The Effects of Kundalini Yoga on Sleep Disturbance

A Dissertation Presented to the Faculty of the California School of Professional Psychology at Alliant International University

In Partial Fulfillment of the Requirement for the Degree
Doctor of Philosophy In Clinical Psychology

Sabina Sehgal, M.A.

2007

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AT
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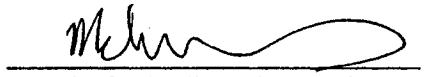
Approved by:



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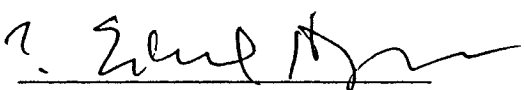

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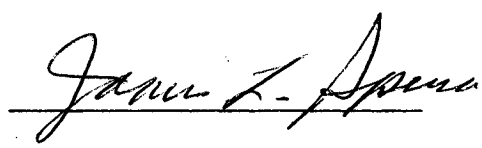

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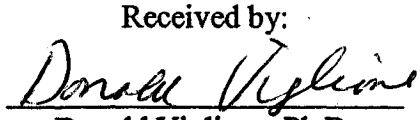

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An Abstract of a Dissertation Presented to the Faculty of the California School of Professional Psychology at Alliant International University, San Diego

In Partial Fulfillment of the Requirement for the Degree

DOCTOR OF PHILOSOPHY IN CLINICAL PSYCHOLOGY

By

Sabina Sehgal, M.A.

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Abstract

Many people have difficulty sleeping. A 1995 survey by Gallop found that 49% of adults were dissatisfied with their sleep at least 5 times per month. It has been estimated that 10% to 40% of adults in America have intermittent insomnia; while10% to 15% have long term sleep difficulties. The American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) defines insomnia as a complaint regarding the quantity, quality, or sleep timing at least 3 times a week for at least 1 month. Research studies define insomnia as a sleep latency (time taken to fall asleep) that is greater than 30 minutes, sleep efficiency (time asleep/time in bed) less than 85%, or sleep disturbance more than 3 times a week. Insomnia has been associated with decreased work performance as well as increased motor vehicle accidents. Cost estimates for lost productivity and insomnia related accidents exceed $100 billion per year. Numerous controlled clinical trials have demonstrated that improving insomnia with pharmacological treatment reduces sleep disturbance. However, the side effects, poor compliance rate, and cost of these drugs have stimulated the search for other options. Recently, behavioral techniques such as yoga, relaxation, and meditation also have been shown some success in treating insomnia. All these behavioral techniques have as an active component, lowering physiological arousal. Thus, accumulating evidence suggests that techniques assisting with decreasing physiological arousal have a beneficial effect on sleep disturbance. For this reason, an empirical investigation of the role yoga may have in the treatment of sleep disturbance appears warranted.

The purpose of this study was to assess the effectiveness of a Kundalini yoga intervention on sleep disturbance. Participants with sleeping difficulty were recruited from the San Diego community. Thirty-two participants were alternately assigned to either a weekly yoga group or a music control group. The yoga group practiced Kundalini poses specifically shown to benefit sleep, over an 8-week period. Outcome measures included Pittsburgh Sleep Diary, Arousal Scale, Profile of Mood States and the Epworth Sleepiness Scale. Data were analyzed for 32 participants

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(15 treatment, 17 control) ages 22-35 who had a sleep disturbance (PSQI>/=5). Yoga participants reported significant improvement in wake-time after sleep onset (p = .03) and quality of life (p = .04), compared to music controls. Yoga led to significant improvements on QOL and one sleep parameter (WASO). The majority of sleep variables improved across time in both groups, however differential effects of yoga were not found. Both yoga and music may be potentially promising treatments for managing sleep difficulty, however future research with an additional no treatment control is needed.

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ACKNOWLEDGEMENTS

There are many people who I would like to thank for their support, patience, and encouragement during my journey through graduate school.

I am thankful for the guidance and counsel I received from my committee members. I am thankful to Dr. Greenberg for having faith and confidence in me. Her patience in reading draft after draft of every paper amazes me. Dr. Greenberg, thank you so much for being so generous with your time, guidance, and support. Dr. Harpin and Dr. Spira thank you for your comments and suggestions. I have benefited greatly from your advice. Dr. Gevirtz, thank you for your generous availability and enthusiasm for my project.

The unconditional love and support of my parents kept me driven throughout my doctoral journey. Mummy and Daddy your unwavering faith and confidence in my abilities and in me have shaped me to be the person I am today. I must thank you for showing me the truth of hard work, diligence, and determination. I am so grateful for the sacrifices you made to give me a better life and for the opportunities to make my dreams come true. You have both given me the strength to persevere through this endeavor. I would also like to thank my brother for his support and guidance. What would I have done without your keen sense of humor and wittiness to make me smile? I am grateful to my grandparents for their continuous love, support, and thoughtfulness. I am thankful to my four little cousins who have a way of making me forget about the stress and hassle of daily life. Talking to the four of you puts a smile on my face and makes me appreciate each moment.

I have been fortunate enough to have many friends who cherish me despite my eccentricities. I risk doing them a disservice by not mentioning them here, but plead paucity of space. Lynn, we began this graduate school process together, encountering bumps and hurdles along the way; and here we are. I am so glad you have been there to share in this journey. Hala and Marin, I am so grateful to have two such amazing friends in my life. Hala, thanks for the laughter we have shared, the late-night talks, and the endless fun. You have helped me keep a balance in my life, which I am eternally grateful for. Marin, thanks for the tea breaks, early morning chats, and endless support. You have helped to keep me grounded and mostly sane. Jamie and Jadie, I have known you both since the second grade and cannot imagine what my life would be like without the two of you. Thanks for always being there for me and for cheering me on, even from afar. Jamie, from do-do dishwashing advertisements to hard lessons in life, thanks for being there for me unconditionally. Jadie, thanks for believing in me and supporting me through the years. Cara, thank you for teaching me what friendship is all about. From the moment we became roommates to this day, I have never known someone as kind, good-hearted, and caring as you. I can't believe eleven years have passed already, I still hold our friendship dear to my heart and know that you have been a big part of what has made me into who I am today. From our undergraduate years together to our crosscountry trip to sunny San

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Diego, I will never forget our endless talks and adventures. I am so lucky to have been blessed with a friend like you.

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Our Purpose in Life

Suffering is caused by ignorance.

People inflict pain on others in the selfish pursuit of their happiness or satisfaction.

Yet true happiness comes from a sense of peace and contentment, which in turn must be achieved through the cultivation of altruism, of love and compassion, and elimination of ignorance, selfishness, and greed.

I believe that the very purpose of life is to be happy.

From the very core of our being, we desire contentment.

In my own limited experience I have found that the more we care for the happiness of others, the greater is our own sense of well-being.

Cultivating a close, warmhearted feeling for others automatically puts the mind at ease.

It helps remove whatever fears or insecurities we may have and gives us the strength to cope with any obstacles we encounter.

It is the principal source of success in life. Since we are not solely material creatures, it is a mistake to place all our hopes for happiness on external development alone.

The key is to develop inner peace.

Dali Lama

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Chapter One

Introduction and Literature Review

Overview

Sleep disturbance is a widespread phenomenon, affecting many people (Jean-Louis, Kripke, & Ancoli-Israel, 2000). Disturbance of sleep contributes to significant health problems, including chronic disease, headache, gastrointestinal disturbance, and musculoskeletal problems (Jacobs, Benson, & Friedman, 1996). Therefore, it is essential that health care providers inquire about sleep habits as a part of a routine examination.

Identification and treatment of sleep disturbance are essential steps in managing the effects sleep disturbance has on individuals (Sateia & Nowell, 2004). Providing individuals with the tools needed to improve sleep will assist them with a healthy lifestyle change. Some treatments available for sleep disturbance include pharmacology, sleep restriction, sleep hygiene, biofeedback, and stimulus control. The aforementioned treatments have shown beneficial improvements in sleep disturbance (Sateia & Nowell, 2004). Recently, alternative techniques such as yoga, relaxation, and meditation also have shown some success in treating insomnia (Khalsa, 2004; Koch, Volk, Heidenreich, & Pflug, 1998). All these techniques are designed to lower physiological arousal (Sateia & Nowell, 2004). Thus, accumulating evidence suggests that mind-body techniques have beneficial effects on sleep disturbance, this study investigates Kundalini yoga as a treatment for sleep disturbance. Specifically, Kundalini yoga was assessed for its effect on sleep, mood, and quality of life.

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This chapter will review the current rates of sleep disturbance as well as define what is meant by sleep disturbance. Costs of insomnia to society will also be examined. The current theories regarding the etiology of sleep disturbance will be reviewed. Then, various treatments for sleep disturbance will be explored. The associated effects of yoga on other diseases will be discussed, including psychological, physical, and cognitive changes associated with yoga practice. A summary and statement of the problem will review how specific breathing patterns, mantras, and postures may mediate the relationship between yoga and sleep. Lastly, the hypotheses for the current research will be stated.

Sleep Disturbance

Research shows that many individuals suffer from sleep disturbance (Jacobs et al. 1996; Jean-Louis et al. 2000, Sateia & Nowell, 2004). Estimated rates of sleep disturbance vary across studies due to the lack of a consistent definition (Lichstein, Durrence, Taylor, Bush, & Riedel, 2003). Some studies delineate specific criteria (reporting difficulty initiating sleep as a sleep latency >/= 30 minutes), while other studies are more general in what represents difficulty initiating sleep (subjective report of difficulty falling asleep) (Lichstein et al., 2003). Other factors influencing the discrepant rates reported include severity, chronicity, age-group, and sampling bias (Lichstein et al., 2003). This study will attempt to address the ambiguity among earlier studies by using a clear and operational definition of sleep disturbance and specify an age range for inclusion.

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In the present study, the term "sleep disturbance" was defined based on participant report of difficulty falling asleep (>/= 30 min of sleep latency), number of nocturnal awakenings, difficulty awakening in the morning, or feeling fatigue during the day. Individuals participating in the study were given the Pittsburg Sleep Quality Index to assess sleep quality (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The questionnaire assesses seven components including sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction (Buysse et al., 1989). Pittsburgh Sleep Quality Index scores greater than 5 are reliably associated with sleep disorders in young adults (Backhaus, Junghanns, Brooks, Riemann, & Hohagen, 2002). Individuals with a score of greater than five were eligible for participating in the current study.

Sleep disturbance is associated with adverse outcomes and complications. The most common symptoms reported include fatigue, reduced motivation, diminished concentration and vigilance, and short-term memory disturbance (Jacobs et al., 1996). In addition, impaired motor performance and increased somatic complaints, such as headaches, gastrointestinal disturbance, or musculoskeletal problems are common (Murtagh & Greenwood, 1995). Prolonged sleep disturbance is also associated with many psychological and behavioral symptoms, including irritability, anxiety, depression, or increased substance use (Murtagh & Greenwood, 1995). Growing evidence suggests that the psychological factors may not be secondary to lack of sleep, but rather may be primary characteristics that can have a role in the development of a sleep disturbance (Sateia & Nowell, 2004).

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Prevalence and Demographics

Prevalence rates of insomnia in general medical practices range from 10% to as high as 34% (Jacobs et al., 1996 and Jean Louis et al., 2000). Hicks, Fernandez, and Pellegrini (2001) reported the percentage of self-reported sleep problems among college students rose from 24% in 1978 to 53%. In addition, a 1995 Gallup survey (as cited in Jean-Louis et al., 2000) found that 49% of adults were dissatisfied with their sleep at least five nights per month.

High incidences of sleep disturbance are seen in women, separated or divorced individuals, medically ill patients, patients with depression, anxiety, or substance abuse, and people who are less educated or unemployed (Sateia & Nowell, 2004). Research shows that African Americans have more disturbed sleep than Caucasians (Seeman, 1995). Chronic pain patients had higher scores than did healthy control subjects on the Beck Anxiety Scale, Beck Depression Scale and the Pittsburgh Sleep Quality Index (Sayar, Arikan, & Yontem, 2002). In the past, high prevalence rates of sleep difficulty in the elder population have been reported (Seeman, 1995). Growing evidence suggests that the greater occurrence in elders may have less to do with increasing age, but rather with lifestyle changes such as progressive inactivity, dissatisfaction with social life, and greater presence of medical illnesses.

In the United States, costs directly related to insomnia have been estimated to be in the region of $11 billion (Ruyak, 2004). Costs indirectly associated with insomnia, such as reduced work productivity, were estimated to be $30-35 billion (Chilcott & Shapiro, 1996). The extensive costs directly due to insomnia include cost of medications;

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visits to physicians, psychologists, and social workers; evaluation and treatment by sleep specialists; and inpatient care for insomnia (Ruyak, 2004). Indirect costs associated with insomnia include reduced work productivity, increased motor vehicle accidents, and secondary medical expenses (Ruyak, 2004).

The prevalence rates of insomnia and the cost of insomnia to society are substantial. Insomnia can therefore be regarded as a significant problem in the community.

Proposed Etiology

Despite the high prevalence of insomnia, the cause is unclear. Many theories regarding the development of chronic sleep disturbance have been proposed (Sateia & Nowell, 2004). Individuals affected by sleep disturbance are thought to have a pathophysiology leading to heightened arousal. In addition specific stressors and negatively charged cognitions are also potential attributors to sleep disturbance. In the following section, I will briefly review the main theories currently under investigation.

Specific Stressors

Studies on the pathogenesis of insomnia suggest that stressors can be an origin for sleep disturbance (Spielman, Caruso, & Glovinsky, 1987). Specific stressors, such as a medical events, jetlag, psychiatric illness, or occupational stress could precipitate the onset of the condition. As significant facets of the disturbance develop, patients' apprehension, frustration, and distress concerning their inability to sleep enhances, intensifying the cognitive and physiological arousal that, in turn, elicits further sleep disturbance (Sateia & Nowell, 2004). Individuals spend an increasing amount of time in

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bed awake; consequently the bed is conditioned to waking. In addition, individuals ruminate over daytime consequences of the sleep disturbance, further exacerbating sleep difficulties.

Automaticity and Plasticity

Espie (2002) suggests that the progression of chronic sleep disturbance arises out of a function of factors that interfere with the normal plasticity of circadian sleep drives. He posits that unlike normal sleepers, individuals with insomnia do not show the fundamental ability to adjust and regulate for normal variability in sleep or daytime function. Rather, such alterations in sleep are acknowledged as a significant and progressive sleep disturbance. For example, as an individual attempts to sleep, worries of the day compound in the individual's mind therefore disrupting sleep. As the wake time increases the individual may become further frustrated due to the lack of sleep. The cycle may continue for minutes to hours, if the cycle persists for hours, the individual may not have the ability to adjust for variability in sleep pattern. Hence, the routine process of sleep onset is disrupted as a result of the intrusive cognitions that hamper the normal automatic process of sleep onset

Hyperarousal in Insomnia

In addition to evidence on disrupted circadian rhythms, research also suggests that patients with insomnia have greater brain activity (Sateia & Nowell, 2004). In functional neuroimaging studies (Nofzinger et al., 2004; Sateia & Nowell, 2004), healthy participants showed reductions in metabolism from waking to non-REM sleep states in bilateral frontal, anterior cingulated, and medial prefrontal cortices; while patients with

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insomnia showed hypo-metabolism in the bilateral frontal cortex, right occipito-parietal cortex, and a small region of the left temporal-parietal cortex. However, no significant reductions in metabolism were seen in the thalamus, anterior cingulate- cortex, or medial prefrontal cortex in participants with insomnia (Nofzinger et al., 2004). The function of the neural networks are as follows: the ascending reticular formation and hypothalamus are included in the general arousal system, while the hippocampus, amygdale, and anterior cingulate cortex are part of the emotion-regulating system. The prefrontal cortex is associated with the cognitive system. The pattern of whole brain hyper-metabolism across waking and sleep states and the failure of wake-promoting structures to decline in metabolism from waking to sleep states suggest that the higher cerebral metabolism in non-REM sleep in patients with insomnia may be due to lack of a reduction in activity in these subcortical structures in the transition from waking to sleep.

In summary, while much progress has been made in understanding this pathogenesis of sleep disturbance associated with insomnia, the causal factors underlying the condition are unclear. However, what seems to hold true is that a self-sustaining cycle of apprehension about sleeplessness, exaggerated focus on sleep, and the associated physiological and cognitive processes accompanying these conditions are key components in the development and continuance of the condition.

Rationale for the Investigation of Yoga for Sleep Disturbance

There are numerous treatment options available for sleep disturbance, including pharmacotherapy and non-pharmacotherapy treatments or behavioral treatments.

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Treatment Approaches

Pharmacological Treatments. Pharmacological treatments continue to be the most widely used approach for treating sleep disturbance, despite concerns regarding long term consequences, tolerance, and potential complications (Murtagh & Greenwood, 1995). In a review of the pharmacological treatments for sleep disturbance, Ringdahl, Pereira, and Delzell (2004) identified benzodiazepines as frequently prescribed for sleep disturbance. Benzodiazepines are known to shorten sleep latency, decrease nocturnal awakenings, and increase total sleep time (Ringdahl et al., 2004). Side effects of benzodiazepines include daytime sedation, anterogrode amnesia, respiratory depression, high addiction potential, and withdrawal symptoms.

Antidepressants with sedation such as amitriptyline, nortriptyline, or trazadone are also often used to combat sleep disturbance (Ringdahl et al., 2004). Of the three, trazadone has gained greater acceptance due to the anticholinergic side effects of amitriptyline and nortriptyline. Trazadone decreases insomnia caused by selective serotonin reuptake inhibitors. The potential side effects of trazadone include a decrease in REM sleep and association with significant rebound insomnia (difficulty falling asleep, early morning waking, interrupted sleep, or decreased total sleep time).

According to Ringdahl et al, the most commonly used nonprescription agents are the antihistamines diphenhydramine and doxylamine. Side effects of these agents include dry mouth, constipation, and urinary retention.

