# A COMPARISON OF STRESS RELIEF METHODS: HATHA YOGA VERSUS MEDITATION AND WALKING

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By

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## ABSTRACT

Yoga has become an increasingly popular form of exercise in the West with promising findings of improved physiological and psychological well-being. However, researchers have expressed concern in its efficacy in a clinical setting. This study aimed to provide further evidence regarding yoga's therapeutic efficacy in comparing both meditation and light cardio, along with further understanding whether the breathing (pranayama) or physical (asana) aspects of yoga contribute to its effectiveness. Participants ($N$ = 48) were randomly assigned into either yoga, meditation, or walking conditions and completed five sessions at 30 minutes in length over the course of the week. Differences in reduced levels of stress, anxiety, and depression, along with improvements of mood between yoga, meditation, and walking interventions were assessed through a one-way ANOVA. Significant differences were not found between the interventions, failing to reject the null hypotheses. Considerations were made regarding yoga's efficacy as a complementary therapy where other therapies, such as meditation or other forms of exercise, may be more appropriate. Limitations and implications for future research were also discussed.

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ACKNOWLEDGMENTS

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# CHAPTER 1

# INTRODUCTION

## Yoga and Mental Health

Although the evidence is clear regarding the immense physiological and psychological health benefits of regular exercise, only an alarming 21% of the U.S. population meets the standard exercise requirements for overall health and fitness of 150 minutes a week of moderate intensity exercise (Centers for Disease Control and Prevention, 2014). Yoga, an embodiment of various ancient practices originally derived from India, has become an increasingly popular form of exercise in the West due to its assertion in treating and preventing musculoskeletal conditions (Iyengar, 1979), illness and disease (Birdee et al., 2008), and improving mental health (Streeter et al., 2007). Yoga incorporates many "limbs" or stages such as postures (asana), control of the breath (pranayama), concentration (dhārana), meditation (dhyāna), and moral commandments (yama) in its traditional practice (Iyengar, 1979). Hatha yoga, which is one of the most commonly utilized forms of yoga in the West, is primarily comprised of asana being performed alongside pranayama in its practice (Birkel, 2000, as cited in Clay, Lloyd, Walker, Sharp, & Pankey, 2005).

Many studies have compared yoga to other forms of exercise (Harinath et al., 2004; Oken et al., 2006; Streeter et al., 2010) or to meditation and mindfulness techniques (Clay et al., 2005; Saxena & Saxena, 2009) with promising findings of greater

improved quality of life, physical performance, mood, and reduced levels of anxiety. Despite these findings, a handful researchers have described further interest in understanding the underlying mechanisms of yoga that embody its therapeutic efficacy (Cramer, Lauche, Langhorst, & Dobos, 2013; Pilkington, Kirkwood, Rampes, & Richardson, 2005; Shapiro et al., 2007). The aim of the present study is to examine the differences between hatha yoga to a comparably physically demanding exercise (walking) or comparable form of meditation. This is done to further understand which aspects of yoga, physical or meditative, have greater therapeutic efficacy and if yoga has a synergistic effect on psychological well-being compared to the other treatments.

There is a considerable amount of evidence on the therapeutic effect of practicing yoga for those who are struggling with various anxiety and depressive disorders (Cramer et al., 2013; Khalsa, Shorter, Cope, Wyshak, & Sklar, 2009). In a review of the literature, Pilkington et al. (2005) found that yoga interventions were potentially beneficial in reducing depressive symptomatology. Yoga was further discussed as an attractive alternative treatment to traditional methods due to its evidence in reducing depressive symptoms without the use of pharmaceutical drugs and relative safety in its practice. Findings were similar in a recent meta-analysis of yoga for the treatment of depression, such that patients who practiced yoga received short-term improvements in depressive and anxious symptoms with little to no adverse side effects (Cramer et al., 2013). Additionally, yoga appeared to be an effective treatment for individuals with higher levels of depression and in patients with depressive disorders.

Some researchers believe the key to yoga's efficacy is its profound effects in altering neurochemicals in the brain. It has been hypothesized that yoga's efficacy in

treating depressive and anxiety disorders may be due to increased brain GABA levels, which is the main inhibitory neurotransmitter that is responsible for regulating many physiological and psychological processes (Cryan & Kaupmann, 2005). The increase in GABA levels reduce symptom frequency in these disorders by creating a sedative effect, allowing for greater emotional and behavioral regulation. Interestingly, when examining GABA levels through magnetic resonance spectroscopic imaging (MRSI), veteran yoga practitioners who participated in a 60-minute yoga session focused on asanas experienced a 27% increase in the yoga practitioner's GABA levels when compared to those who participated in 60 minutes of reading (Streeter et al., 2007). A curious finding was that the yoga practitioners experienced an increase in GABA levels while being told to withhold meditative breathing, except during asana. 55 minutes of the 60 minutes were spent doing asana, suggesting that the increase in GABA levels were more likely due to the physical aspect of holding poses versus the meditative aspect. In a more recent study by Streeter et al. (2010), participant's mood, anxiety, and GABA levels were measured after various time points after completing 60-minute yoga sessions or 60 minutes of a metabolically matched walking session. Results indicated that participants in the yoga intervention had significantly higher thalamic GABA levels, improved mood, and decreased anxiety than those in the walking intervention. Similar to findings from Cryan and Kaupann (2005), it has been suggested that practicing yoga's relaxing nature activates the parasympathetic nervous system (Jeter, Slutsky, Singh, & Khalsa, 2015). This in turn has been shown to mediate the release of GABA levels in the brain that can be helpful in regulating neurological disorders (Schoepp, 2001), further suggesting a

therapeutic advantage of practicing yoga due to neurocognitive changes after a session (Streeter et al., 2007; Streeter et al., 2010).

The positive effects associated with the practice of yoga have been observed in many different populations. Professional musicians, who commonly experience high rates of performance anxiety and musculoskeletal disorders, experienced less performance anxiety, depression, and improved mood at the end of a two-month yoga program (Khalsa et al., 2009). Furthermore, elderly participants who participated in six-month yoga interventions were found to have improved sleep quality, overall health status, and a reduction in depressive symptoms (Chen et al., 2009), as well as an overall improvement in quality of life and physical measures when compared to a walking group (Oken et al., 2006). Additionally, adolescents with eating disorders who practiced yoga for eight weeks in addition to their standard care experienced less eating disorder symptoms, decreased anxiety, and maintained BMI levels when compared to standard treatment alone (Carei, Fyfe-Johnson, Breuner, & Brown, 2009).

