of anything that kept me from getting on with what I was doing.

_____36. I felt terrified.

_____37. I could see nothing in the future to be hopeful about.

_____38. I felt that life was meaningless.

_____39. I found myself getting agitated.

_____40. I was worried about situations in which I might panic and make a fool of myself.

_____41. I experienced trembling (e.g., in the hands).

_____42. I found it difficult to work up the initiative to do things.

Appendix D

Difficulties in Emotion Regulation Scale (DERS)

(*Gratz & Roemer, 2004*)

Please indicate how often the following 36 statements apply to you by writing the appropriate number from the scale below (1-5) in the box alongside each item.

1	2	3	4	5
Almost never	Sometimes	About half the time	Most of the time	Almost always
(0-10%)	(11-35%)	(36-65%)	(66-90%)	(91-100%)

_____1. I am clear about my feelings.

_____2. I pay attention to how I feel.

_____3. I experience my emotions as overwhelming and out of control.

_____4. I have no idea how I am feeling.

_____5. I have difficulty making sense out of my feelings.

_____6. I am attentive to my feelings.

_____7. I know exactly how I am feeling.

_____8. I care about what I am feeling.

_____9. I am confused about how I feel.

_____10. When I’m upset, I acknowledge my emotions.

_____11. When I’m upset, I become angry with myself for feeling that way.

_____12. When I’m upset, I become embarrassed for feeling that way.

_____13. When I’m upset, I have difficulty getting work done.

_____14. When I’m upset, I become out of control.

_____15. When I’m upset, I believe that I will remain that way for a long time.

_____16. When I’m upset, I believe that I’ll end up feeling very depressed.

_____17. When I’m upset, I believe that my feelings are valid and important.

_____18. When I’m upset, I have difficulty focusing on other things.

_____19. When I’m upset, I feel out of control.

_____20. When I’m upset, I can still get things done.

_____21. When I’m upset, I feel ashamed with myself for feeling that way.

_____22. When I’m upset, I know that I can find a way to eventually feel better.

_____23. When I’m upset, I feel like I am weak.

_____24. When I’m upset, I feel like I can remain in control of my behaviours.

_____25. When I’m upset, I feel guilty for feeling that way.

_____26. When I’m upset, I have difficulty concentrating.

_____27. When I’m upset, I have difficulty controlling my behaviours.

_____28. When I’m upset, I believe that there is nothing I can do to make myself feel better.

_____29. When I’m upset, I become irritated with myself for feeling that way.

_____30. When I’m upset, I start to feel very bad about myself.

_____31. When I’m upset, I believe that wallowing in it is all I can do.

_____32. When I’m upset, I lose control over my behaviours.

_____33. When I’m upset, I have difficulty thinking about anything else.

_____34. When I’m upset, I take time to figure out what I’m really feeling.

_____35. When I’m upset, it takes me a long time to feel better.

_____36. When I’m upset, my emotions feel overwhelming.

Appendix E

Five-Facet Mindfulness Questionnaire (FFMQ)

(Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006)

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

1	2	3	4	5
never or very rarely true	rarely true	sometimes true	often true	very often or always true

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

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

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

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

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

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

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

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

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

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

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

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

_____ 13. I am easily distracted.

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

(continued on next page)

_____ 15. I pay attention to sensations, such as the wind in my hair or sun on my face.

_____ 16. I have trouble thinking of the right words to express how I feel about things

_____ 17. I make judgments about whether my thoughts are good or bad.

_____ 18. I find it difficult to stay focused on what's happening in the present.

_____ 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.

_____ 20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.

_____ 21. In difficult situations, I can pause without immediately reacting.

_____ 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.

_____ 23. It seems I am "running on automatic" without much awareness of what I'm doing.

_____24. When I have distressing thoughts or images, I feel calm soon after.

_____ 25. I tell myself that I shouldn't be thinking the way I'm thinking.

_____ 26. I notice the smells and aromas of things.

_____ 27. Even when I'm feeling terribly upset, I can find a way to put it into words.

_____ 28. I rush through activities without being really attentive to them.

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

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

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

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

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

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

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

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

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

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

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

Appendix F

Multidimensional Assessment of Interoceptive Awareness – 2nd Edition (MAIA-2) Survey

(Mehling, Acree, Stewart, Silas, & Jones, 2018)

Below you will find a list of statements. Please indicate how often each statement applies to you generally in daily life.