The most commonly prescribed sleep agents are the selective benzodiazepine receptor agonists zolpidem and zaleplon. Zolpidem decreases sleep latency and increases

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total sleep time (Sateia & Nowell, 2004). Common side effects include drowsiness, dizziness, headache, and gastrointestinal symptoms. Zaleplon decreases nocturnal awakenings thus increasing total sleep time. Although the treatment of choice for insomnia has been the prescription of sedative hypnotics or other sleep inducing agents, concern over the side effects, which include deterioration of daytime functioning (Johnson & Chernik, 1982), the development of psychological dependence, tolerance, and addiction (Espie, 2002), rebound insomnia (Ringdahl et al., 2004), and financial expenses (Murtagh & Greenwood, 1995), have led researchers to explore alternative treatments for sleep disturbance.

Non-pharmacological treatments. Growing evidence suggests that non pharmacological treatments, alone, or possibly in combination with drugs, produce clinically significant and durable improvement (Sateia & Nowell, 2004). While little doubt exists concerning the benefits of pharmacotherapy for short term treatment of acute insomnia, statistics show that the effects of short term pharmacotherapy trials decline over time in patients with chronic insomnia (Sateia & Nowell, 2004). By contrast, cognitive behavioral treatments show greater long-term benefit. Non-pharmacological treatments for sleep disturbance include, but are not limited to, the following: sleep hygiene education, sleep restriction therapy, relaxation therapy, music therapy, and yoga (Sateia & Nowell, 2004).

Sleep hygiene education has been shown to be an effective treatment for sleep disturbance (Sateia & Nowell, 2004). One such study used a university sample to determine effects of sleep hygiene (Brown, Bulboltz, & Soper, 2006). The study used a

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randomly assigned, controlled design. Significant reductions in sleep difficulty and improved sleep habits were demonstrated. One limitation to this study was the lack of follow-up data to determine whether the improvements were sustained. Another study looked at the effect of meditation, sleep restriction therapy, and sleep hygiene on sleep disturbance (Stepanski & Wyatt, 2002). All treatment approaches were found to produce similar significant reductions in wake time after sleep-onset (WASO). The sleep hygiene group showed a decrease in WASO from 81minutes to 51 minutes at a six-week follow-up. The study lacked a control group, however, making it difficult to determine if factors outside the experiment had an effect.

Improving sleep hygiene involves giving patients a list of instructions facilitating a regular sleep/wake schedule. Instructions include: participate in a relaxing activity, go to bed only when tired, use the bedroom only for sleep and sexual activity, avoid naps, avoid caffeine, nicotine and alcohol four to six hours before bed, avoid a poor sleeping environment, decrease fluid intake before bed, avoid heavy meals, heavy exercise, stimulating late-evening activities, and eliminate bedroom clocks. Another factor important in sleep hygiene is the effect of exercise. Exercise increases sleep quality, unless performed immediately before bedtime. A controlled study by Ringdahl et al. 2004) showed moderate exercise improves sleep quality, onset latency, and duration in older adults.

Another approach in treating sleep disturbance is sleep restriction therapy, which attempts to re-associate the bed with sleep (Lichstein et al., 2004; Sateia & Nowell, 2004). A randomly assigned controlled study using sleep restriction showed participants

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in a sleep restricted group significantly improved in overall sleep efficiency more than a corresponding sleep hygiene group (Hoch, 2001). Friedman, Bliwse, Yesavage and Salom (1991) found sleep restriction therapy (SRT) and relaxation therapy (RLT) significantly reduced sleep latency and wake time after sleep onset at post treatment. However, the SRT group maintained improvements at a 3-month follow-up while the RLT group did not. Sleep restriction therapy presumes that insomniacs spend more time in bed in an attempt to get more sleep, thereby decreasing sleep efficiency and increasing frustration. The goal is to curtail the amount of time spent in bed to more nearly match the subjective amount of time asleep. Sleep restriction creates a mild state of sleep deprivation and promotes a more rapid sleep onset, more efficient sleep, and less inter-night variability (Lichstein et al., 2004).

Relaxation-based interventions are also predicated on the observation that insomnia patients often display high levels of arousal (physiological and cognitive), both at night and during the day (Sateia & Nowell, 2004). Relaxation methods are used to deactivate the arousal system and the selection of techniques varies depending on whether physiological or cognitive arousal is targeted for treatment (Sateia & Nowell, 2004). Progressive muscle relaxation (a method of tensing and relaxing different muscle groups throughout the body) and biofeedback (a visual or auditory feedback is provided to the patient to control some pre-determined physiological parameters) seek to reduce somatic arousal (e.g., muscle tension), whereas attention focusing procedures such as imagery training (visualization technique to focus on some pleasant or neutral images) and thought stopping are intended to lower presleep cognitive arousal (e.g., intrusive

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thoughts, racing mind). Freedman and Papsdorf (1976) assessed the effect of biofeedback, progressive muscle relaxation, and a set of placebo relaxation exercises on insomnia. The experimental groups demonstrated significant decreases in sleep parameters (sleep-onset, and total sleep time) compared to the control group; however improvements were not maintained by either group at a two-month follow-up.

In addition, sedative music listening has been shown to decrease anxiety, tension, and stress in a variety of populations (Johnson, 2003) including surgical patients (Moss, 1988) and coronary care unit patients (Guzzetta, 1989). Other investigators have found that the use of music significantly reduces pain in cancer patients (Zimmerman, Pozehl, Duncan, and Schmitz (1989). Because music can reduce muscular energy, heart and respiratory rates, blood pressure, and alleviate psychological distress (Kartman, 1984) its use at bedtime to promote relaxation and decrease insomnia may be a viable, cost-effective, and non-addictive alternative to hypnotics. Grossman, Grossman, Schein, Zimlichman, and Gavish (2001) compared the effects of music and breathing combined to music alone on blood pressure. Participants were randomized into treatment (breathing and music) or control (music) groups. Treatment at home consisted of listening to music on a walkman or using musically guided breathing exercises for 10 minutes daily for 8 weeks. Clinical blood pressure (BP) levels were measured at baseline, after 4 weeks, and after 8 weeks of treatment. Measurements were also taken in the home, daily, throughout the study. Although both group showed significant reductions in BP, BP was lowered significantly more in participants who listened to music and practiced slow and regular breathing ($p = .01$), when compared to participants who listened to music alone ($p = .03$).

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In an uncontrolled study Johnson (2003) evaluated the effect of (classical, sacred, and new-age) music on sleep latency and number of awakenings using sleep logs. Ten day baseline (pre-treatment) and 10 day during treatment assessments showed significant increases in levels of sleepiness at bedtime and a significant decrease in time to sleep onset and number of awakenings at post-treatment. Lai and Good (2005) discovered a similar finding in their controlled study. Sedative music (new age, harp, piano, orchestra, and slow jazz) resulted in better sleep quality including longer sleep duration, greater sleep efficiency, shorter sleep latency, less sleep disturbance, and less daytime dysfunction in the music group, compared to a wait list control. Despite a meaningful clinical improvement in many participants, over half of those who improved were still poor sleepers after three weeks. In a study using polysomnography, Gitanjali (1998) found no difference in sleep architecture or in subjective feelings of quality of sleep when employing a classical Indian music intervention.

In summary, many treatments have been proven beneficial in treating insomnia. Effective treatments have entailed both pharmalogical and non-pharmalogical interventions. Yoga as an intervention for insomnia will be investigated further for its capacity to decrease both physiological (Khalsa, 2004; Patel, 1975 and Raub, 2002) and cognitive arousal (Cohen et al., 2004, Lavey et al., 2005; and Sahajpal & Rinpari, 2000). A music control will be. Grossman and colleagues (2001) found BP to be reduced significantly more when using a musically guided breathing intervention compared to a music alone control. Since breathing is a vital component of Kundalini yoga, theoretically we would expect Kundalini yoga to be more effective than a music control. The current

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study used classical and new age music as a control, as used by most studies in the literature (e.g. Johnson, 2003 and Lai & Good, 2005).

Yoga and the Mind/Body Component

The mind/body component inherent in the practice of yoga is one reason to investigate yoga for the treatment of sleep disturbance. Yoga is a practical discipline which incorporates a wide variety of practices with the goal of developing of a "state of mental and physical health, well-being, inner harmony, and ultimately a union of the human individual with the universe" (Khalsa, 2004, p. 269). Yoga techniques include the practice of meditation, regulation of respiration with a variety of breathing exercises, and practice of a number of physical exercises and postures. A general feature of these practices is their capability of inducing a coordinated psycho-physiological response, which is the antithesis of the stress response (Khalsa, 2004). This "relaxation response" consists of a generalized reduction in both cognitive and somatic arousal as observed in the modified activity of the autonomic nervous system (as cited in Khalsa, 2004).

Evidence for Mind/Body Techniques

Carlson and colleagues (2004) investigated the relationship between a mindfulness-based stress reduction program for early stage breast and prostate cancer patients and quality of mood, stress symptoms, sleep quality, cortisol levels, and melatonin. Fifty-nine patients enrolled in an eight week program of mindfulness that included: meditation, gentle yoga, and daily home practice. Classes met once a week for 90 minutes. Pre and post assessments revealed significant improvements in overall quality of life, symptoms of stress, and sleep quality. One major limitation of this study

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was the lack of a control group, so results of this study may have been due to extraneous variables. Another limitation of this study entailed the non-specificity of the study which makes it difficult to determine which component of the intervention was most beneficial.

Gross and colleagues (2004) conducted a non-controlled longitudinal study looking at mindfulness-meditation or symptoms of depression, anxiety, sleep disturbance and quality of life after organ transplant. Twenty patients enrolled in an eight week program of mindfulness. Classes were held once a week for 2.5 hours. Significant pre-post improvements were seen for depression, anxiety, and sleep. Despite the fact that both studies show beneficial effects of a mind body technique limitations, including non-randomization and uncontrolled designs, make it difficult to pinpoint whether the outcomes were produced solely by yoga.

The Effects of Yoga on Disease

According to a recent literature review, yoga treatments in India have been shown to have beneficial effects on medical disorders including coronary artery disease (Mahajan, Reddy, & Sachdeva, 1999) and hypertension (Murugesan, Govindarajulu, & Bera, 2000; Patel, 1975). The same literature review found that yoga treatment in the United States has beneficial effects on osteoarthritis of the hands (Garfinkel et al., 1994) (as cited in Raub, 2002). Murugesan and colleagues (2000) found that both yoga and drug groups were effective in treating hypertension. Selvamurthy et al. (1998) conducted a study in India using a tilt table or yoga asanas as a treatment for hypertension. Patients were treated for three weeks for 30 minute sessions. He found significant pre-post reductions in blood pressure for both treatment groups (as cited in Raub, 2002). Mahajan

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and colleagues (1999) randomly assigned participants to a yoga group or a lifestyle advice group. The yoga group was given an intensive four-day yoga training program followed by practice at home. Assessments were taken at baseline, 4 weeks, 10 weeks, and 14 weeks. Significant reduction in coronary artery disease risk factors were seen in participants taking part in the yoga intervention plus lifestyle advice group, as compared to the control group receiving only lifestyle advice (as cited in Raub, 2002). Garfinkel and colleagues (1994) followed patients with osteoarthritis of the hands. Participants were randomly assigned to receive yoga treatment or no treatment. Classes were held once a week for 8 weeks. At pre-post assessment the yoga treatment group improved significantly more than the control group in pain and range of motion.

Taneja and colleagues (2004) assessed the effect of yoga on irritable bowel syndrome (IBS) in a randomized control design. Participants included 22 males with a diagnosis of IBS. Participants were divided into a yoga intervention group or conventional treatment group for eight weeks. Participants enrolled in the yoga group learned 12 postures and right nostril breathing, while participants in the conventional treatment group received medication. Results indicated that although both interventions led to significant improvements, yoga treatment showed a trend towards greater improvement for bowel and autonomic symptoms.

In a randomized controlled study, Casden (2005) assessed the effects of Ashtanga yoga on autonomic functioning, cognitive functioning, psychological symptoms, and somatic complaints in a healthy adult population. Participants were assigned to either Ashtanga yoga or a wait-list control for 6 weeks. Participants were required to attend 2

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classes per week; each class session was 75 minutes in duration. Results indicated significant pre-post improvement in psychological symptoms, somatic complaints, and cognitive functioning in the yoga group. Although there was no significant improvement for sleep disturbance, the yoga intervention group showed a trend toward greater improvement.

In a randomized controlled trial, Williams and colleagues (2005) studied the effect of Iyengar yoga for chronic low back pain. Participants were assigned to either Iyengar yoga therapy or an educational control group for 16 weeks. The intervention consisted of 29 postures from the following categories: supine, seated, standing, forward bends, twists, and inversions. It was demonstrated that yoga therapy caused a significant reduction in self-reported disability and pain, and reduced use of pain medication, relative to the educational group. The significant improvements of yoga participants were maintained at the 3 month follow-up, indicating that the yoga intervention was associated with longer lasting reductions in disability and pain outcomes than an educational intervention.

Garfinkel and colleagues (1998) investigated the effect of a yoga-based regime for relieving symptoms of carpal tunnel syndrome in an 8-week, randomized, controlled trial. Forty-two individuals with carpal tunnel syndrome were assigned to either a yoga based intervention consisting of 11 postures designed for strengthening, stretching, and balancing joints in the upper body, twice weekly, or a control group who were offered a wrist splint to supplement their current treatment. Individuals in the yoga group showed significant greater pre/post improvements in grip strength and pain reduction. Trends

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toward improvement were also observed in sleep disturbance, although these were not statistically significant.

A study by Lavey and colleagues (2005) examined the effects of yoga on mood in a psychiatric inpatient unit. Participants completed the Profile of Mood States (POMS) prior to and following participation in a yoga class. Yoga classes were 45 minutes in duration, once a week, and consisted of gentle stretching and strengthening exercises with attention focused on breathing. Participants were able to attend an unlimited number of classes while they were in the inpatient unit. Statistical analyses indicated, that at discharge, participants reported significant pre-post improvements on all five of the negative emotion factors on the POMS, including tension-anxiety, depression-dejection, anger-hostility, fatigue-inertia, and confusion-bewilderment. There was no significant change on the sixth POMS factor, vigor-activity. The results suggest that yoga was associated with improved negative mood. A limitation of the study was that it was not a controlled study, thus it is possible that observed improvements may be attributed to factors other than the yoga intervention. Another limitation of the study is the number of classes taken by each participant. Although the study did not assess for number of classes attended, the variability of sessions attended by each participant may have had an affect on treatment outcome

Holmer (2004) investigated the effect of gentle yoga as a treatment for relieving symptoms of fibromyalgia. Participants were alternately assigned to a yoga group or wait-list control group. Participants were required to attend yoga classes twice a week for eight weeks. Classes met for 90 minutes each week. Self report questionnaires were

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administered at baseline, 4 weeks, and after the 8 week program. Outcome measures included pain, fatigue, disability, anxiety, depression, sleep quality, pain coping, and perceived helplessness. Results indicated significant pre-post improvement in pain, fatigue, sleep, and anxiety in the yoga group when compared to wait-list controls.

Sahajpal and Rinpari (2000) investigated the effect of induced yogic relaxation training (IYRT) on stress level, self-concept, and quality of sleep among minority group individuals in India. Twelve minority college students were given pre/post measures over a one month span. The measures included the Tennessee Self Concept Scale, a stress test, a semi-structured interview schedule, and a sleep diary. The intervention consisted of instruction in five yogic relaxation postures. IYRT was demonstrated and practiced individually for 20 minutes a day. Significant pre-post improvements in quality of sleep, reductions in stress level, and improvements in self-concept were shown.

Cohen and colleagues (2004) examined psychological adjustment and sleep quality in a randomized trial of the effects of Tibetan Yoga (TY) intervention in patients with lymphoma. Thirty-nine patients with lymphoma were assigned to a TY group or wait list control group. Patients in the TY group participated in seven weekly yoga sessions which consisted of simple motions done with specific breathing patterns. Patients were encouraged to practice the techniques at least once per day. Psychological adjustment was assessed at baseline, one week, one month, and three months across several domains including distress, anxiety, and depression. Fatigue and sleep disturbance were also assessed at these time frames. Patients in the TY group reported significantly better overall sleep quality and subjective sleep quality, faster sleep latency,

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longer sleep duration, and less use of sleep medications during the three month follow up over and above baseline levels, compared with patients in the control group. However, there were no statistically significant group differences for the measures of psychological adjustment or fatigue.

In summary, research conducted on yoga has shown beneficial effects in many areas. However, there have also been studies conducted that have not shown significant improvement above and beyond other treatments. Quality of life has been significantly enhanced in pre-post assessment when using yoga as an intervention (Carlson, Speca, Patel, & Goodey, 2004; Casden, 2005). Some studies have shown mood to be significantly improved in pre-post assessment (Lavey et al., 2005 and Casden, 2005). However, other studies have shown no changes in mood when implementing yoga as a treatment (Carlson et al., 2004). Sleep disturbance has been shown to be improved with a yoga intervention (Sahajpal & Rinpari, 2000, Gross et al., 2004, Cohen et al., 2004, & Holmer, 2004). Yet, a recent study by Casden (2005) did not show significant pre-post effects of yoga treatment on sleep. Physical disorders (Garfinkel et al., 1998; Taneja et al., 2004 & Williams et al., 2005) and psychological adjustment (Lavey et al., 2005 & Taneja et al., 2004) have also been shown to improve with yoga. However, Williams et al., 2005 Gross et al., 2004 and Cohen et al. found no significant differences in psychological adjustment when examining outcome measures. There are several reasons that can explain these findings. First of all, the yoga interventions in these studies varied in length, intensity and type of yoga performed. Secondly, different populations were assessed for most studies, ranging from healthy university students, differing medical

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populations, and individuals with disturbed mood. Since there still many inconsistent findings to date, continued research in the area of yoga will be helpful to determine the role of this intervention in the future.

Kundalini Yoga

The literal translation of Kundalini is "coiling" (Kumar, 2000). In classic hatha yoga literature Kundalini is often described as a serpent coiled at the base of the spine. The image of uncoiling, like a spring, conveys the sense of untapped potential energy (Kumar, 2000). Kundalini works on the premise that the body has seven chakras and through the use of "the breath of fire" (rapid breathing), one can heat up the body from the bottom up, eventually raising Kundalini to achieve enlightenment. The chakras are thought to be transducers of energy in the body. The seven main chakras include: muladhara, svadhisthana, manipura, anahata, visuddha, ajna, and sahasrara (Greenwell, 1990). As one begins to awaken Kundalini through the practice of yoga, energy moves from the base of the spine. The energy flows upward opening each chakra (unlocking blocks in the system).