Interestingly, yoga may not be beneficial in certain populations. School-aged girls who practiced mindfulness, the act of being purposely conscious of the present moment, alongside yoga over an eight-week duration reported significantly higher appraisal of stress levels and greater frequency of coping than the control group (White, 2012). It was suggested that participants who practiced the mindful-based yoga became more cognizant of daily stressors, which may have proved to be harmful to their overall well-being. However, this may be due to the emphasis of mindfulness, as a similar study that instead utilized a more traditional yoga practice found children reporting greater

emotional balance and reductions in stress related behavior such as aggression, helplessness, and fear (Stueck & Gloeckner, 2005).

Overall, the therapeutic evidence of yoga on mental health is robust across a variety of populations. Yoga appears to have the most significant effect on stress related disorders such as anxiety and depression, although its practice has also shown to be effective in improving sleep quality and overall mood after its practice. Furthermore, the integration of yoga alongside conventional therapies appears to be an effective and low-cost treatment option, with evidence supporting its efficacy in improving overall mood and remission rates in depressed individuals taking antidepressants (Shapiro et al., 2007), and improved cognitive function in severely depressed patients on antidepressants (Sharma, Das, Mondal, Goswami, & Gandhi, 2006).

## Exercise and Mental Health

Physical exercise, which is the leisurely form of exerting physical demands on the body unrelated to domestic or occupational tasks, has a considerable amount of evidence as not only a viable tool in anxious and depressive symptoms, but can also serve as a buffer to physiological and emotional consequences of psychological stressors (Salmon, 2001). Although many different forms of exercise are practiced, aerobic exercises that are of moderate intensity, such as walking, seem to have the greatest therapeutic efficacy as exercise programs (Dishman & Buckwort, 1996). Furthermore, it was found in a population-based study by De Moor, Stubbe, Boomsma, and Geus (2006) that exercisers were on average less depressed, anxious, and neurotic than non-exercisers, suggesting that those who exercise regularly are less prone to developing stress and mood disorders.

Although it is clear that exercise has positive effects on mental health, the intensity and duration of exercise can be highly variable depending on the individual. Despite the evidence that a workout must be sufficiently demanding to elicit positive mood change, extended bouts of aerobic exercise can be less effective in improving one's overall mood (Rocheleau, Webster, Bryan, & Fraizer, 2003). An overly demanding exercise routine, especially for a sedentary individual, may lead to an unpleasant experience and an increase in negative mood, which may prevent future adoption of a regular exercise routine (Salmon, 2001). However, it has been noted that only about 10 minutes of moderate aerobic exercise is necessary to improve one's mood, with diminishing effects after about 20 minutes, suggesting that short bouts of moderate intensity exercises are sufficient for improving mental health (Hansen, Stevens, & Coast, 2001).

For most Americans, walking tends to be the most commonly utilized form of aerobic exercise that can meet the requirements for moderate physical activity (Eyler, Brownson, Bacak, & Housemann, 2003). Daily walking can increase individual's mood by reducing feelings of anger and hostility, which may be due to an increase of activity in the parasympathetic nervous system (Sakuragi & Sugiyama, 2006), which follows similar thinking to describe the calming effects of yoga practice (Jeter et al., 2015). Interestingly, after a four-month exercise intervention of approximately 40 minutes of walking, three times a week, participants who were diagnosed with major depressive disorder were found to have comparable remission rates as those taking standard antidepressant medication (Blumenthal et al., 2007). Overall, regular exercise appears to be a reliable preventative therapeutic option for mood regulation and overall wellbeing.

Although, for the layperson or an individual with predisposed risk factors such as cardiovascular disease, beginning a physical exercise program without medical supervision may prove dangerous or even counterproductive for physical and mental health (Paluska & Schwenk, 2000; Strohle, 2008). For those where a physical exercise regimen may be potentially hazardous or even impossible, other alternative therapies that are not as physically intensive may prove invaluable for improving one's overall well-being and mental health.

## Meditation and Mental Health

Meditation, which is often synonymous with mindfulness, is the processes of being intentionally aware of the present moment without judgement (Kabat-Zinn, 2009). In clinical practice and research, the manualized approach to meditation is mindfulness-based stress reduction (MBSR), which similar to traditional meditation, focuses on the gradual acquisition of non-deliberate awareness of perceptions, physical sensations, emotions, and thoughts (Grossman, Niemann, Schmidt, & Walach, 2003). In healthy individuals, MBSR has shown to be effective in reducing stress, ruminative thinking, and trait anxiety, as well as increasing one's empathy and self-compassion (Chiesa & Serretti, 2008). Furthermore, MBSR is especially effective for the management of stress in various clinical populations, such as cancer and chronic pain, and has shown to be effective in improving depression, anxiety, quality of life, along with health parameters of physical well-being, sensory pain, and medical symptoms (Grossman et al., 2003).

Although the task of meditating is seemingly simple, it is powerful enough to elicit physiological changes in the brain. Newberg et al. (2001) scanned the brain activity of experienced Tibetan Buddhist meditators before and after an hour-long meditation

session. It was found that meditating was associated with greater activity in the frontal lobes and noticeable changes in the activity of the sensorimotor cortex, thalami, and midbrain, suggesting that meditation may activate a complex set of central nervous system interactions in its practice. In a similar study, participants without any prior meditation experience underwent four days of meditation training, with brain activity being measured before and after the training as participants were asked to attend to breath (ATB) for 20 minutes (Zeidan, Martucci, Kraft, Mchaffie, & Coghill, 2014). Results indicated that state anxiety was significantly reduced after every session where subjects meditated after receiving mindfulness training, but that ATB alone was not significant enough to elicit any reductions in state anxiety, which may be explained due to a noticeable change in brain activity involved in sensory evaluations that is associated with the default ruminative thought processes, which in turn may combat negative disposition. Similarly, Farb et al. (2010) found that participants who underwent mindfulness meditation training experienced less brain activity when viewing sad images when compared to a control group. This in turn led to less reactivity to sadness and depression scores that were produced by these images, suggesting greater emotional regulation in those who practice mindful meditation.