Select one number for each statement from 1-5.

1=never 2=rarely 3=sometimes 4=often 5=always.

_____1. When I am tense I notice where the tension is located in my body.

_____2. I notice when I am uncomfortable in my body.

_____3. I notice where in my body I am comfortable.

_____4. I notice changes in my breathing, such as whether it slows down or speeds up.

_____5. I ignore physical tension or discomfort until they become more severe.

_____6. I distract myself from sensations of discomfort.

_____7. When I feel pain or discomfort, I try to power through it.

_____8. I try to ignore pain.

_____9. I push feelings of discomfort away by focusing on something.

_____10. When I feel unpleasant body sensations, I occupy myself with something else so I don't have to feel them.

_____11. When I feel physical pain, I become upset.

_____12. I start to worry that something is wrong if I feel any discomfort.

_____13. I can notice an unpleasant body sensation without worrying about it.

_____14. I can stay calm and not worry when I have feelings of discomfort or pain.

_____15. When I am in discomfort or pain I can't get it out of my mind.

_____16. I can pay attention to my breath without being distracted by things happening around me.

_____17. I can maintain awareness of my inner bodily sensations even when there is a lot going on around me.

_____18. When I am in conversation with someone, I can pay attention to my posture.

_____19. I can return awareness to my body if I am distracted.

_____20. I can refocus my attention from thinking to sensing my body.

_____21. I can maintain awareness of my whole body even when a part of me is in pain or discomfort.

_____22. I am able to consciously focus on my body as a whole.

_____23. I notice how my body changes when I am angry.

_____24. When something is wrong in my life I can feel it in my body.

_____25. I notice that my body feels different after a peaceful experience.

_____26. I notice that my breathing becomes free and easy when I feel comfortable.

_____27. I notice how my body changes when I feel happy / joyful.

_____28. When I feel overwhelmed I can find a calm place inside.

_____29. When I bring awareness to my body I feel a sense of calm.

_____30. I can use my breath to reduce tension.

_____31. When I am caught up in thoughts, I can calm my mind by focusing on my body/breathing.

_____32. I listen for information from my body about my emotional state.

_____33. When I am upset, I take time to explore how my body feels.

_____34. I listen to my body to inform me about what to do.

_____35. I am at home in my body.

_____36. I feel my body is a safe place.

_____37. I trust my body sensations.

Appendix G

Self-Compassion Scale (SCS)

(Neff, 2003a)

HOW I TYPICALLY ACT TOWARDS MYSELF IN DIFFICULT TIMES

Please read each statement carefully before answering. To the left of each item, indicate how often you behave in the stated manner, using the following scale:

Almost never **Almost always**

1 2 3 4 5

_____ 1. I'm disapproving and judgmental about my own flaws and inadequacies.

_____ 2. When I'm feeling down I tend to obsess and fixate on everything that's wrong.

_____ 3. When things are going badly for me, I see the difficulties as part of life that everyone goes through.

_____ 4. When I think about my inadequacies, it tends to make me feel more separate and cut off from the rest of the world.