Kundalini yoga is a dynamic system that combines yoga postures (asana), breathing exercises (pranayama), relaxation, meditation, and chanting to raise the consciousness to enlightenment. Kundalini yoga uses powerful breathing, chanting, meditation and poses to relax the mind, body, and spirit. A specific sequence of the aforementioned (postures, chants, and breathing patterns) techniques are combined to assist with different disorders. For example, individuals diagnosed with Obsessive

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Compulsive Disorder (OCD) use a specific breathing pattern to help decrease associated symptoms.

Effects of Kundalini Yoga

Khalsa (1996) studied the clinical efficacy of Kundalini yoga in the treatment of eight adults with obsessive-compulsive disorder (OCD). The treatment approach used included a technique of unilateral forced nostril breathing. The OCD-specific breathing pattern requires individuals to block the right nostril and breathe very slowly through the left nostril. This pattern continues for 31 minutes. The ideal time per complete breath cycle is one minute, with each section of the cycle lasting 15 seconds. Unilateral breathing has been shown to have nostril-specific effects on the CNS and the autonomic nervous system (Khalsa, 1996). In addition, Khalsa (1996) found that specific breathing patterns selectively stimulate the contra lateral cerebral hemisphere, resulting in changes in mood, cognitive performance, EEG, and encephalography findings. The intent in using unilateral breathing in OCD is to specifically target the metabolic and physiologic abnormalities in the right frontal lobe. In Khalsa's study, participants were given the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS), The Symptom Checklist-90-R (SC-90-R), and the Perceived Stress Scale (PSS). Testing was held at near three-month intervals after initial baselines. Significant improvements were seen on the Y-BOCS (54% group improvement) and Perceived Stress Scales (39% mean improvement) at 12-months. The Symptom Checklist-90-R showed significant improvement when comparing baseline and 12 months for OCD (53.3% mean improvement), anxiety (62.5% mean improvement), and global severity index (53.25% mean improvement). Although

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significant improvements were found in the study, one cannot attribute the improvement to the Kundalini intervention due to the un-randomized nature of the study. Specifically, the study did not entail a control group. In addition, the sample size was limited.

A controlled study was conducted by Khalsa (1997) as a follow-up to the previous study (Khalsa, 1996). Twenty-one patients diagnosed with OCD were divided into two groups, equally matched for age, sex, and use of medication. Group one used the Kundalini yoga meditation protocol (described previously) and group two used the Relaxation Response plus Mindfulness Meditation technique. Seven adults in each group completed 3 months of treatment. Six psychological rating scales were used at baseline and three-month time points: Y-BOCS, SCL-90-R OC, SCL-90-R GSI, POMS, PSS, and Purpose in Life test (PIL). The group that practiced Kundalini yoga demonstrated a greater and statistically significant decreases in OCD symptoms, and a trend indicating greater improvements in stress and meaning of life. Within group statistics showed that the yoga group significantly improved on all six scales, while the Relaxation Response plus Mindfulness Meditation group had no significant improvements. Therefore, Kundalini yoga appeared to be a more beneficial treatment for OCD than relaxation plus mindfulness meditation.

In a non-randomized, non-controlled study, Khalsa (2004) investigated the effect of Kundalini yoga on chronic insomnia. Participants diagnosed with chronic insomnia maintained daily sleep-wake diaries during the pre-treatment two-week baseline and a subsequent eight-week intervention. The intervention included slow abdominal breathing, yoga postures, and silent mantras one hour long in duration. The treatment was practiced

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by participants on their own, following a single in-person training session. Sleep efficiency (SE), total sleep time (TST), total wake time (TWT), sleep onset latency (SOL), wake time after sleep onset (WASO), number of awakenings, and sleep quality measures were derived from sleep-wake diary entries. Participants were phoned every two weeks to assess compliance and assist with any posture difficulty. For 20 participants completing the protocol, statistically significant improvements were observed in sleep efficiency, total sleep time, total wake time, sleep onset latency, and wake time after sleep onset at the end of treatment as compared with pretreatment values. This study is vital to the current investigation because of its direct support of Kundalini yoga as a treatment for insomnia.

In summary, the research conducted on Kundalini yoga thus far is preliminary. Positive results for sleep and obsessive compulsive disorder have been shown to date. However, due to the lack of control groups, results cannot be solely attributed to the effects of the Kundalini yoga intervention. The present study is aimed to replicate and improve upon Khalsa (2004) study by adding a control group.

Statement of the Problem

Many people have difficulty sleeping. A 1995 survey by Gallop found that 49% of adults were dissatisfied with their sleep at least five times per month (as cited in Jean-Louis, Kripke, & Ancoli-Israel et al., 2000). It has been estimated that 10% to 40% of adults in America have intermittent insomnia; and 10% to 15% have long term sleep difficulties (Hicks, Fernandez, & Pelligrini, 2001). The American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (2000)

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defines insomnia as a complaint regarding the quantity, quality, or sleep timing at least three times a week for at least one month. Research studies define insomnia as a sleep latency (time taken to fall asleep) that is greater than 30 minutes, sleep efficiency (time asleep/time in bed) less than 85%, or sleep disturbance (nocturnal waking, difficulty falling asleep, difficulty awakening, feeling fatigue during the day) more than three times a week for one month (Lacks, 1992). Insomnia has been associated with decreased work performance as well as increased motor vehicle accidents (Ringdahl et al., 2004). Cost estimates for lost productivity and insomnia related accidents exceed $100 billion per year (Ringdahl et al., 2004)

The impact of sleep problems on different aspects of life among young adults have also been consistently documented (Ban & Lee, 2001; Yang et al., 2003). A national survey (Ban & Lee, 2001) carried out in 1998 showed that mean sleep duration of 10,773 adults aged 20 or over was 6.9 hours and 33.5% of them reported having insufficient sleep. Several studies have reported associations between sleep difficulties and impaired academic performance, greater alcohol consumption, higher negative mood, and more emotional and behavioral problems (Yang et al., 2003). A national survey (Ban & Lee, 2001) carried out in 1998 showed that mean sleep duration of 10,773 adults aged 20 or over was 6.9 hours and 33.5% of them reported having insufficient sleep. Several studies have reported associations between sleep difficulties and impaired academic performance, greater alcohol consumption, higher negative mood, and more emotional and behavioral problems (Yang et al., 2003).

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Justification

This study extended previous research showing that quality of sleep is affected by Kundalini yoga practice. Some origins of insomnia include hyper-arousal, stressors, and dysfunctional thought patterns. Numerous controlled clinical trials have demonstrated that improving insomnia with pharmacological treatment reduces sleep disturbance (Lichstein et al, 2003; Murtagh & Greenwood, 1995). However, the side effects, poor compliance rates, and cost of these drugs have stimulated the search for other options. Several controlled studies have demonstrated that Cognitive- Behavioral therapies such as stimulus control, temporal control, and sleep restriction have improved differing sleep parameters (Murtagh & Greenwood, 1995). Recently, controlled studies implementing mind-body techniques such as yoga, relaxation, and meditation also have shown some success in treating sleep disturbance (Sahajpal & Rinpari, 2000; Cohen et al., 2004; Freedman & Papsdorf, 1976). Khalsa (2004) conducted the only study looking at the effect of Kundalini yoga on insomnia; however, the main limitation of the study is that it was not controlled. Another limitation of this study was the small sample size. Therefore, the current study extended Khalsa's findings using a control group to strengthen its design. In addition, a larger sample will be used. A power analysis showed that 16 participants per group would be sufficient for a large effect based on Cohen's (2004) study. Specifically, this study looked at the effect of Kundalini yoga on sleep disturbance, quality of life, mood, and sleepiness.

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Potential Confounds

Extraneous variables that may potentially affect the predicted effects of yoga on sleep disturbance will be described next. Involvement in a regular yoga practice in the prior three month period (three times a month or more) may hinder results of the study since participants will not be gaining new information; thus individuals enrolled in a current yoga program were excluded. The use of sleep medication may interfere with results; however, this was controlled by inclusion and exclusion criteria, as will caffeine, alcohol intake and exercise regime. Participants in the study agreed to sustain current medication dosage throughout the study. In addition, participants were asked to record length of exercise time, caffeine intake and alcohol intake on the provided sleep diary. Individuals with severe psychiatric conditions or medical disorders and substance abuse disorders were excluded from the study. Attention through the weekly meeting sessions in the yoga treatment group may potentially affect sleep-related outcomes data; as a control for this potential confound the music control group will receive weekly phone calls from the principal investigator regarding their participation and providing consultation.

Goals and Objectives

The purpose of this study was to examine the effectiveness of a yoga based intervention on sleep disturbance. Variables were evaluated over an 8-week period. The variables examined included sleep disturbance, mood, arousal, and quality of life.

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Hypotheses

H1: Participants in the yoga intervention group will show a greater decrease in sleep disturbance from pre/post treatment than the music control group.

H2: Participants in the yoga intervention group will show more improved positive mood than the music control group.

H3: Participants in the yoga intervention group will show more enhanced quality of life from pre/post treatment than the music control group.

H4: Participants in the yoga intervention group will show a greater decrease in symptoms of arousal from pre to post treatment than the music control group.

H5: Pre/post decreases in sleep disturbance in the yoga group will be associated with improvements in arousal, QOL, and mood.

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Chapter Two

Methods

Participants

Forty male and female participants were recruited from the San Diego community. Participants were young adults with sleep disturbance between the ages of 18-35. The age of the participants was limited due to the intense activity required by the Kundalini yoga practice. To be classified as an individual with a sleep disturbance a score of five or greater is needed on the PSQI (Buysse et al., 1989); therefore individuals that were included in the study had to obtain a score of five or greater on the PSQI. Individuals were excluded from the study if they were not between the ages of 18 - 35 years old, if they had a severe medical, orthopedic, or mental disorder that would preclude physical exercise, if they had been diagnosed with a substance abuse disorder/ had had legal problems associated with alcohol (drinking under the influence), if they were pregnant, if they reported participation in regular yoga, or meditation practices (an average of once a week or more) over the past month. If patients were drinking an excessive amount of caffeine per day (an average of 830 milligrams per day/ 10 cups of coffee per day) (McGee, 2005) they were excluded from the study. Research shows that 250 milligrams of caffeine/3 cups of coffee per day is an average/moderate amount; an excessive amount has been defined as 830 milligrams of caffeine per day (McGee, 2005; Cushman, 2005). Individuals who were on prescribed medication were required to have been consistently on medication for a one month period. Individuals were also asked to remain on a consistent dosage of medication for the entire study and to notify the

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principal investigator of any changes. Post-test questionnaires were given to assess medication changes. The principal investigator monitored participant's usage of street drugs.

Flyers advertising the study (Appendix A) were posted to recruit participants. An internet advertisement (Appendix B) was also posted to inform individuals about the study. In addition, an email announcement (Appendix C) was sent to students and faculty at Alliant International University for recruitment purposes. Individuals who were interested in the study were instructed on the flyer/advertisement to contact the principal investigator via phone or email. The principal investigator contacted potential participants by a return phone call and interviewed them via a telephone screening questionnaire (Appendix D) to determine eligibility for the study.

Evaluation of Sample Size and Statistical Assumptions

Sample Size. In order to check for adequate sample size, power was calculated based on a previous study by Cohen et al. (2004). In Cohen's (2004) study, pretest-to-follow-up total score for sleep disturbance were $M = 5.8$, $SD = 2.3$ for the treatment group, and for the control group $M = 8.1$, $SD = 2.4$. To achieve 80% power to detect between group differences 16 participants were needed per group. The final sample size for the ANOVA analyses was $N = 32$.

Sample Characteristics

After initial telephone screening with 54 sleep disturbed individuals, 40 prospective participants met the study inclusion criteria and were invited to participate in the study. Of these, 4 declined due to re-location, 2 declined due to work schedule

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conflicts and 4 declined due to time commitment involved, 4 declined due to length of time to begin intervention. Altogether 32 participants completed the informed consent and were assigned to the groups, with 15 (47%) in the yoga group and 17 (53%) in the music control group. Of the 32 who committed to the study, 20% responded to flyers posted at Alliant International University, 40% responded to an advertisement on Craig's List, 15 % responded to flyers at Frog's gym in Solana Beach, and 25% were informed by word of mouth. To assess for possible differences among the recruitment sources, independent samples *t*-test for continuous data and chi-square tests for categorical data were conducted. Analyses yielded no significant differences (p's all > .05) among recruitment strategies on demographics or baseline levels of outcome measures.

Dropouts. The study had no individuals drop out; however, there were eight participants (25%) who did not respond to the mid-intervention assessment period. The principal investigator contacted participants with missing data by phone/email. Participants were encouraged to continue. All participants continued with the study.

Medication use. Use of some form of medication was reported by 40% of the study participants. Twelve and a half percent of the sample used birth control, 12.5% used antidepressants, 6.3% used allergy medications, and 3.1% of the sample used anxiety and sleep medication. To assess for possible differences among medication usage, independent samples *t*-test was conducted. Analyses yielded no significant differences for medication use (p's all > .05) between groups. Although not a significant finding (p = .97), five percent of both the music control group and yoga groups reported an increase in medication usage after the 8-week intervention.

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Table 1

Summary of Demographic Data in the Total Sample and by Group

Variable	Total (n =32)	Yoga (n=15)	Control (n= 17)
Gender:			
Female	60%	67%	53%
Male	40%	33%	47%
Age:			
Mean	28	29	28
Range	22-35	22-35	18-35
SD	4.39	4.26	4.47
Ethnicity:			
Caucasian	53%	52%	42%
Asain/Pacific Islander	28.00%	19%	37%
Other	13%	19%	5%
Hispanic	8.00%	10%	5%
African American	5%	0	11%
Marital Staus:			
Single	88.00%	95%	79%
Married	8.00%	0	16%
Divorced	3%	5%	5%
Separated	0	0	0
Widowed	0	0	0

(Table 1 continues)

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Table 1, continued

Summary of Demographics Data in the Total Sample and by Group

Variable	Total (n =32)	Yoga (n=15)	Control (n =17)
Education Completed:			
High School	8.00%	5%	11%
Partial College	0	0	0
College Graduate	91%	91%	90%
Graduate Degree	53.00%	67%	37%
Employment Status:			
Full-time	85%	81%	89%
Part-time	15%	19%	11%
Unemployed	0	0	0
Homemaker	0	0	0
Medication Use:			
Sleep	3%	7%	10%
Anxiety	3%	0	6%
Oral Contraceptive	13%	13%	12%
Allergy Medicine	6%	13%	10%
Anti-depressants	4%	7%	18%
Hours of Exercise/Week:			
Mean	0.45	0.53	0.36
Range	0-1	0-1	0-.85
SD	0.31	0.31	0.3

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Informed Consent

A consent form was provided to all individuals who agreed to participate in this study (Appendix E). The researcher reviewed the consent form with participants, reviewing the nature of the study, the benefits and risks of participating in the study and the option of the participants to withdraw from the study at any time. Participants read and signed the informed consent prior to participation in the study. The informed consent included a release to participate in the study. It stated that all of the data obtained from the client would remain confidential by number coding all documents. Participants who wanted to receive a summary of the research findings were asked to write their e-mail address on the consent form.

Participants were informed that participation in this study included minimal risk of injury, as does any supervised exercise program. Participants were advised that yoga instruction would be provided by an instructor who was experienced, trained, and certified in Kundalini yoga. Participants were advised that their safety and progress would be monitored by the principal investigator. In addition, participants were asked to accept their personal limits while practicing the poses. Participants were informed that neither Alliant International University, nor the yoga instructor would be liable for any injuries sustained by the participant as a result of the yoga practice.

Protection of Human Participants

This study was approved by the Institutional Review Board (IRB) of the California School of Professional Psychology at Alliant International University, San Diego. Individual participation was voluntary, and all participants were free to withdraw

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from the study at any time without penalty. A physical injury also precluded subjects from continuing in the study. Prior to their involvement in this research, participants were informed as to the general nature of the study and given a description of the experimental procedures. Participants were informed that the purpose of the study is to explore the effects of yoga and music on sleep disturbance. The procedures of this study followed the ethical principles and standards set forth by the American Psychological Association.

Background Demographics Measure.

A self-report demographic questionnaire (Appendix F) was given to all participants to assess age, sex, ethnicity, educational level, marital status, living status (alone/not), number of children, and occupational work status. Information on symptom duration regarding sleep disturbance, current medical conditions, current medication use, current participation in psychotherapy, and support group, current participation in aerobic exercise and stretching were obtained from this questionnaire. In addition, information regarding caffeine and alcohol/drug intake was obtained. Other factors affecting sleep which were assessed include information regarding work schedules, infant care, current back pain, and partner snoring.

Outcome Measures.

The following dimensions were assessed as outcome measures in the current study: (a) mood (b) quality of life (d) sleep quality (e) sleepiness.

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Profile of Mood States-Short Form (*POMS-SF*). The POMS-SF (Shacham, 1983) is a 37-item self-report measure which is the abbreviated form of the POMS (McNair & Shilony, 1994). The POMS-SF assesses six aspects of mood and affective states including Tension-Anxiety; Depression-Dejection; Anger-Hostility; Vigor-Activity; Fatigue-Inertia; and Confusion-Bewilderment, each yielding separate scores (Shacham, 1983). A total mood score can be derived by summing the scores of the six mood factors (weighing Vigor negatively). Each item is answered on a 5-point Likert scale from 0 (not at all) to 4 (extremely). Internal consistency estimates for all of the six mood subscales of the POMS-SF are high, reaching .80 or above (Shacham, 1983). According to Nyenhuis, Yamamoto, Luchetta, Terrien, and Parmentier (1999) the POMS scales are consistently more highly correlated with other measures of mood (mean $r = .67$) than non-mood related scales (mean $r = .50$). The POMS Total Mood Disturbance Scale correlated highly ($r = .79$) with the Visual Analogue Mood Scale composite score (Nyenhuis et al, 1999). Psychometric evaluation of the POMS-SF confirms that this version of the POMS maintains the factor based six subscale structure of the original POMS (Baker, Denniston, Zabora, Polland, & Dudley, 2002). Additionally, correlations between total mood disturbance and subscale scores on the POMS-SF and those of the original POMS have all been shown to exceed .95 (Curran, Andrykowski, & Studts, 1995). The POMS-SF offers a shorter administration time while retaining the six-subscale structure, providing a good alternative to the original 65-item measure. In this study, the total mood disturbance score and six subscale scores was used.