Interestingly, when MBSR and aerobic exercise were compared as alternative treatments for individual with social anxiety disorder, both treatments had equivalent efficacy in reducing depressive and anxious symptoms along with increased subjective wellbeing (Jazaieri, Goldin, Werner, Ziv, & Gross, 2012). Although, since physical exercise can be difficult or impossible for some, it is intriguing that a sedentary practice such as MBSR elicits identical therapeutic benefits as aerobic exercise and raises further

questions into the differences in alternative treatment options for mental health. But overall, it is evident that traditional forms of meditation and more conventional methods such as MBSR have the potential as alternative therapies for reducing stress, anxiety, and depression, along with improvements in subjective quality of life and wellbeing without the included physical aspect associated with other alternative therapies.

## Physiological Differences Between Yoga and Exercise

Although yoga and physical exercise are both effective alternative therapies for a variety of physical and psychological parameters (Ross & Thomas, 2010), one of the biggest concerns with yoga practice is that most types of yoga are not physically intensive enough meet the recommendations of physical activity for improving or maintaining physical health or cardiovascular fitness (Hagins, Moore, & Rundle, 2007). In part, this may be due to less maximum oxygen consumption ($VO_2R$) required in a typical yoga session than an exercise that is moderately intensive, such as walking. When compared to walking on a treadmill at 3.5 MPH, which is considered adequate amount of exercise for promoting cardiovascular fitness, those participating in a hatha yoga routine only required 14.50% $VO_2R$ where walking on a treadmill required 44.8% $VO_2R$, indicating that yoga may not be intensive enough to meet standards for cardiovascular performance (Clay et al., 2005). Although, this finding can be highly variable due to the many different forms of yoga practice. Sun salutations, which involve a sequence of 12 asanas, can be practiced in quick succession as a cardiovascular exercise and as a transition to other asanas. Yoga routines that incorporated consistent use of the sun salutation postures, such as vinyasa yoga, were found to be sufficiently contributable to increasing $VO_2R$ to improve cardiovascular fitness (Hagins et al., 2007). Furthermore,

it was found that long-term practice of yoga does improve cardiovascular performance on some level (Harinath et al., 2004). However, long-term aerobic exercise seems to be much more effective at ultimately improving cardiovascular performance than even more cardiovascularly demanding forms of yoga such as vinyasa (Blumenthal et al. 1989).

Besides the moderate effect yoga has on cardiovascular performance, practicing hatha yoga over the period of several weeks appears to be highly beneficial for increasing overall muscular strength, endurance, and flexibility (Tran, Holly, Lashbrook, & Amsterdam, 2001). Patients diagnosed with rheumatoid arthritis, who commonly experience difficulties with most conventional exercise programs, found that after practicing 8-weeks of yoga, they had significantly reduced arthritic activity, levels of fatigue, and greater ability to reduce their medications (Badsha, Chhabra, Leibman, Motfi, & Kong, 2009). In addition, middle aged women who were struggling with walking due to osteoarthritis and low-back pain, which are common musculoskeletal disorders, had significantly greater improvements in mobility and balance after an 8-week yoga intervention (Ulger & Yagli, 2010). These improvements in musculoskeletal function did not translate to professional musicians who also practiced yoga for 8 weeks, although this may be due to a younger and healthier population (Khalsa et al., 2009). However, continued practice of yoga in healthy individuals may reduce future disposition of musculoskeletal disorders, as many non-Western societies who adopt yogic related sleeping positions tend to have less musculoskeletal problems (Tetley, 2000). Because of these findings, yoga postures are becoming commonly utilized in most Western athletic programs to treat and prevent musculoskeletal injuries (Raub, 2002).

## Physiological Differences Between Yoga and Exercise

Although meditation, mindfulness, and attending to breath (ATB) through pranayama is common in most yoga practices, it has been demonstrated that practicing asana without incorporating pranayama is still sufficient in increasing GABA levels (Streeter et al., 2007). Similar to the benefits of GABA on neurological disorders (Schoepp, 2001), this increase in GABA can regulate the body's reaction to stressors that may exacerbate certain physiological disorders as well, such as asthma and hypertension (Herman & Cullinan, 1997).

Practicing meditation has been shown to have a similar effect on GABA levels, which in turn improves one's sense of focus through an activation of the autonomic nervous system to regulate distracting stimuli and perceived stressors (Newberg & Iversen, 2003). Interestingly, this shift in brain activity has relatively little to do with $VO_2R$, as a hatha yoga routine requires approximately 4,300% greater $VO_2R$ than sitting meditation, despite that overall oxygen consumption is only approximately 100% greater than meditating (Clay et al., 2005). Thus, it is unlikely that any form of sedentary meditation will make any significant impact on cardiovascular fitness.

The poor impact meditation has on cardiovascular performance is further illustrated in a study by Saxena and Saxena (2009), where asthmatic patients either practiced static Omkara yoga, which emphasizes strong breathing and chanting, or standard meditation. It was found that standard meditation was not significant in improving lung function, but that the deep breathing and chanting from Omkara yoga elicited significant improvement in participant's lung quality and consequently reduced asthmatic symptoms. Similarly, MBSR was found to significantly improve asthmatic patient's quality of life and stress levels, but did not improve lung functioning (Pbert et

al., 2012). Compared to meditation, practicing yoga does seem to improve lung functioning in asthmatic patients, despite that it is relatively limited in its effectiveness (Manocha, Marks, Kenchington, Peters, & Salome, 2002). However, the implementation of meditative aspects is a core principal in yoga and relatively easy to combine harmoniously in practice. Although there appears to be some variability between the physiological factors of yoga and meditation, the differences observed between the two therapies seem minimal when compared to a static yoga routine.