_____ 5. I try to be loving towards myself when I'm feeling emotional pain.

_____ 6. When I fail at something important to me I become consumed by feelings of inadequacy.

_____ 7. When I'm down and out, I remind myself that there are lots of other people in the world feeling like I am.

_____ 8. When times are really difficult, I tend to be tough on myself.

_____ 9. When something upsets me I try to keep my emotions in balance.

_____ 10. When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.

_____ 11. I'm intolerant and impatient towards those aspects of my personality I don't like.

_____ 12. When I'm going through a very hard time, I give myself the caring and tenderness I need.

_____ 13. When I'm feeling down, I tend to feel like most other people are probably happier than I am.

_____ 14. When something painful happens I try to take a balanced view of the situation.

_____ 15. I try to see my failings as part of the human condition.

_____ 16. When I see aspects of myself that I don't like, I get down on myself.

_____ 17. When I fail at something important to me I try to keep things in perspective.

_____ 18. When I'm really struggling, I tend to feel like other people must be having an easier time of it.

_____ 19. I'm kind to myself when I'm experiencing suffering.

_____ 20. When something upsets me I get carried away with my feelings.

_____ 21. I can be a bit cold-hearted towards myself when I'm experiencing suffering.

_____ 22. When I'm feeling down I try to approach my feelings with curiosity and openness.

_____ 23. I’m tolerant of my own flaws and inadequacies.

_____ 24. When something painful happens I tend to blow the incident out of proportion.

_____ 25. When I fail at something that's important to me, I tend to feel alone in my failure.

_____ 26. I try to be understanding and patient towards those aspects of my personality I don't like.

Appendix H

The Spiritual Intelligence Self-Report Inventory (SISRI-24)

(*King, 2008*)

The following statements are designed to measure various behaviours, thought processes, and mental characteristics. Read each statement carefully and choose which **one** of the five possible responses best reflects you by circling the corresponding number. If you are not sure, or if a statement does not seem to apply to you, choose the answer that seems the best. Please answer honestly and make responses based on how you actually are rather than how you would like to be. The five possible responses are:

0 – Not at all true of me | 1 – Not very true of me | 2 – Somewhat true of me | 3 – Very true of me | 4 – Completely true of me

For each item, circle the **one** response that most accurately describes you.

1.	I have often questioned or pondered the nature of reality.	0	1	2	3	4
2.	I recognize aspects of myself that are deeper than my physical body.	0	1	2	3	4
3.	I have spent time contemplating the purpose or reason for my existence.	0	1	2	3	4
4.	I am able to enter higher states of consciousness or awareness.	0	1	2	3	4
5.	I am able to deeply contemplate what happens after death.	0	1	2	3	4

6. It is *difficult* for me to sense anything other than the physical and material.	0	1	2	3	4
7. My ability to find meaning and purpose in life helps me adapt to stressful situations.	0	1	2	3	4
8. I can control when I enter higher states of consciousness or awareness.	0	1	2	3	4
9. I have developed my own theories about such things as life, death, reality, and existence.	0	1	2	3	4
10. I am aware of a deeper connection between myself and other people.	0	1	2	3	4
11. I am able to define a purpose or reason for my life.	0	1	2	3	4
12. I am able to move freely between levels of consciousness or awareness.	0	1	2	3	4
13. I frequently contemplate the meaning of events in my life.	0	1	2	3	4
14. I define myself by my deeper, non-physical self.	0	1	2	3	4
15. When I experience a failure, I am still able to find meaning in it.	0	1	2	3	4
16. I often see issues and choices more clearly while in higher states of consciousness/awareness.	0	1	2	3	4

17. I have often contemplated the relationship between human beings and the rest of the universe.	0	1	2	3	4
18. I am highly aware of the nonmaterial aspects of life.	0	1	2	3	4
19. I am able to make decisions according to my purpose in life.	0	1	2	3	4
20. I recognize qualities in people which are more meaningful than their body, personality, or emotions.	0	1	2	3	4
21. I have deeply contemplated whether or not there is some greater power or force (i.e., god, goddess, divine being, higher energy, etc.)	0	1	2	3	4
22. Recognizing the nonmaterial aspects of life helps me feel centered.	0	1	2	3	4
23. I am able to find meaning and purpose in my everyday experiences.	0	1	2	3	4
24. I have developed my own techniques for entering higher states of consciousness or awareness.	0	1	2	3	4