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Pre-Sleep Arousal Scale (PSAS). The PSAS (Nicassio, Mendlowitz, Fussell, & Petras, 1985) is a self-report questionnaire used to assess an individual's state of arousal as he/she falls asleep. The instrument consists of 16 items assessing cognitive and physical manifestations of arousal. The PSAS is comprised of two subscales, Cognitive Arousal and Somatic Arousal. Individuals are required to rate their previous night's symptoms on a 5-point Likert scale (1 = not at all; 5 = extremely). Two subscale scores are computed separately by summing across cognitive and somatic arousal items. The current study used both subscales to assess pre-sleep arousal.

The PSAS was administered to college students, adult normal sleepers and adult insomniacs to assess psychometric properties. Cronbach's alphas for the Somatic subscale were .79 for college students, .84 for normal sleepers, and .81 for insomniacs. The alpha coefficients for the Cognitive subscale were .88 for college students, .67 for normal sleepers, and .76 for insomniacs. Test-retest correlations for a sample of 30 college students over a three-week interval were .72 for the Cognitive subscale and .76 for the Somatic subscale. These results indicate that the PSAS subscale items show internal consistency and are relatively stable across time.

Construct validity was assessed by comparing PSAS score to measures of anxiety, depression, and sleep (Nicassio et al., 1985). The Cognitive and Somatic subscales of the PSAS were significantly correlated with scores on the Taylor Manifest Anxiety Scale (r = .50 and r =.58 respectively, p< .001) and the CES-D (r = .40 and r = .41, respectively, p < .001). In addition, the PSAS subscale scores were compared to sleep indices. Significant correlations were seen between the PSAS Cognitive arousal scale and sleep-

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onset latency (r = .59), total sleep time (r = - .34), and awakenings from sleep (r = .35), $p < .001$. Significant correlations were seen between the PSAS Somatic arousal scale and sleep-onset latency (r = .29), awakenings from sleep (r = .29), and listlessness during the day (r = .23), $p < .001$.

Quality of Life Scale (QOLS). Participants' quality of life and overall well-being was assessed by the QOLS (Burckhardt & Anderson, 2003). This questionnaire was derived from the original 15-item QOLS which was developed by Flanagan (Burckhardt & Anderson, 2003). The new version of the QOLS is rated on a 7-point Likert scale, ranging from 7 (delighted) to 1 (terrible). The instrument measures six conceptual domains of quality of life: material and physical well-being, relationships with other people, social, community and civic activities; personal development and fulfillment; recreation and independence. The instrument is scored by summing the items to make a total score; higher scores equal a higher QOL. The present study used the total score to assess quality of life. Reliability of the QOLS was found to be adequate based on the older, 15-item version of the measure with sufficient internal consistency (α = .82 to .92) and high test-retest reliability (r = 0.78 to r = 0.84) (Burckhardt & Anderson, 2003). Other researchers have reported similar reliability findings on the newer 16-item scale (Burckhardt & Anderson, 2003). Convergent and discriminant construct validity were found to be sufficient as evidenced by high correlations with a similar measure, the Life Satisfaction Index – Z, as well as low to moderate correlations with other measures that are not similar: Duke – UNC Health Profile (DUHP) and the Arthritis Impact Measurement Scale (AIMS) (Burckhardt & Anderson, 2003).

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Physical Symptom Measures

Pittsburgh Sleep Quality Index (PSQI). The PSQI is a 19-item self report questionnaire and five questions are rated by a bed partner or roommate (Buysse, Reynolds, Monk, Berman, and Kupfer, 1989). Only the self-rated questions are included in the scoring. The latter five questions are used for clinical information only, and are not used in the scoring of the PSQI. The 19-item self-rated questionnaire is combined to form seven component scores including sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction (Buysse et al., 1989). Questions can be endorsed on a range of zero to three (0 = no difficulty, 3 = severe difficulty). The seven component scores are added to yield one global score. This study used the global score. The seven component scores of the PSQI had an overall reliability coefficient of .83, indicating a high degree of internal consistency. Test-retest reliability for the global PSQI scores was .85. The estimate for sleep duration and sleep onset latency in the PSQI correlated highly and was significant ($r = .81, p = .000$; $r = .71, p = .000$, respectively) when compared to sleep log data. The correlations between PSQI and polysomnographic data were much lower, but also significant for sleep efficiency, sleep onset latency, percentage of Stage 2 and total sleep time without Stage 1. The PSQI has a high sensitivity and specificity for insomniacs in comparison to healthy controls, thus highlighting that it is a good measure for differentiating between poor sleepers and good sleepers (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002).

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Epworth Sleepiness Scale (ESS). The ESS is a self report measure of daytime sleep and sleepiness (Johns, 1991). Participants are asked to rate on a scale of 0-3 how likely they would be to doze off or fall asleep in eight situations (0 = would never doze, 3 = high chance of dozing). The eight situational questions are added together to give a total score for each participant. The current study used the total score to determine daytime sleepiness. The internal consistency of the ESS is good ($\alpha = .88$) in participants suffering from excessive daytime sleepiness, while it is fair ($\alpha = .73$) for patients who do not suffer from daytime sleepiness (Violani et al., 2003). ESS scores were significantly correlated with sleep latency measured at night with polysomnographic data (Johns, 1991).

Pittsburgh Sleep Diary. (PsghSD). The PsghSD is a daily log used to assess sleep latency, sleep duration, wake times, sleep quality, and mood. The PsghSD is an instrument with separate components to be completed at bedtime and wake-time (Monk et al., 1994). Bedtime components relate to the events of the day preceding the sleep/wake-time components to the sleep period just completed. Comparisons in the study (Monk et al., 1994) are made with polysomnographic and actigraphic sleep measures, as well as personality and circadian type questionnaires. The instrument was shown to have sensitivity in detecting differences due to weekends, age, gender, personality and circadian type, and validity in agreeing with actigraphic estimates of sleep timing and quality (Monk et al., 1994). Over a 12-31 month delay, Pittsburgh Sleep Diary (PsghSD) measures of both sleep timing and sleep quality showed correlations between 0.56 and 0.81 ($N = 39, p < 0.001$). The PsghSD is computed by averaging daily

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entries into weekly averages. The averages in this study were computed in two week increments.

Visual Analogue Scale. Participants in the yoga group were asked to rate the overall quality of the intervention on a 10 cm VAS scale (Appendix G) with points ranging from "worthless, no value" to "optimal, very valuable."

Manipulation Check. Rating of Participant Progress. The yoga class instructor completed a rating of each participant's basic ability to perform Kundalini yoga (Appendix H). This manipulation check was intended to measure if the participant actually learned Kundalini yoga as intended by the study. A visual analogue scale was filled out by the instructor every two weeks. The instructor placed a slash through a 10cm line with end points ranging from "struggling to perform yoga postures" to "easily performs yoga postures."

Compliance Check. Participants in both groups were asked specifically, "have you practiced the assigned technique today?" Duration of daily practice was also assessed for both groups. Attendance was taken weekly by the principal investigator at the yoga sessions. The music group was telephoned on a weekly basis to check compliance and offer any needed consultation.

Integrity Check. To assure the Kundalini yoga instructor was following the appropriate techniques of Kundalini another certified Kundalini yoga instructor attended 25% of the classes. The second Kundalini instructor rated the primary instructor's adherence to the Kundalini technique. The ratings were based on the appropriateness of the yoga instructor's technique. The rater had a list of poses, chants, and sequence of

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breathing that the yoga instructor followed. Based on this form, the rater observed the instructor on accuracy of technique.

The Credibility/Expectancy (CEQ). CEQ is a six-item self-report measure. The CEQ consists of two subscales. The Credibility scale measures how logical the participant believes the treatment they are receiving is; while the Expectancy scale measures how much improvement the participant feels they will achieve by using the specific treatment. Factor analysis of the measure showed that questions one, two and three loaded on the credibility scale (.79 to .93); while questions four, five, and six loaded on the expectancy scale (.82 to .96) (Devilly & Bokkovec, 2000). The measure uses two rating scales, a nine-point adjective anchored scale (1 = not at all to 9 = very); and a percentage scale from zero to one hundred percent. The current study used separate scores from each scale to determine participant's belief and expectancy of treatment. Devilly and Borkovec (2000) report that the scale demonstrates high internal consistency within each factor with a standardized alpha of between .79 and .90 for the expectancy factor, a Cronbach's alpha of between .81 and .86 for the credibility factor, and a standardized alpha between .84 and .85 for the whole scale. Test-retest reliability over a one-week period of the expectancy factor was significant at $r\ (67) = .82, p < .001$ and the credibility test retest reliability also showed a significant correlation, $r\ (67) = .75, p < .001$. Inter-item correlations across studies ranged from .53 and .85 for items on the expectancy factor and between .62 and .78 for items on the credibility factor.

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Procedures

To recruit participants, flyers describing the study were distributed throughout San Diego. Prospective participants were instructed to contact the principal investigator by telephone for further information. A telephone screening form was used to standardize the participant contact and screening method. During the initial phone contact, patients were told that the purpose of the study was to examine the effects of Kundalini yoga on sleep disturbance, and if they participated they would be randomly assigned to either the yoga group or music control group. The general program was briefly described and the prospective participants questions were answered.

If the individual was interested in the study, a series of questions was asked by the principal investigator to determine if he or she meet the inclusion criteria for the study. Participants who met the inclusion criteria were invited to participate in the study. For participants who accepted the invitation, an appointment was scheduled within one week prior to the commencement of the study with the principal investigator for the purpose of providing informed consent and completing demographic and health history forms, initial baseline assessment, and group assignment. Prior to beginning the initial assessment, each participant was asked to read and sign an informed consent forms. Participants also received a logistics handout (Appendix I) which reviewed their group assignment, program days and times, location, start date, suggestion for attire, and what to bring.

Each participant had the opportunity to win prizes through a raffle drawing. Participants earned raffle tickets by completing pre/post/follow-up assessments, attending sessions, listening to music, and completing the sleep diaries. Participants completing

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each assessment period earned two tickets (baseline, mid-intervention, post-intervention). Participants earned two tickets for each two week diary that was completed. At the end of the study, there was a raffle drawing. The raffle tickets were exchanged for prizes including gift certificates for yoga classes, two one-hour massages, or a one-hour facial.

The baseline, mid-intervention and post-intervention assessments included both psychological (POMS, PSAS, and QOLS) and physical health measures (ESS and PSQI), which were administered immediately before treatment and after the eight weeks of yoga treatment. Participants also completed sleep diaries during the two week baseline, two weeks out of the eight week treatment period (weeks four and five), and at the two week follow-up. The baseline, mid-intervention and post-intervention assessments were conducted by the principal investigator. The assessments were administered in-person, and each participant met individually with the principal investigator.

Interventions

The participants who met the study requirements were randomly assigned to one of two groups: (a) Yoga Group or (b) Music Control Group. Participants were assigned based on a drawing of names, with every other name being alternately assigned. The principal investigator mailed the participant's group assignment.

Yoga Intervention. The yoga class was taught by a certified Kundalini yoga instructor. The instructor had been through an intensive training protocol to learn the technique of Kundalini. The yoga classes were based on the traditional primary series of Kundalini yoga as taught by Yogi Bhajan (Rattana, 1989). The classes were conducted outside on a patio adjacent to Alliant International University's library. There were

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approximately 10-12 participants in each of the eight classes. The classes met for 60 minutes each week.

Kundalini Yoga and the Breath. The practice of Kundalini yoga places less emphasis on postures, as many of the other types of yoga do. Instead, Kundalini yoga places more of an emphasis on the individual's breathing, chanting, hand and finger gestures. These are done together, or in sequence to create exact, specific effects. The movements used are regulated with the powerful "breath of fire". The breath of fire starts with a long deep breath, then as soon as the lungs are completely expanded, the air is immediately forced out, as soon as most of the air is out the individual is to immediately expand the lungs again, allowing the air back in. Each time the inhalation occurs the individual arches the spine forward and presses the palms inward against the knees in a light manner to feel the diaphragm filling the lungs completely.

Kundalini Yoga Intervention. The yoga instructor began the session by introducing the general subject of yoga. A brief description of relaxation, breathing, and chanting were discussed. (The description of the breath can be found under Kundalini yoga and the breath). The poses, mantras, and sequence of poses remained constant throughout the 8-week period. The first two poses in the set used deep abdominal breathing, while all others used the breath of fire (except where explicitly states deep breathing used). The specific instructions for each pose were excerpted from KISS (Khalsa's 2001, chapters. 3-6) are given below:

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Kundalini Yoga Class Format

1. Deep Abdominal Breathing. Sit in "easy pose," on floor with legs crossed, straightened spine, and chest slightly forward. Hands on knees with palms facing up. Touch the thumb to the index finger (both hands). Close eyes. Exhale. Relax and expand belly, inhale deeply. (5 breaths)
2. Prayer Position. Place hands in prayer position, centering thumbs in front of chest. Begin mantra "Ohm Namo Guru Dev Namo, Ohm Namo Guru Dev Namo. Repeat 3 times.
3. Spine Flex. In easy pose, take hold of outside ankles. Inhale and flex your spine forward. Chest out. Shoulders back. Exhale and slump your body. Shoulders curve forward. Chest caves in. Spine rounded. Continue breathing and movement in a rhythmic forward and backward manner. (2 minutes)
4. Spinal Twists. Still sitting in easy pose, bring hands up to shoulders, fingers in front, thumb in back. Straighten spine. Twist from side to side. (3 minutes)
5. Shoulder Shrugs. Place hands on knees. Spine straight and neck in line with spine. Inhale and lift shoulders straight up towards ears. Exhale, let shoulders drop down. (3 minutes)
6. Neck Rolls. Hands on knees in easy pose. Drop head forward, inhale. Begin to rotate head around to right. Make movement slow. As head

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drops back exhale. After 3-4 circles in one direction, reverse the movement. (3 minutes)

7. Forward Stretch. Extend legs out. Bring arms up and overhead. Stretch arms out over legs. Hands should hold on to ankles or toes. Bend forward, exhale. Inhale as moving up. (2 minutes)
8. One Leg Stretch. One leg remains outstretched while the other leg is in a half-Indian style pose. Both arms are brought down over outstretched leg, holding onto ankle or toe. While holding ankles or toes, exhale on forward bend. Inhale as moving up. (2 minutes) Reverse. (2 minutes)
9. V-Stretch. Legs are in V-shape. One arm is alternately outstretched over the same side leg. The inhalation of breath coincides with the alteration of the arms outstretched over the same-side leg. (3 minutes)
10. Easy Pose – Deep abdominal breathing. Thumb touching index finger. (2 Minutes). Raise hands into prayer position and begin mantra "Sat Nam" (5 minutes).
11. Prayer Position. Repeat mantra from Step 2. (4 minutes)
12. Ego Transformer. Sit in easy pose or on heels. Raise arms straight to a 60-degree angle from the horizontal. Stretch thumbs up toward the sky. Rest of fingers are curled onto pads of hands. Begin the powerful breath of fire. (2 minutes)
13. Pump. Sit back on heels. Hand up with palms touching, take a deep inhale. Hold inhale in, and pump the navel in and out. Similar to the

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breath of fire. When breath cannot be held longer, exhale. Repeat 4 times.

14. Sit on heels. Relax. Deep abdominal breathing. (3 minutes)
15. Sit heels. Right palm faces heart center (chest) while left palm faces out. Pull hands as breathing fully and deeply (hands remain locked) Elbows are out. (2 minutes)
16. On heels. Arms behind head. Hands clasped at neck. Bend forward (forehead touching mat). Breath is powerful. Movement can be fast or slow. (2 minutes)
17. Sit in easy pose. Hands on knees. Palms up. Thumb touching index finger. Deep abdominal breathing. (3 minutes)
18. Static Forward Stretch. Bring legs forward. Place outstretched arms over legs and remain here. Deep abdominal breathing. (1 minute)
19. Neck Rolls. Repeat. (Step 6)
20. Cat and Cow. Come onto all fours. Arch back drawing navel up and in, exhale (head comes up). Inhale, lowering spine (head comes down). Increase pace as movement continues.
21. Single Shoulder Shrugs. Sit on heels. Bring one shoulder up toward ear, while dropping the other shoulder. Exhale and inhale powerfully while alternating shoulder drops.
22. Shavasana. Lying on floor (on your back). Long deep breathing. Fully relax. (5 minutes)

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23. Downward Dog. Lie down on floor face downward. Place palms by sides of chest, fingers straight. Place the underside of toes and balls of feet on floor. Exhale and raise trunk from floor. Hips move toward the ceiling and back away from hands. Keep arms straight. Move head inward towards feet. Keep legs straight. (1 minute)

24. Childs Pose. Kneel down on back of heels. Bend forward. Bring forehead to mat. Bring arms down along sides. (1 minute)

25. Walk. Standing position. Bend forward. Grab ankles with hands. Walk around mat. (1 minute)

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Home Practice of Kundalini Yoga

Participants were assigned to attend one yoga class per week over an eight week period. Each participant was also given a Kundalini yoga DVD for daily home practice. A trained Kundalini yoga instructor demonstrated Kundalini yoga poses on the DVD. The in-class session and DVD instructional format incorporated the same postures, mantras, and meditation. The DVD was split into two parts, Part A is morning practice which lasts 30 minutes (first 10 poses from in class format described above); Part B is evening practice which lasts 45 minutes (all poses from in class format). Both morning and evening versions entail the same postures, mantras, and meditation; however, the evening version has an addition eight poses. Each version begins with three minutes of deep breathing. Participants are asked to inhale deeply through the nostrils and exhale completely through the nostrils. For the next three and a half minutes participants are asked to recite a mantra and use "breath of fire" (forceful, rapid breathing). This breathing technique is used throughout the duration of the class, intermixed with deep (less forceful) breathing. The next five minutes entail a warm-up to release tension from the head, neck and shoulders. Participants are then asked to perform some yoga postures for five minutes for the morning yoga, and 15 minutes for the evening yoga. The last 10 minutes of parts A and B of the instructional DVD incorporates a meditation and mantra. The in-class format of the Kundalini yoga practice followed the evening version of the instructional video. Participants were asked to practice at home with the DVD every day for approximately one hour. The participants were told that they could shorten (to 30 minutes total) the format of the instructional video which entailed practicing 30 minutes

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in the morning and 30-45 minutes in the evening. Due to the difficulty of the postures, endurance and flexibility required to complete the entire series, the classes/at-home sessions were able to be modified to meet the student's current abilities. Participants shortened the length of practice time (in home). No other modifications were made.