The evidence regarding the immense psychological benefits of yoga is clear, suggesting that regular yoga practice is an effective alternative therapy for reducing stress, anxiety, depression, and improving overall mood (Cramer et al., 2013; Streeter et al., 2010). Improvements in these psychological parameters are coupled with the physiological benefits of improved strength and flexibility (Tran et al., 2001), which has shown to be helpful in individuals who with musculoskeletal disorders (Ulger & Yagli, 2010). Furthermore, there is some evidence in regard to preventative care for future musculoskeletal problems in healthy individuals (Raub, 2001) and as an effective therapy for reducing symptomatology in asthmatic individuals (Saxena and Saxena, 2009).

Although yoga appears to be a relatively safe treatment option, concerns have been raised over the inability of yoga to meet the recommendations of physical activity for improving cardiovascular fitness (Clay et al., 2005). However, incorporating sun salutation poses have shown to be sufficient in contributing to overall cardiovascular fitness (Hagins et al., 2007), suggesting that specific yoga programs can be utilized for individuals wanting to improve cardiovascular performance. Furthermore, since physical exercise in itself has been shown to be effective in reducing anxiety, depression, and

stress (Salmon, 2001), adding moderate intensity cardio activity (such as walking) to a yoga program should be sufficient in maintaining the optimum therapeutic effects of both therapies while minimizing the risk of injury or over exhaustion, which may be detrimental to one's overall health (Pauluksa & Schwent, 2000; Strohle, 2008).

Similar to meditation, the sedative effects associated with the practice of yoga appear to be due to complex changes in brain activity, such as increases in GABA production (Cryan & Kaupmann) and a shift of activation into the parasympathetic nervous system (Newberg & Iversen, 2003). Although mindfulness meditation or MBSR can be an invaluable tool for reducing anxiety, depression, managing stress, and improving quality of life (Grossman et al., 2003) for individuals where physical exercise may be dangerous or even impossible, it is evident that yoga is more effective than standard meditation in most psychological parameters with the added benefit of improving various physiological parameters as well.

In conclusion, in most physiological and psychological parameters, it appears that yoga may be the most effective therapy option in reducing stress, anxiety, depression, and improving overall mood when compared to waking or meditation.

## The Present Study

In the present study, participants will engage in five sessions of either yoga, meditation, or walking sessions throughout the course of a week. Repeated measures will be used to compare the three exercise groups regarding their levels of stress, anxiety, depression, and mood, along with mindfulness and perceived physical affect measures. To further understand the underlying mechanisms of yoga and to compare its efficacy against the other therapies, it is hypothesized that individuals who practice hatha yoga will have

greater reductions in self-reported stress, anxiety, and depression, along with improvements in overall mood than those who practice either a comparable form of meditation or physical exercise (walking) over the course of one week. It is also hypothesized that those who practice yoga or walking will experience greater self-reported perceptions of health status compared to those who meditated over a one-week period. Lastly, it is further hypothesized that those who practice yoga or meditation will experience greater improvements in self-reported measures of mindfulness than those who participated in walking over a one-week period. Thus, the aim of the current study will be to further understand the underlying processes of yoga by comparing the practice of yoga to similar therapies that may mimic the breathing aspects (pranayama) and physical aspects (asana) of yoga, along with a comparison of all three therapies together to explore the possibilities of future integration of alternative therapies that can be easily utilized for the treatment and prevention of a variety of psychological and physiological parameters that are necessary for maintaining overall well-being.

# CHAPTER 2

# METHOD

## Participants

All participants ($N$ = 48) were CSUF students, with a majority being female (68.8%) and Hispanic (39.5%), with ages ranging from 18-30 ($M$ = 21.63, $SD$ = 2.57). All participants were recruited through either the CSUF SONA psychology research participation system or through an optional classroom assignment. Nearly half of all participants considered themselves physically active and practiced in regular exercise in the past six months (56.3%). Between gender, approximately half of all men (53%) and women (54%) considered themselves physically active and practiced in regular exercise in the past six months.

## Measures

Data collection for the variables of interest were conducted through various self-report questionnaires, which were administered to all study participants.

### Depression, Anxiety, and Stress Levels

The short form version of the Depression Anxiety Stress Scales (DASS-21) is an effective tool for measuring the dimensions of depression, anxiety, and stress through a rating scale of 0 (“did not apply to me at all”) to 3 (“applied to me very much, or most of the time”) of 21 statements ($\alpha$ = .93) that correspond to negative affect one has felt over the past few weeks such as “I found it hard to wind down” and “I tended to over-react to

situations" that correspond to an overall negative affect score, with 7 questions each relating to depression (α = .88 ), anxiety (α = .82 ), or stress (α = .90) subscales (Henry & Crawford, 2005). The DASS-21 has similar validity to the original DASS and was utilized in the study to reduce completion time of all required measures.

**Affect**

The Positive and Negative Affect Scale – Expanded Form (PANAS-X) utilizes 60 affect adjectives rated on a 5-point Likert scale (1 = very slightly, or not at all, 5 = extremely) to provide scores for general dimensions of positive and negative affect, along with other related subscales such as fear, self-assurance, shyness, and surprise. For this study, only the general dimensions of affect were utilized, which included 10 adjectives relating to positive affect (α = .83) such as "active" and "inspired" along with 10 adjectives relating to negative affect (α = .85) such as "afraid" and "hostile" (Watson & Clark, 1999). Scores from these 20 adjectives were used to measure overall affect. Test-retest reliability for the current sample for both the positive affect (.81) and negative affect (.82) subscale were found to be acceptable.

**Mindfulness**

The Freiburg Mindfulness Inventory (FMI) is a scale designed to measure mindfulness on a scale of 1 ("rarely') to 4 (almost always) of 30 statements (α = .93) such as "I am open to the experience of the present moment" and "I watch my feelings without getting lost in them" that correspond to recent mindfulness experience along with other relevant constructs such as self-awareness and disassociation. For this study, the short-version of the FMI was utilized, which consists of 14 statements taken from the original FMI with similar reliability (α = .86) (Walach, Buchheld, Buttenmuller, Kleinknecht, &

Schmidt, 2006). Test-retest reliability for the current sample FMI (.77) was found to be adequate.

### Self-Reported Perceptions of Health Status

The 12-Item Short-Form Health Survey (SF-12) is a multipurpose short-form measure of health status that measures the dimensions of physical and mental health through 12 statements such as "During a typical day, my health limits me from climbing several flights of stairs" and "I have been feeling calm and peaceful." (Ware, Kosinski, & Keller, 1996). For this study, an adaptation of the SF-12 will be used that utilizes a 5-point Likert type scale (1= strongly agree, 5 = strongly disagree) to analyze possible changes in one's physical or mental state during the study. Although all questions were presented to participants to maintain the integrity of the survey, only the physical health subscale of the SF-12 was analyzed. The test-retest reliability for the current sample of the physical health subscale of the SF-12 was found to be poor (.57), which may have been due to the adaptation of the scale to a 5-point Likert scale.

## Procedure

The study was conducted as a one-week repeated measures trial. Undergraduate students who were recruited through the CSUF SONA system were given participation credit required for their class. Students who participated through the optional classroom assignment were awarded extra credit. In addition, all participants who completed the study were also included in a raffle to receive one of three $25 visa gift cards and thanked for their time. Consent forms were given and signed by all participants. All participants were required to be over the age of 18, have no underlying physical or medical

conditions, and have access to a quiet room and computer or smartphone to complete the interventions.

Eligible participants were given a link to an online questionnaire that included all the measures and demographic questions. After completing the initial questionnaire, participants were randomly selected into either the yoga, meditation, or walking group. Although all participants had an equal chance of being placed into each group, an even group randomization option, available through the survey distribution software, was used to aid in creating equal group sizes. For example, once a participant was randomly placed into the meditation group, the next participant could only be placed into either the yoga or walking condition.

Each group was given written instructions (see Appendix A) on how to practice their prospective therapy and given any resources necessary (videos, examples, etc.) to conduct sessions throughout the week. All participants practiced a total of five sessions of either yoga, meditation, or walking, 30 minutes a day, over the course of a week. Participants were given a visual schedule (see Appendix D) of when to practice the therapy as an example and encouraged to create their own schedule to complete the five sessions throughout the week. Furthermore, participants were asked to refrain from other forms of exercise (greater than a brisk walk) for the duration of the study. Once the participants completed five sessions, they were sent the final questionnaire, debriefed, and thanked for their participation.

Participants in the yoga group were given a video of a 30-minute hatha yoga program conducted by a certified yoga instructor (Parker, 2013). The program begins with various warm-up and stretches in supine positions, including twists, raising and

dropping of the leg, and moving onto the hands and knees into cow and cat pose. Afterwards, sets of Katu Pranam (Greetings to Katu) are performed, which consist of 14 different poses starting with a basic sitting position that flow into poses such as caterpillar and downward dog. Various other poses such as warrior II, reverse warrior, back bend, bridge, and happy baby are done successively as the program finishes into shavasana (corpse pose). Participants were asked to follow the video program to the best of their abilities in a quiet and comfortable environment, and further informed they may modify or skip any pose that is too difficult to perform. If participants became comfortable with the yoga program, they were encouraged to set a timer for 30 minutes and conduct the yoga program without the video. If participants begin to experience any physical discomfort during the study that may be attributable to the yoga intervention, they were highly encouraged to contact the principal investigator immediately and discontinue their participation in the study.

Like the yoga group, participants in the meditation group were given basic instructions (see Appendix B) on how to conduct a mediation session along with a recording of an MBSR sitting meditation program. Because many participants may be new to meditation, the complete 30-minute meditation session was broken into two 15-minute segments. Participants were given a selection of 15-minute meditation videos to practice twice throughout the day, typically being in the morning and night. Throughout the recordings, there are gaps of silence to allow the listener to focus on the meditation, attending to breath, and being mindful of the present moment. Participants must be sitting in a chair, completely engaged in the meditation session, and not being doing additional tasks for the duration of the session. If participants became comfortable with

the meditation programs throughout the study, they were encouraged to set a timer for 15 minutes and conduct the mediation programs without the recording.

Participants in the walking group were given instructions (see Appendix C) to walk in 30-minute sessions at approximately 2.5 mph. A video demonstrating someone walking 2.5 mph was given to all participants for reference. All participants were encouraged to walk in different environments and discouraged from counting their typical commute to classes as the 30-minute walking session. Furthermore, participants were encouraged to set a timer for 15 minutes so that they have ample time to return to their original location by the end of the session.

To ensure participants completed their assigned interventions, time spent on the video was recorded and assessed for the proper length of time required to complete the intervention. Any data from participants who spent less than 30 minutes watching a video for a total of five sessions prior to taking their final questionnaire was not recorded for the final analysis. Although participants were encouraged to practice the meditation or yoga intervention without the recording, none of the participants indicated they did so on the final questionnaire.

## Analyses

Analyses were conducted on all participants who completed the study in its entirety. Three analyses were conducted on the data. The first analysis was a one-way ANOVA to compare the means between the three experimental conditions (yoga, meditation, and walking) by utilizing gain scores calculated by the pre-test and post-test data from the seven DVs of interest (stress, anxiety, depression, positive affect, negative

affect, mindfulness, and self-perceived physical health). Assumptions for the one-way ANOVA were assessed before conducting the proposed analysis.

# CHAPTER 3

# RESULTS

## Assumptions

The assumption of independence of observations appeared to not be violated due to each participant being exclusive to their respective intervention group. Next, absence of outliers were analyzed by transforming all the gain scores to z-scores and analyzing the box-and-whisker plots. After examining the z-scores and box-and-whisker plots, it was concluded that three cases violated the assumption. Of these three cases, one was in the walking condition and the other two were in the meditation condition. However, the outlying cases were not removed to the already low sample size and with z-scores being at the relatively low range of -3.2 to 3.7. Despite these few outliers, the distribution of scores appeared to be normal through examination of histograms and Q-Q plots, meeting the assumption of normality. Lastly, the assumption of homogeneity of variance was assessed. Although group sizes were unequal between the yoga ($n$ = 11), walking ($n$ = 18), and meditation ($n$ = 19) groups and may be a concern for the homogeneity of variance, the results from Levine's test ($p > .05$) indicated that none of the measures of interest violated the assumption.