Music Control Group. The control group received a CD with classical or new age music. The participants in this group were instructed to listen to the music every night before sleeping and every morning upon waking. The control group continued for an 8-week time frame. The control group was administered the baseline, mid-intervention and post-intervention assessments at the same time as the yoga participants. All assessments were administered in person and individually. The principal investigator telephoned participants in the music group weekly to check on adherence and provide consultation (Appendix J). After the last assessment was completed, the wait list group was offered one Kundalini yoga session and the DVD that was offered to the yoga intervention group participants.

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Research Design and Statistical Analysis

Research Design

This prospective, experimental study with repeated measurements examined the effect of Kundalini yoga on sleep quality, mood, quality of life, and sleepiness. For the purpose of recruitment, individuals from the San Diego community who had been identified as having a sleep disturbance were included. The time period for this research included a two-week baseline period, followed by an eight week intervention period, a post-assessment period.

Statistical Analyses

The study used time and treatment group (yoga/ music) as independent variables. Time was a within groups variable; while treatment group was a between-groups variable (2 levels). The dependent variables in this study consisted of mood, sleep quality, sleepiness, and quality of life. In addition, sleep diary data was averaged separately over three, 14 day assessment periods (baseline, mid-intervention, post-intervention). The diary evaluated sleep efficiency, total sleep time, total wake time, sleep onset latency, wake time after sleep onset, number of nocturnal awakenings, waking difficulty, and fatigue during the day.

Statistical analyses were completed using the software SPSS 11.0. The reliability of the dependent measures used with this sample was first assessed to ensure internal consistency. Internal consistency analysis was performed using coefficient alphas. The data was also evaluated to ensure that the variables met the underlying assumptions for MANOVA. Analysis of normaility, outliers, homogeneity of variance-covariance,

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linearity, homogeneity of regression, covariate reliability (covariates measured without error), and absence of multicollinearity and singularity will be conducted. Additionally, data were investigated to ensure that the variables met the underlying assumptions for ANOVA.

Comparative group analyses were conducted to assess for significant differences between the groups on baseline levels of outcome variables, demographics, medical history and behavioral variables using chi-square tests for categorical variables and independent sample *t*-tests for continuous variables. There were no significant group differences found on the baseline outcome measures.

Two separate methods were used to analyze the data: multivariate analysis of variance (MANOVA) and analysis of variance (ANOVA).

In order to evaluate the effect of Kundalini yoga on, mood, quality of life, sleepiness, and sleep arousal a MANOVA was conducted to test significant group x time interactions. Following the MANOVA, a series of group x time ANOVA's were conducted on the three individual dependent variables (mood, quality of life, and sleepiness). The ANOVA was followed by paired *t*-tests for dependent samples run separately within each group to compare pre-test and post-test scores. Significant group x time interactions addressed the hypothesis for MANOVA and ANOVA.

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Chapter III:

Results

Reliability of Scales

Reliability of Scales

The data were analyzed using SPSS Windows v. 11. Internal consistency analyses were performed using coefficient alphas. Reliability coefficients for baseline and post-treatment data are presented in Table 2. All of the variables exhibited very good internal consistency. Coefficient alphas ranged from .82 to .92 at baseline and from .80 to .91 at eight-week follow-up.

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Table 2

Reliability of Predictor and Criterion Variable Measures (Coefficient Alpha's)

Measure	Coefficient Alpha	
	Baseline	Post-Treatment
Profile of Mood States	0.91	0.88
Quality of Life	0.87	0.84
Arousal Scale	0.92	0.91
Epworth Sleepiness Scale	0.82	0.81
Credibility/ Expectancy Questionnaire	.31	.29

$N = 32$

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The Credibility/Expectancy (CEQ). The Credibility/Expectancy Questionnaire was not analyzed in this study due to the low alpha coefficient (.31). After reviewing the questions it was determined that the principal investigator did not include the complete questionnaire, two of the six items were missing. Therefore, the validity of the measure was reduced.

Procedures for Processing Data

Data were inspected for errors in scoring and data entry. Categorical data, such as race, gender and marital status were inspected by analyzing minimum and maximum values, checking the number of valid cases and missing cases. Continuous data, such as age and scores on outcome measures, were similarly analyzed by inspecting the minimum, maximum and mean values of the scores. No errors were found upon inspection. The assumption of normality on baseline outcome measures in each group was assessed in several ways. The skewness and kurtosis values of outcome scores in each group were reviewed and any values greater than +3.0 or less than –3.0 were considered problematic. Further, the Kolmogorov-Smirnov statistic, a test of normality, was reviewed in search of significant scores, which were also considered problematic. All problematic scores were further reviewed. A visual inspection of histograms was performed, and cases with a reasonably normal distribution were considered normal. Also visual inspections of the normality plots were inspected for a straight line, suggesting a normal distribution. Lastly, de-trended normal Q-Q plots were inspected, and if there were no clustering of points around the zero line, it was considered normal. After thorough investigation, no violation of the normality assumption was found.

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Next, the data were inspected for outliers. First, a box plot of the distribution of scores of the two groups were reviewed for outliers (1.5 box-lengths away from the edge of the box) and extreme outliers (3 box-lengths away from the edge of the box). Outliers were checked for errors in scoring and data entry, by reviewing the raw data. Then, the 5% trimmed mean score of each group's baseline outcome measure were compared to the original mean, to assess the influence of the outlier on the mean. Case number four was normal at baseline, and began to change extremely once intervention began. Because case four started off normally, I assumed that our participant was very influenced by the treatment obtained. The outliers found in the investigation did not appear to greatly influence the overall mean of the baseline outcome measures. In addition, when statistical analysis of the outcome data was conducted with and without outliers, no significant differences were found. Therefore, all data collected, including outliers, were included in data analysis.

To evaluate the daily sleep diary data, averages in two-week increments were taken for each time period assessed. The baseline data consisted of the first two weeks of the study (before treatment began). The mid-treatment data consisted of weeks five and six (during participant's time in treatment). Post-treatment data was collected during weeks 11 and 12 (when in-person treatment ended). Each sleep parameter (TWT, TST, SE, SOL, and WASO was calculated separately.

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Group Equivalence at Baseline

Group equivalence was determined by analyzing demographic and outcome variables at baseline. An independent-samples *t*-test was conducted to analyze age, a continuous variable. There were no significant differences in scores for the yoga group ($M = 28.60$, $SD = 4.28$) and the music group [$M = 28.52$, $SD = 3.80$; t (30) =.049, p = .96]. The magnitude of the difference in the means was very small (eta squared = .00006). An independent-samples *t*-test was also conducted to compare income levels for the yoga group ($M = 48{,}000$, $SD = 66426.6$) and the music group [$M = 83{,}000$, SD = 67298.3; t (30) =.771, p =.15]. The magnitude of the differences in the mean was .068. Chi-square analyses were conducted to compare categorical baseline data. The two groups did not differ significantly in gender (1, N=30) = .24, p = .63, education (1, N=30) = .41, p = .52, marital status (1, N = 30) = 2.17, p = .14, or race (1, N = 30) = .11, p = .74. Further the two groups did not differ significantly with respect to baseline caffeine intake (1, N=30) = -.64, p = .52, alcohol intake (1, N=30) =-.82, p=.41, or exercise activity (1, N=30) = 1.5, p = .14.

Group equivalence on outcome measures at baseline was analyzed by conducting a series of independent samples *t*-tests. There were no significant differences found between the yoga and music control group on baseline scores assessing quality of life, profile of mood states, cognitive arousal scale, somatic arousal scale, sleep index, sleepiness scale, and sleep parameters (total wake time, total sleep time, sleep efficiency, sleep onset latency, and wake time after sleep onset (See Table 3).

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Table 3

Group Equivalence on Baseline Outcome Measures Scores Analyzed by Independent Samples t-tests

Measure	Yoga		Music		
	M	*SD*	*M*	*SD*	*t*
POMS-TMD	17.73	17.65	21.94	18.60	.52
QOL	85.10	12.26	83.30	13.72	0.38
Cognitive Arousal Scale	19.40	6.93	21.70	7.24	-0.91
Somatic Arousal Scale	12.10	4.06	13.41	5.38	-0.75
Epworth Sleepiness Scale	6.80	4.05	8.70	4.83	-1.20
TWT	1.10	0.36	1.21	0.40	-1.03
TST	7.3	0.70	6.98	1.00	0.90
SE	87.1	4.41	85.00	5.03	1.23
SOL	24.5	10.79	20.88	10.67	0.96
WASO	46.2	20.6	46.41	18.35	-0.03

Note. POMS – TMD = Profile of Mood States-Total Mood; QOLS = Quality of Life Scale; SOL = Wake Time After Sleep Onset – Latency; WASO– Wake Time After Sleep Onset; TST = Total Sleep Time; SE = Sleep Efficiency; TWT = Total Wake Time.
No group differences were significant at $p < .05$.

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Comparison of Total Sample with Other Studies

The present study's average scores compared to other samples will now be discussed. All means and standard deviations for baseline outcome measures for the total sample can be found in Table 4. The currents study POMS-TMD scores (M = 19.96, SD = 18.00) were comparable to those of the Carlson et al. (2004) study (M = 22.62, SD = 33.16) which used a sample of 58 cancer patients. Carlson and colleagues (2004) did not find a significant difference in negative mood for their patients following yoga, citing the initial low mood score as cause. The mean QOLS 84.13 (SD = 12.88) in the present study was slightly lower than the average score for healthy populations (M = 90) (Burckhardt & Anderson, 2003). Since the present sample reported sleep difficulties, a slightly lower score seems appropriate. The mean ESS scores (M = 7.81; SD = 4.52) for this sample were higher than a normal control (M = 5.9, SD = 2.2) (Johns, 1991). The Khalsa (2004) study did not report sample means/standard deviations for the sleep diary data in that sample. However, using the PSQI we can compare overall sleep quality. The current study's PSQI (M = 9.20; SD = 3.63) closely resembled that of individuals having difficulty initiating and maintaining sleep in Khalsa's study (M = 10.38; SD = 4.57) (N = 45); whereas healthy controls have reported means of 2.67 (SD = 1.70) (Buysse et al., 1989). Means and standard deviations for the Cognitive Arousal subscale were, respectively, 21.45 and 5.80 for college students (N=147) and 25.50 and 6.57 for insomniacs (N=30), as compared to the current sample (M = 20.62; SD = 7.08). Therefore this sample was more similar to college students than insomniacs. The means and standard deviations for the Somatic subscale were, respectively 11.63 and 3.74 for

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college students and 17.67 and 6.45 for insomniacs, as compared to this sample (M = 11.86; SD = 4.21), which was, again, more similar to college students.

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Table 4

Baseline Outcome Measure Means and Standard Deviations for Total Sample

Measure	*M*	*SD*
POMS-TMD	19.96	18.00
QOL	84.13	12.88
Cognitive Arousal Scale	20.62	7.08
Somatic Arousal Scale	12.84	4.75
Epworth Sleepiness Scale	7.81	4.52
PSQI	9.20	3.63
TWT	1.15	0.39
TST	7.12	0.87
SE	86.03	4.80
SOL	22.60	10.71
WASO	46.31	19.12

Note. POMS – TMD = Profile of Mood States-Total Mood; QOLS = Quality of Life Scale; PSQI = Pittsburgh Sleep Quality Index; SOL = Wake Time After Sleep Onset – Latency; WASO- Wake Time After Sleep Onset; TST = Total Sleep Time; SE = Sleep Efficiency; TWT = Total Wake Time.

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Yoga Class Attendance and Participant Satisfaction

There was moderate attendance at the yoga classes, with an average rate of five of eight (62%) classes attended. Participants who were not able to make their scheduled weekly class were allowed to attend the same class on an alternate day.

The participants' at home yoga practice was also assessed using the self-report "Daily Yoga Log." Participants were asked to practice the 30-minute yoga video at home every day they were not in class (6 days per week). Daily Yoga Log entries revealed a wide range of reported at home practice among participants, ranging from no practice to 8 hours of practice throughout the entire 10-week intervention period of the study. Overall, the participants reported an average of 2 days per week of at-home yoga video practice (M = 3.4 hours, SD = 2.0).

In addition, daily home practice was correlated with improvement scores. Although there were no significant correlations, several medium effect size correlations were found: TWT, r (14) = .40, p = .096; SE, r (14) = -.42, p = .12; WASO, r (14) = .37, p = .18; and QOL, r (14) = .33, p = .22. This trend towards significance suggests that an increase in participants may have led to significant findings. In-class practice was also correlated with improvement scores. The findings suggest that coming to class did not effect any sleep parameters, however a moderate correlation was found between in-class practice and QOL, r (14) = .40, p = .14.

Participant self-reported satisfaction was rated after completion of the yoga intervention using a 10cm VAS scale, with scores ranging from 0-10. Overall satisfaction with the yoga experience was high, with an average score of 8.0 (SD = .88). While

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program satisfaction ranged from 5.6 to 9.0, over 60% of the participants rated their satisfaction with the yoga classes at 8.0 or above. Class attendance and participant satisfaction were but moderately, non-significantly negatively correlated, r (15) = -.485, p = .067.

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Manipulation Check

Participant Progress

The yoga instructor's former mentor attended two classes (25%) to determine if the poses and sequence taught were appropriate to Kundalini practice. The observer determined that the yoga instructor's methods were appropriate.

The yoga instructor observed and rated participants in the yoga classes to determine whether they actually learned and performed yoga. Ratings of the participant's progress were based on visual observation of participation in the yoga classes by the instructor. The instructor measured each yoga participant's ability to perform yoga postures, using a VAS scale with scores ranging from 0-10, with higher scores reflecting greater progress. Assessments were conducted after each class.

The results, via a one-way repeated measures ANOVA, show that participants in the yoga group made significant progress in their yoga practice over time $F(1,7) = 5.15$, $p < .05$. The eta squared statistic was .81, indicating a large effect size (See Figure 1). Participants focus ability was also rated by the instructor. Participants in the yoga group also made significant progress in their focus ability over time $F(1, 7) = 15.74$, $p < .001$. The eta squared statistic was .53, indicating a moderate effect (Figure 2). See Table 4 for means and standard deviations for progress in weekly ability and focus ratings (Week 3 through Week 8). Week 1 and week 2 were baseline periods therefore the intervention had not been introduced at this time. Weeks 11 and 12 were post-intervention. Although participants were asked to continue with practice during the post-intervention time

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period, there were no classes held during this time and therefore no rater to evaluate progression of poses and focus.

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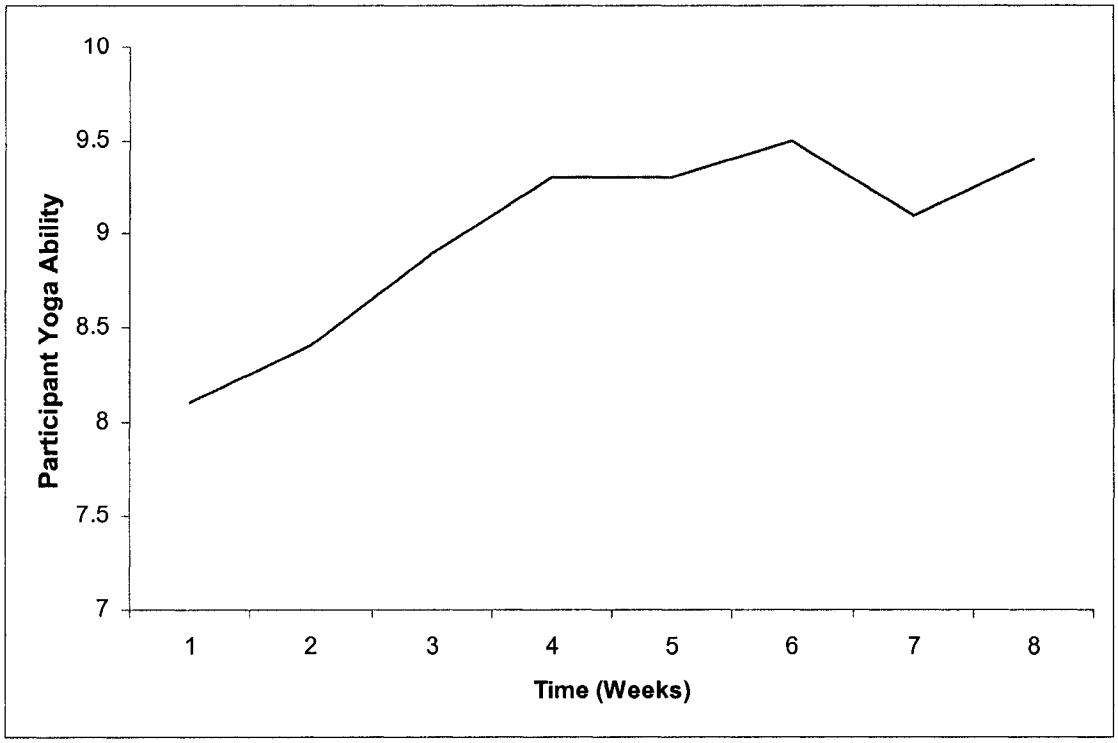

Figure 1. Participant progress ratings for the yoga group. Participants showed significant progress in the yoga classes from week 3 through week 8.