## One-Way ANOVA Between Intervention

A one-way ANOVA was used to analyze whether there were significant differences between the intervention groups (yoga, meditation, and walking) under the

measures of interest. Results from the ANOVA revealed that the main effect of intervention type was not significant for measures of stress, $F(2, 47) = 1.73$, $p = .188$, anxiety, $F(2, 47) = 1.04$, $p = .361$, depression, $F(2, 47) = .56$, $p$ .573, positive affect, $F(2, 47) = .36$, $p = .700$, negative affect, $F(2, 47) = .10$, $p = .901$, mindfulness, $F(2, 47) = .65$, $p = .529$, and perceived physical health, $F(2, 47) = .18$, $p = .834$ (see Table 1 for means). Although the results were not statistically significant, effect sizes were examined between the variables of interest and found to be small, if not negligible ($\eta < .10$). Due to the non-significant results of the one-way ANOVA, post-hoc tests were not further assessed.

Table 1 Participant Characteristics by Intervention

| | Yoga Group | | Walking Group | | Meditation Group | | | |
|---|---|---|---|---|---|---|---|---|
| Measure | *M* | *SD* | *M* | *SD* | *M* | *SD* | *F*(2, 47) | *p* |
| DASS - Stress | -.09 | .54 | -.29 | .49 | -.02 | .38 | 1.73 | .188 |
| DASS - Anxiety | -.23 | .44 | -.15 | .38 | -.03 | .36 | 1.04 | .361 |
| DASS - Depression | -.30 | .60 | -.20 | .46 | -.11 | .39 | .56 | .573 |
| PANAS - Positive Affect | .22 | .44 | .22 | .42 | .06 | .86 | .36 | .700 |
| PANAS - Negative Affect | -.34 | .70 | -.41 | .75 | -.30 | .67 | .10 | .901 |
| Freidburg Mindfulness Inventory | .10 | .40 | .18 | .46 | .19 | .42 | .65 | .529 |
| SF-12 - Physical Health | -.11 | .35 | -.19 | .46 | -.32 | .67 | .18 | .834 |

*Note.* The Depression Anxiety and Stress Scale (DASS-21) is from Henry and Crawford (2005); The Positive and Negative Affect Scale – Expanded Form (PANAS-X) is from Watson and Clark (1999). Only the positive and negative affect subscales were used. The Freidburg Mindfulness Inventory is from Walach et al. (2006); The Self-Reported Perceptions of Health Status (SF-12) is from Ware et al. (1996). Only the physical health subscale was used. All values represent raw, nonstandardized values.

**Additional Analyses**

In addition to the first analysis, a multivariate analysis of variance (MANOVA) was conducted to further assess the possible differences between the intervention groups, accounting for a correlation among the DVs. Due to the small sample size, Pillais' Trace was used for significance testing. The MANOVA results showed a non-significant difference between the intervention groups and DVs of interest (stress, anxiety, depression, positive affect, negative affect, mindfulness, and self-perceived physical health), $F(2, 47) = .906$, $p = .556$; Pillais' Trace = .274.

In the last analysis, gender was also examined as a possible variable of interest. Using the same gain scores derived from the DVs, similarly to the previous ANOVA, a separate ANOVA was conducted to determine if there was a significant difference between males and females in relation to the DVs of interest. Results from the analysis concluded that effect of gender was also not significant for the measures of stress, $F(1, 47) = .25$, $p = .627$, anxiety, $F(1, 47) = .23$, $p = .636$, depression, $F(1, 47) = .44$, $p = .508$, positive affect, $F(1, 47) = 1.71$, $p = .198$, negative affect, $F(1, 47) = .52$, $p = .474$, mindfulness, $F(1, 47) = .97$, $p = .330$, and perceived physical health, $F(1, 47) = .01$, $p = .924$ (see Table 2 for means). Thus, these analyses failed to confirm that yoga, meditation, and walking differ in reducing stress, anxiety, and depression, along with overall improvements of mood. Furthermore, gender appeared to have no significant effect between outcomes of the interventions.

Table 2 Participant Characteristics by Gender

| | Female | | Male | | | |
|---|---|---|---|---|---|---|
| Measure | *M* | *SD* | *M* | *SD* | *F*(1, 48) | *p* |
| DASS - Stress | -.16 | .51 | -.09 | .51 | .25 | .627 |
| DASS - Anxiety | -.10 | .41 | -.16 | .35 | .23 | .636 |
| DASS - Depression | -.22 | .51 | -.12 | .34 | .44 | .508 |
| PANAS - Positive Affect | .23 | .58 | -.02 | .71 | 1.71 | .198 |
| PANAS - Negative Affect | -.40 | .64 | -.24 | .82 | .52 | .474 |
| Freidburg Mindfulness Inventory | .21 | .42 | .08 | .44 | .97 | .330 |
| SF-12 - Physical Health | -.23 | .49 | -.21 | .63 | .01 | .924 |

*Note.* All values represent raw, nonstandardized values.

# CHAPTER 4

# DISCUSSION

Among researchers, the practice of yoga has been a highly discussed topic in recent years due to the repeated findings of improved mood, quality of life, and decreased levels of stress, depression, and anxiety (Jeter et al., 2015). Furthermore, numerous studies have compared yoga to other known and effective practices such as meditation and mindfulness techniques (Clay et al., 2005; Saxena & Saxena, 2009) and other physical activities (Harinath et al., 2004; Oken et al., 2006; Streeter et al., 2010). Although yoga has shown the protentional to be a powerful complementary therapy to conventional clinical practice, researchers have expressed the need for continued evidence of yoga's efficacy.

One aim of this study was to compare the effects of a short-term hatha yoga intervention to the similar interventions of meditation and walking, thereby further strengthening the evidence regarding yoga as a complementary therapy instead of meditation or another form of exercise. The other aim of this study was to understand whether the breathing (pranayama) or physical (asana) aspect of yoga was responsible for improvements in psychological dimensions, or whether the combination of the both was fundamental to its efficacy.

The current study examined these research questions through three hypotheses. The first hypothesis was that individuals who practiced yoga would have greater

improvements in mood, in addition to reductions in stress, anxiety, and depression levels than both meditation and walking over the course of one week. This initial hypothesis was essential to understanding if yoga is a more effective intervention than both meditation and light cardio. The other two hypotheses, that those who practiced yoga or walking would experience greater self-reported perceptions of health and those who practiced yoga or meditation would experience greater improvement in self-reported mindfulness, aided in alternative explanations of the differences between pranayama and asana. Unfortunately, results from the study did not support any of these hypotheses.

Although more evidence is necessary to make concrete conclusions, it appears that yoga, walking, and meditation do not differ in their therapeutic efficacy when practiced over the course of a week. Thus, one could practice any of the three interventions and achieve similar outcomes in terms of psychological health. In addition, evidence was not found contrasting the differences between asana and pranayama, suggesting that both physical movement and controlled breathing may both be helpful in improving aspects of psychological health regardless of them being done successively or individually. However, these conclusions should be taken with caution and be further investigated by future research.

## Limitations

There were various limitations to the current study that may have affected its results and findings. The first limitation is small sample size. Although other published studies on similar exercise studies with yoga have had relatively small sample sizes (Badsha et al., 2009; Harinath et al., 2004; Manocha et al., 2001), the small sample size may have contributed to a Type-I error and a larger sample size would have been

preferred. Another limitation was the lack of control on external variables on the independent variables of interest. Participants were entrusted to practice each intervention multiple times throughout the week and completion of this requirement was based mostly upon participant's honesty. Though completion of the intervention was reviewed beforehand through examination of total completion time and number of interventions completed, participants were not observed during the study for actual completeness. In comparison to the yoga and meditation group, no method was used to confirm completeness of the walking intervention besides participant honesty alone. Implementing greater control procedures would have been possible (such as walking trackers or participants showing up for a yoga class), but incredibly difficult due to the small scale of this study. The lack of control may have had unknown effects on the data and further contributed to a possible Type-I error.

Another limitation was the length of the interventions. Most published exercise studies that involve yoga have measured yoga after the minimum length of eight weeks. However, due to time constraints and the possibility of greater attrition, participants only spent a week practicing the interventions. It would have been highly fascinating to see significant differences between the intervention groups after such a short period of time, but may have also contributed to a Type-I error and non-significant findings. Despite concerns for possible longitudinal effects on the data, the vast number of significant findings from published studies examining longer-term effects of yoga suggest it may have been more appropriate to have a longer intervention. Lastly, the absence of a control group in the study made it impossible to tell if there was a placebo effect from all

the interventions. This would have proved an interesting finding and strengthened the overall analysis of the data.

## Conclusion

In conclusion, although there were no significant differences between yoga, meditation, or walking and none of the null hypotheses were rejected, the current study still proposed an interesting consideration that yoga may not be the most appropriate complementary therapy in clinical practice. Exercise, meditation, or any other researched therapy may be more appropriate based on the client's physical health, motivation, and/or past experiences with the therapy of interest. Future research should continue to examine the therapeutic efficacy of yoga, and similar practices such as meditation and other forms of exercise, as a complementary therapy to further improve clinical practice and its overall impact on the individual

# APPENDIX A

## YOGA INTERVENTION WRITTEN INSTRUCTIONS

Hello,

Thank you for agreeing to participate in this study. **Please be sure to save this email as you will be referring to it throughout the study.**

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You have been randomly assigned to practice 5 yoga video sessions throughout the course of a week (7 days). You may choose to participate in these sessions on whichever days that work best for you and your schedule, so long as they are on separate days.

Each session will last approximately 30 minutes conducted by a certified yoga practitioner. Follow along with the video to the best of your abilities. If you feel physical discomfort at any time during or after the activity, please stop the activity immediately and contact us at FullertonStressStudy@gmail.com

Although the session can be completed on any comfortable surface, a yoga mat may be helpful. At the end of your session, you will be asked a few questions regarding your experience for that day's session. Please be honest, as you will not be penalized in any way regarding your answers.

After completion of the 5 sessions, you will be able to take the final survey. Upon completion of the final survey, you will be entered into an opportunity drawing to win one of three $25 Visa gift cards and debriefed on the study. Please allow one to two weeks to receive your participation credit. Gift card recipients will be chosen once data collection has completed.

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**Reminder:**
To maintain the integrity of the study, it is inherent that you do not falsify data. It is important to California State University Fullerton's code of conduct to maintain academic integrity and avoid academic dishonesty (UPS 300.021). If you are having trouble completing the 5 sessions within the 7 day timeframe or are unable to participate in the study any longer, please contact us at FullertonStressStudy@gmail.com to receive credit for the time you participated.
Please take participation in the sessions seriously. If you are having trouble completing the sessions or any other questions, please contact us at FullertonStressStudy@gmail.com
You can also contact the principal investigator at trevor.sebasitan@csu.fullerton.edu

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Thank you again for your participation in this study! You can access each day's yoga sessions through the following links.
Session 1 – http://fullerton.qualtrics.com//SE/?SID=SV_8dmhrfI7yo4qakl
Session 2 – http://fullerton.qualtrics.com//SE/?SID=SV_8dmhrfI7yo4qakl
Session 3 – http://fullerton.qualtrics.com//SE/?SID=SV_8dmhrfI7yo4qakl
Session 4 – http://fullerton.qualtrics.com//SE/?SID=SV_8dmhrfI7yo4qakl
Session 5 – http://fullerton.qualtrics.com//SE/?SID=SV_8dmhrfI7yo4qakl

Once you have completed the final yoga session (Session 5), please click on the following link to access the final survey and be debriefed on the study.
**Do not access this link until you have completed the final yoga session.**

http://fullerton.qualtrics.com/jfe/form/SV_0OEfCiP7w8c6QM5

Attached to this email is the consent form for reference.

# APPENDIX B

## MEDITATION VIDEO WRITTEN INSTRUCTIONS

Hello,

Thank you for agreeing to participate in this study. **Please be sure to save this email as you will be referring to it throughout the study.**

---

You have been randomly assigned to practice 5 meditation video sessions (30 minutes a day, broken down into two 15 minute segments) throughout the course of a week (7 days). You may choose to participate in these sessions on whichever days that work best for you and your schedule, so long as they are on separate days.

The video sessions will be conducted by various professionals who will guide you through the meditation. Due to the nature of this activity, each session is broken down into **two 15 minute segments, totaling 30 minutes.** You may complete these 2 segments at any timepoint throughout the day, so long as they are not within three hours of each other. It may be easiest to do a 15-minute session in the morning and another 15-minute session at night!