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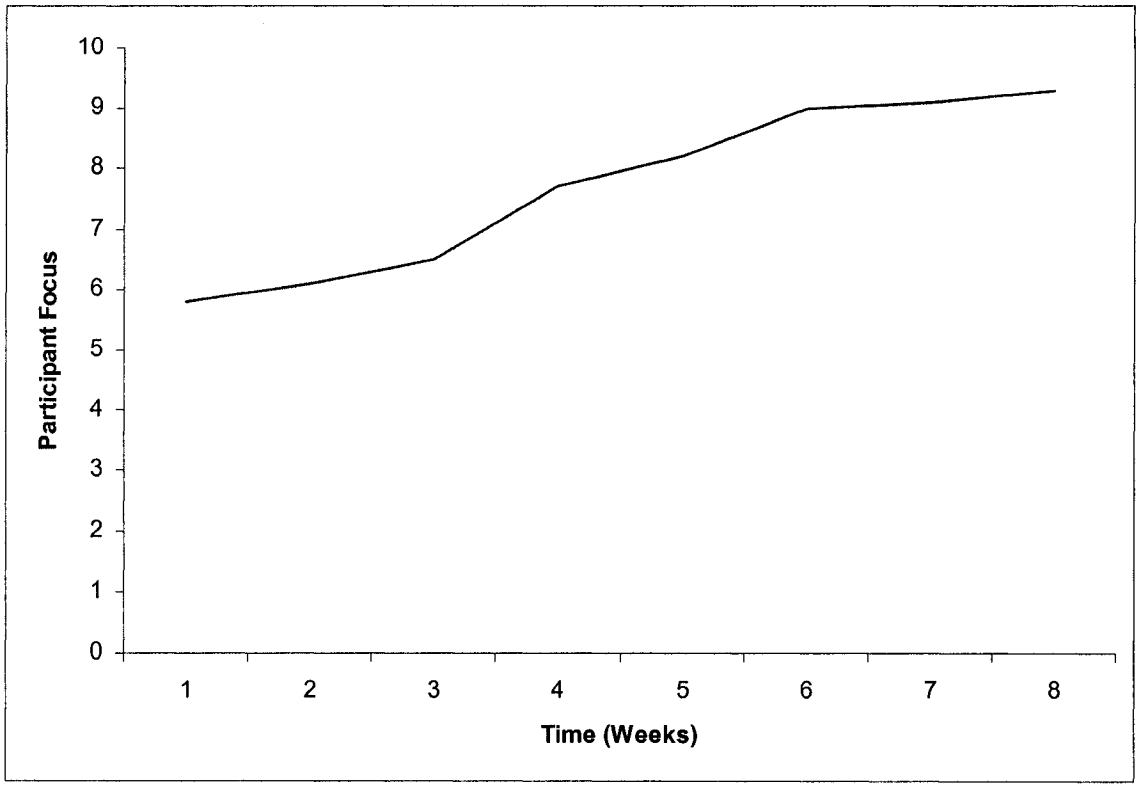

Figure 2. Participant focus ratings for the yoga group. Participants showed significant increase in focus in the yoga classes from week 3 through week 8.

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Table 5

Means and Standard Deviations for Yoga Progress in Ability and Focus

Measure	Yoga Ability		Yoga Focus	
	M	*SD*	*M*	*SD*
Week 3	8.1	2.1	6.4	2.3
Week 4	8.4	0.83	7.5	1.7
Week 5	8.9	1.2	8.7	1.5
Week 6	9.3	0.7	9.2	1.6
Week 7	9.3	0.7	9.1	1.5
Week 8	9.5	0.64	9.3	1.6
Week 9	9.1	1.1	9.3	1.6
Week 10	9.4	0.91	9	1.6

Note. Weeks 3 – 10 include intervention period. Weeks 1 and 2 are baseline and weeks 11 and 12 are post-intervention.
The effect of time on yoga ability (weeks 3 -10) was significant at $p < .05$ and on yoga focus at $p < .001$

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Table 6

Ranges, Means, and Standard Deviations on Outcome Measures by Group and Time

Measure	Group	*N*	Range of Measure	Range of Scores		*M*		*SD*	
				T1	T2	T1	T2	T1	T2
POMS-TMD	Yoga	15	-31-200	-10-46	-8-47	17.73	9	17.65	15.5
	Music	17		-3-72	-4-53	21.94	15.94	18.6	14.97
	Total	32		-10-72	-8-53	19.96	12.68	18	15.4
QOLS	Yoga	15	16-112	63-106	72-126	84.53	90.66	12.39	12.68
	Music	17		53-107	64-103	83.76	82.76	13.66	11.5
	Total	32		53-107	64-126	84.12	86.46	12.88	12.53
ESS	Yoga	15	0-24	0-13	0-15	6.4	5.53	3.9	4.38
	Music	17		0-17	0-13	9.05	7.23	4.76	4.13
	Total	32		0-17	0-15	7.81	6.43	4.51	4.27
SAS	Yoga	15	8-40	8-22	8-26	11.86	11.53	4.20	5.80
	Music	17		8-23	8-17	13.70	11.0	5.15	2.97
	Total	32		8-23	8-26	12.84	11.25	4.75	4.45
CAS	Yoga	15	8-40	12-37	8-29	19.20	14.46	6.99	12.37
	Music	17		10-34	10-30	21.88	17.29	7.13	5.54
	Total	32		10-37	8-30	20.62	15.96	7.08	5.29

Note. POMS-TMD = Profile of Mood States-Total Mood; QOLS = Quality of Life Scale; SAS = Somatic Arousal Scale; CAS = Cognitive Arousal Scale; ESS = Epworth Sleepiness Scale.

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Table 7

Ranges, Means, and Standard Deviations of Sleep Parameters by Group and Time

Measure	Group	*N*	Range of Scores			*M*			*SD*		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
SOL											
	Yoga	15	11-43	3-19	1-16	24.46	10.06	5.2	10.85	5.04	3.44
	Music	17	3-44	3-34	0-25	21.0	10.0	6.0	10.6	8.1	6.0
	Total	32	3-44	3-44	0-25	23.0	10.0	5.0	10.7	6.7	5.0
WASO											
	Yoga	15	20-89	8-73	5-58	50.73	24.33	22.7	21.87	18.06	15.02
	Music	17	6-68	7-46	10-81	42.0	28.0	25.0	15.98	11.48	16.73
	Total	32	6-89	7-73	5-81	46.0	26.0	24.0	19.0	15.0	16.0
TWT											
	Yoga	15	.6-2	.2 - 1	.2 - 1	1.18	0.68	0.55	0.45	0.39	0.28
	Music	17	.51-1.6	.32-1.3	.29-1.7	1.12	0.76	0.61	0.33	0.27	0.32
	Total	32	.51-2.2	.23-1.7	.20-1.7	1.1	0.72	0.59	0.39	0.33	0.3
TST											
	Yoga	15	6.-8.	6-9.	5.0-9.0	7.2	7.5	7.45	0.71	0.92	0.92
	Music	17	5.6 - 9.0	6.2-9.7	6.0-9.5	7.0	7.4	7.7	4.5	0.99	0.97
	Total	32	5.6-9.0	6.2-9.7	5.7-9.5	7.1	7.5	7.6	0.87	0.94	0.94
SE											
	Yoga	15	74-92	81-97	86-97	86	91	93	5.0	5.0	3.0
	Music	17	76-93	73-96	83-96	86	90	93	4.5	5.3	3.2
	Total	32	74-93	73-97	83-97	86	91	93	4.8	5.1	3.3

Note. SOL = wake time after sleep onset – latency; WASO – wake time after sleep onset; TWT = total wake time; TST = total sleep time; SE = sleep efficiency.

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Table 8

Bivariate Correlations of Outcome Measures at Baseline on the Total Sample

	POMS-TMD	QOLS	CAS	SAS	ESS	SOL	WASO	TST	TWT
QOLS	-.61**								
CAS	.56**	-.29							
SAS	.55**	-.34	.78**						
ESS	.05	-.2	.22	.21					
SOL	.13	.14	-.02	-.06	-.19				
WASO	-.23	.13	-.21	-0.14	-.26	.39*			
TST	.06	-.24	.06	.27	.02	-.05	-.13		
TWT	-.08	.09	.02	.04	-.24	0.34	.88**	-.16	
SE	.09	-.17	-.00	.06	.23	-.35*	-.80**	.47**	-.94**

Note. POMS – TMD = Profile of Mood States-Total Mood; QOLS = Quality of Life Scale. CAS = Cognitive Arousal Scale; SAS = Somatic Arousal Scale; ESS = Epworth Sleepiness Scale; SOL = Sleep Onset – Latency; WASO – Wake Time After Sleep Onset; TST = Total Sleep Time; TWT = Total Wake Time; SE = Sleep Efficiency.
*$p < .05$. **$p < .01$.

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Statistical Assumptions. Prior to interpretation of each analysis, data were examined for violation of assumptions. Assumption testing for multivariate analysis of variance (MANOVA) consisted of checking multivariate normality, linearity, univariate and multivariate outliers, homogeneity of variance and multicollinearity. No major violations of assumptions were discovered. Assumption testing for analysis of variance (ANOVA) consisted of checking normality, univariate outliers, homogeneity of variance and homogeneity of regression. No violations of assumptions were discerned.

Correction for Type I Error. A Bonferroni adjustment of the alpha level used to judge statistical significance was not used for the analyses as the sample size was small.

Main Analysis of Outcome Measures

Mood. A 2 x 2 (group x time) repeated measures analysis of variance (ANOVA) was conducted on mood (POMS – TMD). The ANOVA analysis did not reveal a significant group x time interaction between the yoga and the music control group on the POMS – TMD measure, $F(1, 31) = .22, p = .64$ (See Table 9). A significant main effect for time was found $F(1, 31) = 6.50, p = .02$ (See Table 9), indicating both groups decreased in negative mood over time. Follow up analyses were done by splitting the data file and analyzing each group separately. A paired samples *t*-test showed a significant difference between baseline and post-intervention scores on mood, $t(14) = 2.90, p = .01$ for participants in the yoga group. Participants in the control group showed no significant differences on mood over time $t(16) = 1.27, p = .22$.

Quality of Life Scale (QOLS). A 2 x 2 (group x time) repeated measures ANOVA revealed a significant interaction on the QOLS measure, $F(1, 31) = 4.4, p = .045$, with a

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large effect size of .13, indicating differential pre/post test improvement between the groups on the QOLS (Table 9 and Figure 3). A subsequent analysis was conducted using paired samples *t*-tests, showing significant within-group increases from baseline to post-intervention in the yoga group, $F(1, 14) = 7.8, p = .014$ and a large effect size (.35) . Participants in the control group showed no significant differences on the QOLS over the same time period $F(1, 14) = .153, p = .70$ (Table 6).

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Table 9

Results of 2 x 2 (Group x Time) Repeated Measures ANOVAs (Interaction Effects) on Outcome Measures

Measure	*SS*	*MS*	*F*	*P*	η^2	Observed Power
POMS-TMD	29.77	29.77	.22	.64	0.01	.07
QOLS	202.74	202.74	4.37	.04	0.13	.53
SAS	22.43	22.43	2.03	.16	0.06	.28
CAS	.08	.08	.00	.95	.00	.05
ESS	3.65	3.65	1.21	.28	0.04	.19

Note. POMS-TMD = Profile of Mood States-Total Mood; QOLS = Quality of Life Scale; SAS = Somatic Arousal Scale; CAS = Cognitive Arousal Scale; ESS = Epworth Sleepiness Scale.
$df = 1$
$^*p < .05$.

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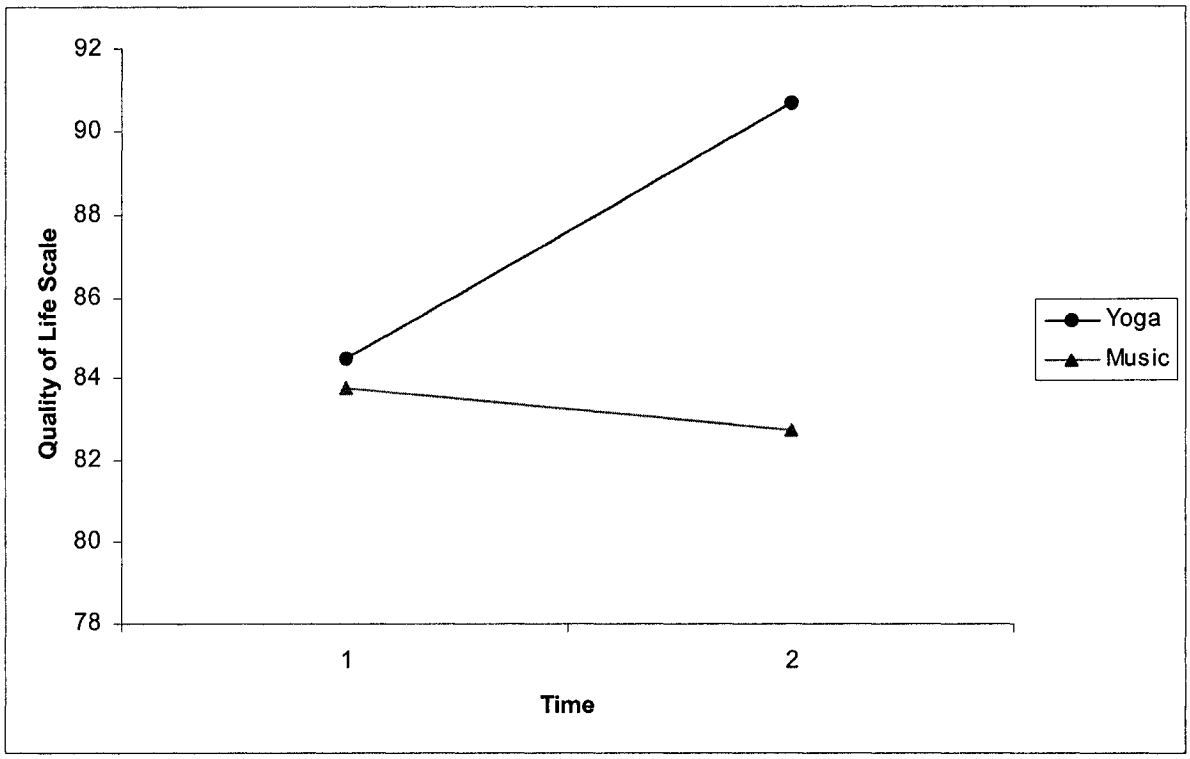

Figure 3. Differential improvement between yoga group and music control group on QOL measure.

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Cognitive Arousal Scale (CAS). A 2 x 2 (group x time) repeated measures ANOVA was conducted on the CAS measure. The ANOVA did not reveal a significant group x time interaction $F(1, 31) = .004, p = .95$. (See Table 9). There was a significant main effect for time, indicating baseline to post-intervention decreases in CAS for both groups $F(1, 31) = 15.55, p < .001$, and a large effect size (.34). (See Table 10). The data file was split to assess each group separately. A subsequent simple effects analysis using a paired-samples *t*-test showed a significant difference between baseline and post-intervention for both the yoga, $t(14) = 2.4, p = .02$, and music groups, $t(16) = 3.23, p < .01$, indicating both groups showed significant baseline to post-intervention decreases in CAS.

Physical Symptoms.

Somatic Arousal Scale (SAS). A 2 x 2 (group x time) repeated measures ANOVA was performed on the SAS measure. The ANOVA did not reveal a significant group by time interaction $F(1, 31) = 2.04, p = .164$. (See Table 9). Similarly, there was not a significant main effect of time on the SAS measure $F(1, 31) = 3.34, p = .078$. (See Table 7).

Sleep Symptoms.

Epsworth Sleepiness Scale (ESS). A 2 x 2 (group x time) repeated measure ANOVA did not show a significant group by time interaction, $F(1, 31) = 1.21, p = .28$. (See Table 8). There was a significant main effect of time, $F(1, 31) = 9.6, p < .01$, indicating a decrease in daytime sleepiness across time regardless of group. (See Table 9). For subsequent analyses, the data file was split to assess each group separately. A

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paired-samples *t*-test did not show a significant difference from baseline to mid-intervention in the yoga group $t\ (14) = 1.31, p = .21$; while significance was shown for the same time period in the music group $t\ (16) = 3.20, p < .01$, indicating a within group decrease in sleepiness across time in the music group only. This effect was opposite to what was hypothesized.

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Table 10

Results of Paired Samples t-tests Comparing Baseline and Post-intervenion on Outcome Measures

		M		*SD*		
Measure	Group	T1	T2	T1	T2	*t*
POMS-TMD	Yoga	17.73	9.00	17.65	15.50	1.30
	Music	21.94	15.94	18.60	14.97	
QOLS	Yoga	84.53	90.66	12.39	12.68	2.80 **
	Music	83.76	82.76	13.66	11.50	
CAS	Yoga	19.20	14.46	6.99	12.37	3.24 **
	Music	21.88	17.29	7.13	5.34	
ESS	Yoga	6.4	5.53	3.9	4.38	3.2 **
	Music	9.05	7.23	4.76	4.13	

Note. POMS-TMD = Profile of Mood States-Total Mood; QOLS = Quality of Life Scale; SAS = Somatic Arousal Scale; CAS = Cognitive Arousal Scale; ESS = Epworth Sleepiness Scale.
* $p < .05$. * * $p < .01$.

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Sleep Parameters

Total Sleep Time (TST). A 2 (group) x 3 (time) repeated measures ANOVA was conducted to compare scores on TST at baseline, mid-intervention and post-intervention. The means and standard deviations are presented in Table 7. There was not a significant group x time interaction when assessing all three time periods (Table 11), F (2, 30) = 1.25, p = .29, multivariate partial eta squared = .04. There was a significant main effect of time during the three time periods F (2, 30) = 5.7, p = .01, multivariate partial eta squared = .16. Post-hoc analyses consisted of a 2 (group) x 2 (time) repeated measures ANOVA on baseline and post-intervention scores. There was not a significant group x time interaction, F (2, 30) = 1.44, p = .24. There was a significant main effect of time between baseline and post-intervention, F (2, 30) = 6.51, p = .016, indicating participants increased their TST between baseline and post-intervention. The data file was split to evaluate each group separately, and a paired samples t-test was conducted, to assess if time effects were shown from baseline and mid-intervention or mid-intervention and post-intervention for each group. A significant main effect for time was seen in the music group only, t (16) = -3.30, p < .01, indicating a significant increase in TST in the music group from baseline to mid-intervention. This was opposite to what was hypothesized.