The session can be completed on any comfortable surface, such as a chair or on a bed. Please do not participate in any other activities for the duration of the meditation sessions. At the end of your session, you will be asked a few questions regarding your experience for that day's session. Please be honest, as you will not be penalized in any way regarding your answers. If you feel any discomfort at any time during or after the activity, please stop the activity immediately and contact us at FullertonStressStudy@gmail.com

After completion of the 5 sessions, you will be able to take the final survey. Upon completion of the final survey, you will be entered into an opportunity drawing to win one of three $25 Visa gift cards and debriefed on the study. Please allow one to two weeks to receive your participation credit. Gift card recipients will be chosen once data collection has completed.

---

**Reminder:**
To maintain the integrity of the study, it is inherent that you do not falsify data. It is important to California State University Fullerton's code of conduct to maintain academic integrity and avoid academic dishonesty (UPS 300.021). If you are having trouble completing the 10 sessions within the 7-day timeframe or are unable to participate

in the study any longer, please contact us at FullertonStressStudy@gmail.com to receive credit for the time you participated.
Please take participation in the sessions seriously. If you are having trouble completing the sessions or any other questions, please contact us at FullertonStressStudy@gmail.com
You can also contact the principal investigator at trevor.sebasitan@csu.fullerton.edu

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Thank you again for your participation in this study! You can access each day's meditation sessions through the following links.
Session 1
First 15 minutes – http://fullerton.qualtrics.com//SE/?SID=SV_5iHsKnhVZ45quu9
Second 15 minutes - http://fullerton.qualtrics.com//SE/?SID=SV_cLO9RykteRcjs2h
Session 2
First 15 minutes – http://fullerton.qualtrics.com//SE/?SID=SV_5iHsKnhVZ45quu9
Second 15 minutes - http://fullerton.qualtrics.com//SE/?SID=SV_cLO9RykteRcjs2h
Session 3
First 15 minutes – http://fullerton.qualtrics.com//SE/?SID=SV_5iHsKnhVZ45quu9
Second 15 minutes - http://fullerton.qualtrics.com//SE/?SID=SV_cLO9RykteRcjs2h
Session 4
First 15 minutes – http://fullerton.qualtrics.com//SE/?SID=SV_5iHsKnhVZ45quu9
Second 15 minutes - http://fullerton.qualtrics.com//SE/?SID=SV_cLO9RykteRcjs2h
Session 5
First 15 minutes -http://fullerton.qualtrics.com//SE/?SID=SV_5iHsKnhVZ45quu9
Second 15 minutes - http://fullerton.qualtrics.com//SE/?SID=SV_cLO9RykteRcjs2h

Once you have completed the final meditation session (Session 5), please click on the following link to access the final survey and be debriefed on the study.
**Do not access this link until you have completed the final meditation session.**

http://fullerton.qualtrics.com/jfe/form/SV_0OEfCiP7w8c6QM5

Attached to this email is the consent form for reference.

# APPENDIX C

## WALKING INTERVENTION WRITTEN INSTRUCTIONS

Hello,

Thank you for agreeing to participate in this study. **Please be sure to save this email as you will be referring to it throughout the study.**

---

You have been randomly assigned to practice 5 walking sessions throughout the course of a week (7 days). You may choose to participate in these sessions on whichever days that work best for you and your schedule, so long as they are on separate days.

Each session should last approximately 30 minutes and can be conducted anywhere outside where you feel comfortable. It is recommended that you set a timer for 15 minute once you begin walking so that you have ample time to return to your original location at the end of 30 minutes. If you feel physical discomfort at any time during or after the activity, please stop the activity immediately and contact us at FullertonStressStudy@gmail.com

The walking should be at a leisurely pace at approximately 2.5 mph. An example of this pace is attached to this email. The walking sessions should be separate from normal daily activities, such as walking to work or class. **Please set aside 30 minutes specifically to go for a leisurely walk without other distractions, such as electronic devices or music.** Do not use a treadmill for the activity unless it is necessary.
Keep track of the approximate time you began and end your walking to log your activity using the links below. **You must log your activity on the same day it was completed to receive participation credit.** After logging your session, you will be asked a few questions regarding your experience for that day's session. Please be honest, as you will not be penalized in any way regarding your answers.

After completion of the 5 sessions, you will be able to take the final survey. Upon completion of the final survey, you will be entered into an opportunity drawing to win one of three $25 Visa gift cards and debriefed on the study. Please allow one to two weeks to receive your participation credit. Gift card recipients will be chosen once data collection has completed.

---

**Reminder:**
To maintain the integrity of the study, it is inherent that you do not falsify data. It is important to California State University Fullerton's code of conduct to maintain

academic integrity and avoid academic dishonesty (UPS 300.021). If you are having trouble completing the 5 sessions within the 7 day timeframe or are unable to participate in the study any longer, please contact us at FullertonStressStudy@gmail.com to receive credit for the time you participated.
Please take participation in the sessions seriously. If you are having trouble completing the sessions or any other questions, please contact us at FullertonStressStudy@gmail.com
You can also contact the principal investigator at trevor.sebasitan@csu.fullerton.edu

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Thank you again for your participation in this study! You can log each day's walking sessions through the following links.
Session 1 – http://fullerton.qualtrics.com/jfe/form/SV_cIT7j6Pzd1HQui1
Session 2 – http://fullerton.qualtrics.com/jfe/form/SV_cIT7j6Pzd1HQui1
Session 3 – http://fullerton.qualtrics.com/jfe/form/SV_cIT7j6Pzd1HQui1
Session 4 – http://fullerton.qualtrics.com/jfe/form/SV_cIT7j6Pzd1HQui1
Session 5 – http://fullerton.qualtrics.com/jfe/form/SV_cIT7j6Pzd1HQui1

Once you have completed the final walking session (Session 5), please click on the following link to access the final survey and be debriefed on the study.
**Do not access this link until you have completed the final walking session.**

http://fullerton.qualtrics.com/jfe/form/SV_0OEfCiP7w8c6QM5

Attached to this email is the consent form for reference.

# APPENDIX D

## SAMPLE SCHEDULE

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| X<br>Start of Sessions | X | X | | X | X<br>End of Sessions<br>⇩<br>Take Final Survey | |

X = 30 minute walking session

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