Total Wake Time (TWT). A 2 (group) x 3 (time) repeated measures ANOVA was performed to compare scores on TWT at baseline, mid-intervention and post-intervention. The means and standard deviations are presented in Table 7. There was not a significant group x time interaction, F (2, 30) = 1.20, p = .312, multivariate partial eta squared = .077. There was a significant main effect for time, F (2, 30) = 64.80, p < .001,

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multivariate partial eta squared = .82. A 2 (group) x 2 (time) repeated measures ANOVA was performed to compare scores on TWT at baseline and post-intervention. There was not a significant main effect of group, F (2, 30) = 1.08, p = .305, multivariate partial eta squared = .035. There was a significant main effect of time, F (2, 30) = 100.9, p < .001, multivariate partial eta squared = .77; indicating participants improved on average TWT from baseline to post-intervention, regardless of group. Further analyses consisted of splitting the file by group and conducting paired samples t-tests. The yoga group showed a significant main effect of time from baseline to mid-intervention t (14) = 8.40, p < .001, and mid-intervention to post-intervention, t (14) = 2.60, p < .05, while the music group showed a significant main effect of time between baseline and mid-intervention only, t (14) = 6.32, p < .001, indicating the yoga group decreased their TWT throughout the 10-week study period, while the music group showed similar improvements only during the first 5 weeks of the study.

Sleep Efficiency (SE). A 2 (group) x 3 (time) repeated measures ANOVA was conducted to assess scores on SE at baseline, mid-intervention and post-intervention. The means and standard deviations are presented in Table 7. There was not a significant group x time interaction, F (2, 30) = .63, p = .54. There was a significant main effect of time, F (2, 30) = 63.57, p < .001, multivariate partial eta squared = .81. An additional 2 (group) x 2 (time) repeated measures ANOVA was conducted to evaluate baseline and post-intervention, there was not a significant group x time interaction, F (2, 30) = .003, p = .96. There was a significant main effect of time F (2, 30) = 91.53, p < .001, multivariate partial eta squared = .75, indicating an increase in SE from baseline to post-intervention

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regardless of group. Further analyses consisted of splitting the file to assess each group separately. Paired sample *t*-tests were conducted. A significant main effect of time was found from baseline to mid-intervention for both the yoga t (14) = -8.75, $p < .001$, and music group, t (17) = -3.80, $p < .01$; both groups improved in SE from baseline to mid intervention, however no changes were observed in either group between mid-intervention and post-intervention (p's >.05).

Sleep Onset - Latency (SOL). A 2 (group) x 3 (time) repeated measures ANOVA was performed to compare scores on SOL at baseline, mid-intervention and post-intervention. The means and standard deviations are presented in Table 7. There was not a significant group x time interaction, F (2, 30) = .80, p = .46. There was a significant main effect of time, F (2, 30) = 49.13, $p < .001$, multivariate partial eta squared = .77. Further examination of SOL compared scores at baseline and post-intervention, via a 2 (group) x 2 (time) repeated measures ANOVA. There was not a significant group x time interaction, F (2, 30) = 1.65, p = .209. However, a significant main effect of time was found, F (2, 30) = 99.98, $p < .001$, multivariate partial eta squared = .77. The data file was split by group and a paired samples *t*-tests was conducted to assess any differences from baseline to mid-intervention and mid-intervention to post-intervention. Significant main effects for time were shown for both yoga t (14) = 5.81, $p < .001$ and music t (16) = 5.01, $p < .001$ from baseline to mid-intervention; and from mid-intervention to post-intervention (yoga) t (14) = 3.25, $p < .01$ and (music) t (16) = 3.60, $p < .01$; demonstrating both groups decreased in sleep latency over time.

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Wake Time After Sleep Onset (WASO). A 2 (group) x 3 (time) repeated measures ANOVA was conducted to examine baseline, mid-intervention and post-intervention scores on WASO. The means and standard deviations are presented in Table 7. There was a significant group x time interaction, $F(2, 30) = 3.53, p = .03$, with a medium effect size of .10 (Table 11 and Figure 4); indicating one group improved significantly more over time on the WASO parameter. Further analyses consisted of a 2 (group) x 2 (time) repeated measures ANOVA for baseline to post-intervention, which also showed a significant group x time interaction, $F(1, 30) = 4.20; p < .05$. Subsequent analyses consisted of two 2 x 2 (group x time) repeated measures ANOVAs examining two different time periods (baseline to mid-intervention and mid-intervention to post-intervention). A significant group x time interaction was found from baseline to mid-intervention, $F(1, 30) = 5.63, p < .05$, indicating greater improvement in WASO from baseline to mid-intervention in the yoga group compared to controls. A significant group x time interaction was not found for the period between mid-intervention and post-intervention, $F(1, 30) = .130, p = .72$; indicating no further group improvement in WASO from mid-intervention to post intervention. There was not a significant main effect for time during the mid-intervention to post-intervention period, $F(1, 30) = 1.14, p = .30$; indicating no improvement over this time period for either group. To further assess the significant group by time interaction from baseline to mid-intervention, the data was split by and a paired samples t-test was conducted. Both the yoga $t(14) = 7.37, p < .001$ and the music group $t(16) = 4.12, p < .01$ improved significantly on WASO when analyzed separately by group. Although the yoga group improved significantly more ($p <$

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.05) than the music group on WASO from baseline to mid-intervention, both groups decreased WASO across time.

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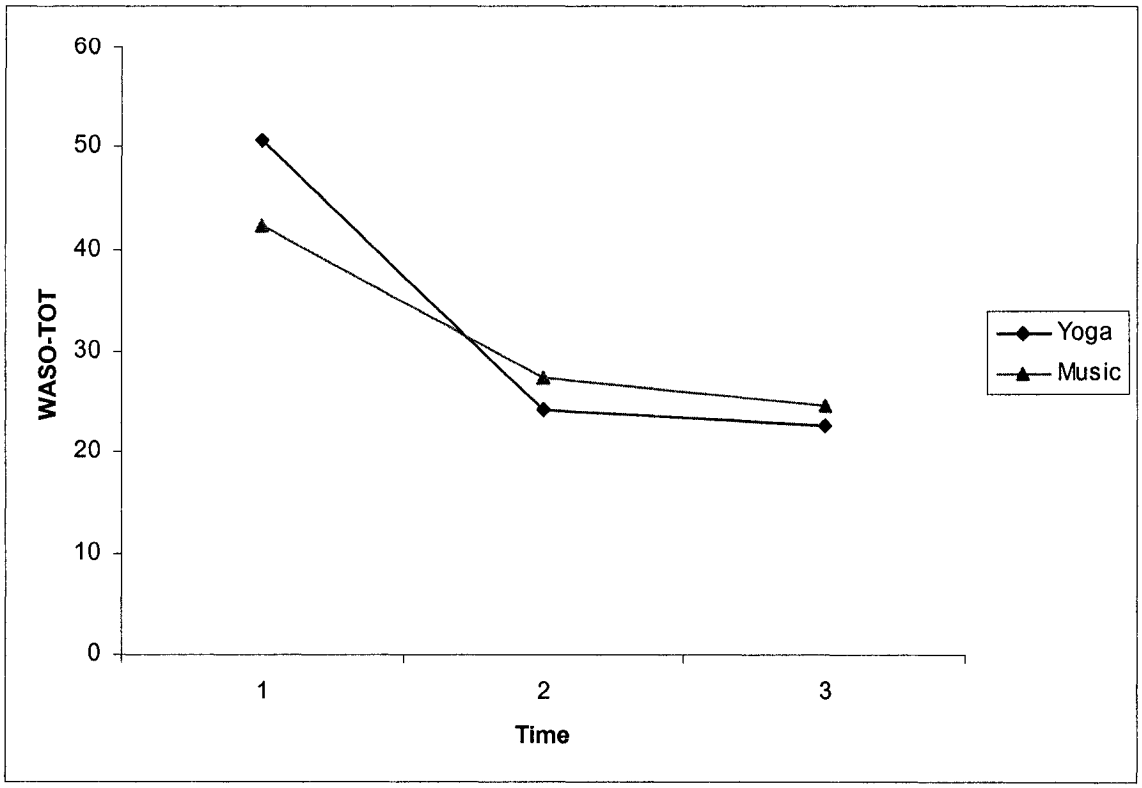

Figure 4. Differential improvement between yoga group and music control group on WASO sleep parameter.

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Table 11

Results of 2 x 3 (Group x Time) Repeated Measures ANOVA (Interaction Effects) on Sleep Parameters

Measure	*SS*	*MS*	*F*	*p*	η^2	Observed Power
SOL	89.04	56	1.30	.27	.04	.24
WASO	666	333	3.53	.03	.10	.63
TWT	.08	.04	1.07	.35	.03	.22
TST	.81	.48	1.26	.28	.04	.24
SE	9.75	5.25	.57	.55	.00	.13

Note. SOL = wake time after sleep onset – latency; WASO – wake time after sleep onset; TWT = total wake time; TST = total sleep time; SE = sleep efficiency. Time = baseline, mid-intervention, post-intervention
$df = 2$
$^*p < .05$.

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Table 12

Results of a 2 x 2 (Group x Time) Repeated Measures ANOVA (Interaction Effects) on Sleep Parameters

Measure	*SS*	*F*	η	Observed Power
SOL	76	1.65	0.05	0.24
WASO	422	4.20 *	0.12	0.51
TWT	0.05	1.09	0.03	0.17
TST	0.70	1.44	0.04	0.21
SE	0.02	0.00	0.00	0.05

Note. SOL = wake time after sleep onset – latency; WASO – wake time after sleep onset; TST = total sleep time; SE = Sleep efficiency; TWT = total wake time. Time = baseline and post-intervention.
$df = 1$
* $p < .05$.

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A (2 x 3) group x time repeated measures multivariate analysis of variance (MANOVA) was performed to investigate group differences in sleep parameters at baseline, mid-intervention, and post-intervention. Five dependent variables were used: sleep efficiency, total wake time, total sleep time, sleep onset latency, and wake time after sleep onset. The independent variables were group and time. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity, with no serious violations noted. There was not a significant difference in change over time between the yoga and music control group on the combined dependent variables: F (5, 27) = .26, p = .93; Wilks Lambda = .95; partial eta squared = .05. Although no significant main effects were shown when analyzing the sleep parameters as a whole; based on means, three of the five sleep parameters (SE, SOL, and WASO) showed more baseline to post-treatment improvement in the yoga group; indicating the yoga group had a higher SE, lower SOL, and lower WASO than the music group. Means and standard deviations reported in Table 7. When the results for the dependant variables were considered separately, there was a significant main effect of group for WASO F (2, 30) = 3.31, $p < .043$, partial eta squared = .100; indicating a significant difference between the averages of the two groups on WASO.

Further bivariate correlations of demographic variables and significant delta change scores (WASO, QOL) revealed a significant negative correlation at mid-intervention to post-intervention between gender and delta WASO, r (-.43) = .01; indicating females in the yoga group had a stronger mid-intervention to post-intervention

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decrease in WASO than males in the yoga group. To examine this further the data file was split by group, and a 2 (time) x 2 (gender) repeated measures ANOVA was conducted to assess the mid-intervention and post-intervention period. A significant (mid-intervention to post-intervention) time x gender interaction was found, WASO (1, 14) = 4.86, $p < .05$; indicating females in the yoga group showed significant improvements from mid-intervention to post-intervention. See Figure 5. Females in the yoga group had a 4-point decrease ($M = 26.45$ to M=22.27) in WASO from mid-intervention to post-intervention, while males in the yoga group had a 5-point increase ($M = 18.5$ to $M = 24$) during the same time period. Additional paired samples t-tests were conducted to further examine WASO. Paired-samples t-tests revealed a significant decrease in WASO from baseline to mid-intervention for females in the yoga group t (10) = 6.74, $p < .001$. Males in the yoga group did not decrease in WASO from baseline to mid-intervention t (3) = 2.83, $p = .066$; however this finding should be interpreted with care due to the low n for males. A gender x time interaction was found for the yoga group, F(1, 30) = 1.57, $p = .23$; however the control group, $F(1, 30) = 3.26$, $p = .05$, showed a significant gender x time interaction.

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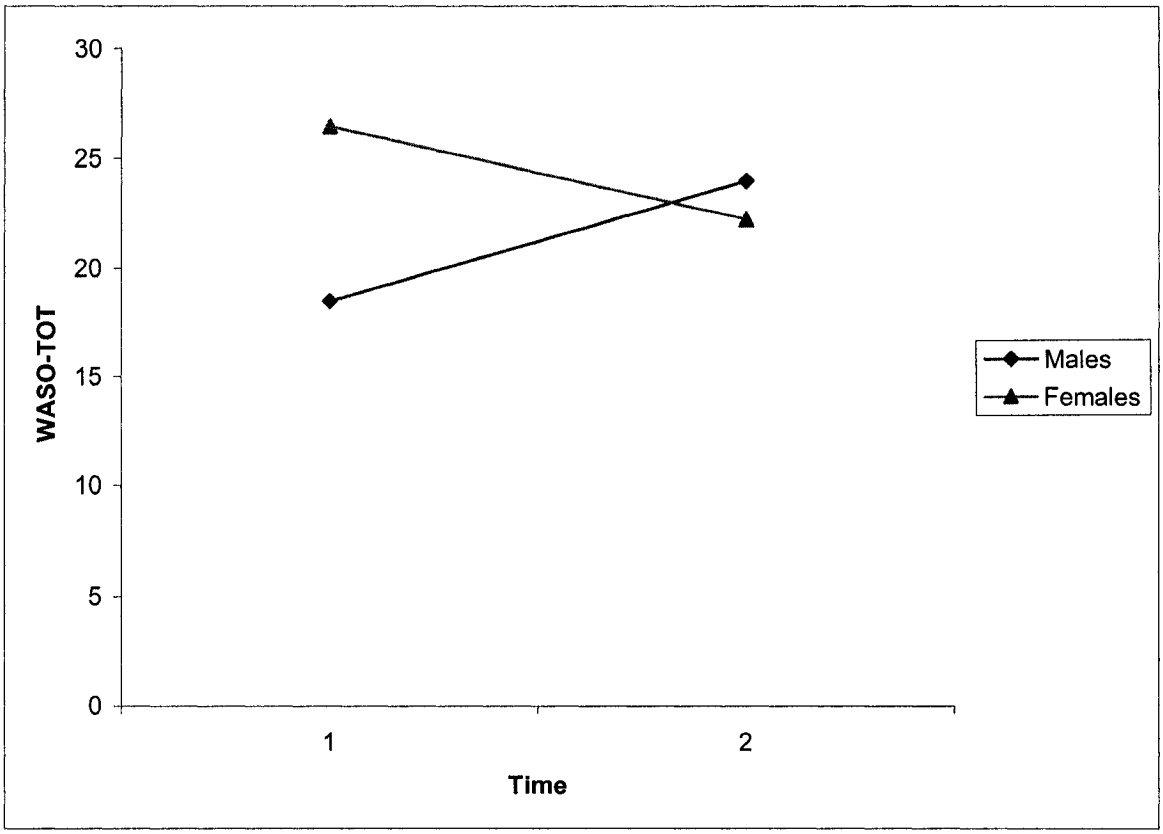

Figure 5. Significant gender x time interaction on WASO in the yoga group.

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Baseline Analysis

Baseline outcome measure scores were statistically analyzed in several ways. Descriptive statistics were completed for each outcome measure at baseline including means and standard deviations for each group and total sample (see Table 6 and 7). The range of scores for the QOLS was between 53 and 107, healthy populations report an average score of 90, whereas scores can range between 61 and 83 in individuals experiencing arthritis, post traumatic stress disorder and fibromyalgia (Burckhardt & Anderson, 2003). The ESS scores ranged from 0-17, healthy populations scores usually range between 2 and 10; while insomniacs usually have a score between 0 and 6 (Johns, 1991). Scores on the POMS-TMD ranged from -10 to 70, lower scores indicating more positive mood. Ranges for other studies were not found.

Bivariate Pearson correlations were conducted on all baseline outcome measure scores (see Table 7), outcome improvement scores (delta scores) and demographic information. Delta scores were calculated by subtracting baseline from mid-intervention outcome scores. Further analysis of the Bivariate Pearson correlation matrix, revealed that baseline negative mood (POMS) was significantly negatively correlated with QOLS $r\,(15) = -.61, p < .001$, and positively correlated with somatic arousal $r\,(15) = .55, p = .001$, and cognitive arousal $r\,(15) = .57, p < .001$. The sleep parameter measures (sleep efficiency (SE), total sleep time (TST), total wake time (TWT), sleep onset latency (SOL) and wake time after sleep onset (WASO) were all significantly correlated with one another, with exception of TST and WASOMIN, TST and WASO, and TST and TWT.

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Baseline Variables Predictive Ability on Improvement Scores

The baseline scores were compared to their delta change scores (post values, minus baseline values) to evaluate whether baseline scores were able to predict their related improvement scores. Somatic arousal, r (30) = -.56, p = .001, cognitive arousal, r (30) = -.70, p = < .001, sleepiness index , r (30) = -.37, p = .037, POMS, r (30) = -.60, p< .001, SOL, r (30) = -.89, p = <.001, WASO, r (30) = -.60, p < .001 and TWT, r (30) = -.66, p < .001 scores were moderately to highly negatively correlated with their respective change scores signifying that the higher the scores were at baseline, the more participants in both groups improved at follow-up. This may be due to ceiling effects, as most of these scores were relatively high at baseline. Therefore, if scores were high to begin with there was ample opportunity for scores to decrease. The QOL, r (30) = -.43, p = .015, TST, r (30) = -.50, p < .01 and SE, r (30) = -.73, p < .001, scores also had a moderate negative correlation with their respective change score, indicating that the higher the score was at baseline the less improvement there was at follow-up. Since the majority of QOL scores were high at baseline, along with a high SE and TST, there was less room for improvement in these measures. In addition, within group differences were determined by comparing baseline scores to delta change scores (post values minus baseline values) in the yoga group only. The cognitive arousal scale baseline values r (13) = .79, p <.001, SOL r (13) = -.96, p < .001, WASO r (13) = -.73, p < .01, TWT r (13) = -.80, p = .001 were moderately to highly negatively correlated with their respective change scores, signifying greater improvement for individuals with higher scores at baseline. Thus, yoga group participants with higher baseline scores on the aforementioned variables

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demonstrated less pretest/posttest improvement in outcomes. This pattern is consistent with regression to the mean, which is a potential threat to internal validity. However, the differential improvement between the yoga and music groups in QOL and WASO suggests real treatment intervention effects. Total sleep time r (13) = -.58, $p < .05$, however, began with relatively high numbers, thus improvement outcome scores changed less.

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Chapter IV:

Discussion

Overview

The purpose of this study was to evaluate the effects of Kundalini yoga on sleep disturbance, mood, quality of life, and sleepiness. The remainder of this chapter will be organized in the following order: (a) summary of findings, (b) manipulation check and program adherence, (c) A review of the current study findings, as it relates to previous research, (d) limitations of the present study, (e) clinical implications, and (f) recommendations for future research directions.

Summary of Findings

Overall, the results of this study show that an 8-week program of Kundalini yoga significantly improves quality of life and decreases total wake time after sleep onset compared to the music group. In addition, an 8-week program of yoga and music listening was shown to be effective in increasing sleep efficiency, decreasing total wake time, sleep onset latency, and cognitive arousal. The music group showed within group improvements in total sleep time and daytime sleepiness, while the yoga group showed within group improvements on negative mood symptoms.

Manipulation Check

As intended by the study, the manipulation check showed that yoga participants attended the Kundalini yoga classes, practiced Kundalini yoga and progressively learned Kundalini yoga over the duration of the 8-week program. Overall, yoga class attendance was moderately high, with an average of 5 out of 8 classes attended (62%). Data was also

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gathered on daily yoga practice; on average participants practice two times per week (29%) at home. Although there were no classes available to the participant's in the music group, weekly data was gathered via phone. Participant's in the music reported music listening an average of 4 days per week (57%). Additionally, analysis of the Participant Progress Measure showed that yoga participants made significant progress in learning Kundalini yoga over the course of the yoga program, as indicated by progress improvement scores.

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Comparisons to Previous Research

The present study attempted to replicate Khalsa's (2004) preliminary study examining the effects of a daily yoga treatment in a chronic insomnia population. Khalsa's study found significant baseline to post-intervention improvements on SE, TST, TWT, WASO and SOL. The present study found significant baseline to post-intervention improvement in WASO only. However, while less impressive, our study found improvements in both the yoga group and the music control group we used to compare treatment effects. The addition of a control group in the current study is an added component, as the majority of previous studies conducted with yoga lack a control group (Khalsa, 2004; Carlson et al., 2003; Lavey et al., 2005). The current study also measured mood, daytime sleepiness, quality of life and arousal; whereas Khalsa's (2004) study only measured sleep parameters. Findings from the current study support previous research (Carlson et al., 2004; Oken et al., 2006) showing significant improvements in quality of life after participation in a yoga program. The following section considers the study findings in the context of recent, comparative research as it relates to each separate parameter measured.

Sleep Parameters

The results of the current study showed that participants with sleep disturbance reported significant baseline to post-treatment improvement on WASO, as compared to music controls. This finding confirms the results of Khalsa's (2004) study that also found yoga to reduce WASO. However, this is the first study examining the effects of Kundalini yoga on sleep disturbance to include a control group. Khalsa's (2004)

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participants showed a 34.5% baseline to post-treatment decrease on WASO, while participants in our study showed a (yoga) 54% and (music) 42% baseline to post-treatment reduction on WASO. The substantial improvement in our study compared to Khalsa's study may be due to the in class practice provided. The participants in Khalsa's study practiced Kundalini yoga at home for the duration of treatment after a single in class demonstration, whereas the present study offered weekly classes and a DVD to practice with at home. Having an experienced teacher lead the class and adjust postures as needed may benefit participants a great deal. In addition, the information provided and the technique presented in class in the present study, may have had a higher quality than practicing at home alone as in Khalsa's 2004 study. Though less notable, SE, SOL, TWT and TST improved from baseline to post-treatment in both groups in the current study. This is different from Khalsa's study where SE, SOL, TWT and TST improved significantly from baseline to post-treatment. However, Khalsa's study did not use a control group to compare treatment outcomes; hence, the significant effects seen may have been due to extraneous variables. Although the aforementioned variables improved from baseline to post-treatment in both groups, TST showed within-group improvement for the music group only. This difference may be attributed to the ability of music to distract one from ruminating about the days' events. On the other hand, the difference may be attributed to the fact that the music group received a great deal more treatment than the yoga group. The yoga participants reduced their practice time from 3-6 times of practice per week (first 4 weeks of treatment) to 2-3 times of practice per week (last 6 weeks of study) during intervention to post intervention, while the music group remained

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consistent with their music listening treatment. Another difference between our study and Khalsa's study was inclusion criteria. Khalsa recruited individuals experiencing insomnia (PSQI $\geq$ 8), while participants in our study reported sleep disturbances (PSQI $\geq$ 5). This difference may have caused our improvements scores to reach a ceiling effect.

Cohen and colleagues (2003) also found significant baseline to post-intervention improvements in SOL and TST in a 7-week study comparing Tibetan yoga to wait-list control. The mean difference for sleep latency from baseline (1.10) to follow-up (.75) was approximately .35 in the yoga group for Cohen's study; while the mean difference for sleep latency from baseline (24.46) to post-treatment (5.2) was approximately 19 minutes in the present study. A substantial difference (19 minutes) although not significant when compared to the control group (decrease of 15 minutes). However, actual comparisons between the outcomes of the two studies cannot be made, because measurement was undefined in the Cohen study. Nonetheless, this is an important study to note because a wait-list control was used, and very few yoga studies have been conducted using controls. Although Cohen's study did use a control group, it was a wait-list control; hence the design of the present study, which implemented an active control, was stronger than Cohen's study. The addition of an active control group may have reduced power in the present study.

Music therapy has also shown improvements in the sleep parameters of older women, as shown by Johnson (2003). In this uncontrolled study, 52 participants ranging from 71-87 years in age were recruited from medical settings and were required to have a diagnosis of chronic insomnia. Data was collected for 20 nights (10 day baseline period

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and 10 day intervention period) with the Stanford Sleepiness Scale (a single item measure of subjective perception of sleepiness) and a sleep log. Participants were required to log their sleep every night for the 20 day period. Results showed a significant baseline to post-treatment decrease in SOL (baseline average 49 minutes, post-treatment average 10 minutes) and a significant baseline to post-treatment decrease in WASO (baseline average 6 awakenings, post-treatment average 2 awakenings). Our study showed a decrease in SOL of 19 minutes for the yoga group and 15 minutes for the music group. Johnson's study showed substantially more improvement than our study. In addition, the sample characteristics between our study and Johnson's study are difficult to compare for the several reasons. Johnson's study used an older population; perhaps music is able to soothe elders to a greater degree than a younger population. It would be difficult to generalize Johnson's findings to a younger cohort. Also, the improvements shown may be greater because the population included females only. As mentioned before, females report greater sleep disturbance, thus greater improvement may be seen in females because there is greater opportunity for change. Similarly, Lai and Good (2004) found significant baseline to post-treatment improvements in sleep latency, sleep duration, and sleep efficiency in a controlled study comparing music therapy to a no treatment control in older adults. Sixty, sleep disturbed participants, ranging from 60 to 83 years of age were recruited from the community. Participants listened to music for 45 minutes daily, for 3 weeks. Although changes were significant, means for the Lai and Good study were not given making it difficult to compare the two studies.

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To summarize, our study is the first to use a controlled design to assess changes in sleep disturbance through Kundalini yoga. Our study showed that an 8-week intervention of Kundalini yoga improved baseline to post-treatment levels on WASO. This is an exciting finding as Khalsa's previous uncontrolled study also showed improvement on this parameter. Although Khalsa's study showed significant baseline to post-intervention improvements on TWT, TST, SOL, and SE, his study did not use a control group. Thus, other factors may have been responsible for the improvement. Similarly, Cohen's study found baseline to post-treatment improvements in SOL and TST, further establishing the case that yoga is an excellent addition to assisting with a sleep regime. Cohen's study showed improvements on these two parameters while implementing a wait-list control, an addition many yoga studies lack. However, the use of an active control group was used by the current study, making the research design of our study stronger.

Quality of Life. In the current study, the yoga group improved significantly on the QOL measure, as compared to the music control. Participants in the yoga group had a 6 point mean increase on the QOL scale as compared to a 1 point mean decrease in the music control group. This finding confirms the results of earlier studies that have shown yoga to improve quality of life (Casden, 2005; Lee, 2003; Oken et al., 2006).

In a 6-week study comparing Ashtanga yoga to a wait-list control, Casden (2005) showed significant within-groups improvement from baseline to mid-intervention on average QOL scores of the yoga group (11 point mean increase), while participants in the control group showed no significant differences (1-point mean decrease).

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Similarly, Oken et al. (2006) examined the effects of yoga on cognition and quality of life in healthy seniors. One-hundred and thirty five participants were randomized to three groups: a 26-week trial of yoga, exercise and wait-list control group. Beginning Iyengar yoga poses were taught once a week for 90 minutes and daily home practice was also strongly encouraged for yoga participants. The aerobic intervention was also scheduled weekly, along with daily home exercises. There was no intervention for the wait-list control group. The SF-36 quality of life measure demonstrated a significant baseline to post-intervention yoga group effect on vitality and fatigue ($p = .006$), role-physical ($p = .001$), bodily pain ($p = .006$), social functioning ($p = .015$), and the hysical composite scale ($p = .005$). The exercise and wait-list control group did not show significant improvement on this measure.

Another yoga study, conducted by Lee et al., 2003 also showed improvement in the SF-36 quality of life measure. Participants engaged in a one hour mind-body training program 2 to 3 times per week. Participants reported taking a mean of 24 classes in the 3-month period. The program consisted of Hatha yoga and qigong. All of the mean baseline SF-36 scores, compared with 3-month follow-up scores indicated improvement ($p < .0001$). This study, however, did not include a control group, making it difficult to determine whether the mind-body training or a plethora of other factors contributed to the improvement.

In summary, the majority of previous yoga studies conducted on quality of life have shown substantial improvements on this measure. Most studies have included control groups, making it clear that yoga has had an effect on this measure. Some studies

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(Casden, 2005; Holmer, 2004) have used wait-list control groups, making it difficult to know whether using another active form of treatment would show similar results. The present study used two active treatments to assess the effect of both music therapy and yoga on individuals' quality of life. Findings from the current study suggest that yoga significantly improved quality of life from baseline to post-intervention, while music did not. The music groups scores on the quality of life measure actually decreased suggesting there may be some component to yoga that enhances an individual's quality of life. One explanation for this finding could be related to the significant correlation between the cognitive arousal scale and quality of life improvement score. As quality of life increased, cognitive arousal decreased. Cognitive arousal was defined as "thoughts running through your head," "pondering events of the day," "being mentally alert," etc. Yoga may have decreased the amount of attention placed on these cognitions prior to sleeping. Kundalini yoga places a greater emphasis on chanting and power breathing than other types of yoga. Most yoga practices incorporate breathing, poses, and meditation. Kundalini yoga places less emphasis on actual poses and more on uniting the breath with movement, chants, and meditation. This allows one to focus more attention on internal processes than other yoga techniques may provide. Another explanation for the significant baseline to post-treatment increase in quality of life might have been the group atmosphere in the yoga class. Participants may have felt support from the yoga instructor and other members in the class leading to greater baseline to post-intervention improvements.

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Physical Symptoms

Sleep quality and yoga. Both the yoga and music listening participants in the present study reported significantly higher levels of sleep quality from before to after treatment. This finding is consistent with the results of earlier studies that have shown yoga to improve sleep quality scores. Holmer (2004) found that yoga participants reported significantly lower levels of sleep disturbance after treatment, compared to controls. In that study, with fibromyalgia, participants in the yoga group engaged in two Hatha yoga sessions per week for eight weeks (classes were 90 minutes in duration). Participants in the control group were wait-listed for 8 weeks.

Similarly, Cohen et al. (2004) found subjective sleep quality to improve significantly from baseline to post-treatment in a yoga group ($p < .002$) over a wait-list control group. Thirty-nine patients with lymphoma who were undergoing treatment were assigned to either a yoga group or wait-list control. The participants in the yoga group participated in 7 weekly yoga sessions including controlled breathing, postures, and mindfulness during the sessions.

In addition, Gross et al. (2004) found that an 8-week mindfulness meditation class significantly lowered PSQI scores from baseline to post-treatment for individuals receiving treatment ($p = .011$ at post-treatment, and $p = .002$ at the 3-month follow-up). The mindfulness class was 150 minutes in duration and consisted of meditation and Hatha yoga. Participants were asked to use at least one meditation practice 5 days per week for 45 minutes throughout the 8-week course and during follow-up. Although significant finding were uncovered, it is noteworthy to mention that the study was

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uncontrolled, thus the results may be attributed to other variables. In addition, because both yoga and meditation were used in this study, it is difficult to establish which part of the intervention was most beneficial, or if both components are needed to improve the quality of sleep. The present study used yoga alone and showed significant improvements in sleep quality, suggesting yoga alone assists with sleep quality.

Sahajpal and Ralte (2000) found quality of sleep among a group of minority students to increase after participation in a 1-month long induced yogic relaxation training (IYRT).This study did not use a control group, making it difficult to determine if the IYRT practiced 20 minutes per day affected sleep quality or if there was another variable responsible for the improvement. Another difference from the present study is all the participants in this study were students, while only half the participants in the current study were students. For comparison purposes, the sample recruited for this study were college freshmen, females between 18 to 20 years of age. In addition the sample size was quite small, 12 students; whereas the present study included both males and females, a larger age range, and a larger sample size of 32 participants. However, Sahajpal and Raltes' study attained significant baseline to post-treatment improvements in sleep quality and stress levels, suggesting that the sample size in the present study may have been sufficient.

Sleep quality and music. The finding that music therapy is an effective intervention for sleep quality has also been shown in recent literature. Lai and Good (2005) randomly assigned 60 older adults to either a music or control group. Participants in the music group were required to listen to 45-minutes of music before bedtime for 3

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weeks. The control group was told that they would be given music to listen to at the end of the 3 week period. Both groups were asked to keep a sleep log. Music resulted in significantly better sleep quality as well as significantly better components of sleep quality. However, the sample characteristics differed between this study and that of Lai and Good. Mainly, the present study used young adults (18 – 35 years old); while that study used older adults (60 – 83 years old). Also, when comparing Lai and Goods' study to that of the present study, there was no differential improvement found between our music and yoga intervention. Hence, when using two active treatments, music may not facilitate sleep quality to a greater degree.

Another study examining the effects of music on sleep quality showed similar results. Hernandez-Ruiz (2005) paired music with progressive muscle relaxation (PMR) to explore the effect it would have on sleep patterns and anxiety in abused women in shelters. Twenty-eight women were randomly assigned to either the experimental group or control group. The experimental group listened to 20-minutes of music (self-selected) with a PMR script for 5 consecutive days. Results indicated that music therapy constituted an effective method for increasing sleep quality from baseline to post-intervention as measured by the PSQI. It is difficult to determine if the music alone accounted for the significant results; however past studies would suggest music alone would have assisted with sleep quality.

In summary, previous studies using yoga as treatment or as a component of treatment have shown to improve sleep quality. It is important to take into account that the majority of earlier studies have used either a wait-list control group or no control

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group to compare to a yoga intervention. Hence, this study's usage of an active control group is an important addition to the literature at hand. The results of the current study suggest that both yoga and music interventions for the treatment of sleep quality are effective. However, a caveat in the present study is that our study did not have a no treatment control; hence the change in our baseline to post-treatment scores may have resulted from other factors such as time or attention. It is difficult to compare other studies directly with this one as well, as most other studies used baseline to post-intervention scores of the PSQI to assess sleep quality, while we used the Pittsburgh Sleep Diary.

Sleepiness. Participants in both the yoga and music groups improved significantly on the Epworth Sleepiness Scale. However, only the music group was found to have within group improvements on the ESS a measure of daytime sleepiness. To date, no studies have been conducted on yoga's effects on sleepiness. However, other mind-body techniques have been implemented to investigate the effect on sleepiness. One such example is a study conducted by Li et al. (2004) to determine the effects of Tai Chi on sleep quality and daytime sleepiness in older adults reporting moderate sleep difficulties. One hundred and eighteen men and women were randomly assigned to either Tai Chi or low impact exercise control group. Participants partook in a 60-minute session of either the Tai Chi or low-impact exercise, 3 times a week for 24 consecutive weeks. The Tai Chi participants reported significantly greater improvements in the Epworth Sleepiness Scale ($p = .001$) as compared to the low-impact exercise group. The music group may have shown a greater benefit from the music listening, than the yoga group because of the

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amount of treatment the music group received. The yoga group reduced their yoga practice towards the end of the study, while the music group remained consistent with their music listening from the beginning to the end of the study. Therefore, the music group received a great deal more treatment than the yoga group.

Music has also been shown to be effective in combating daytime sleepiness. Johnson (2003) showed that individuals using music nightly for 10 days significantly improved on the Stanford Sleepiness Scale ($p < .01$). Participants reported less frustration, restlessness, exhaustion, and more satisfaction after the music intervention.

In summary, the present study is the first to look at the effects of a yoga intervention on sleepiness. A significant baseline to post-intervention improvement was seen on the sleepiness measure; however the same result was found for the music therapy group. Since there have been no previous studies conducted on yoga and sleepiness (Tai Chi), another mind body technique, was examined to determine its effect on sleepiness as comparison. One hundred eighteen women and men aged 60 to 92 were randomized into Tai Chi or low-impact exercise; and participated in a 60-minute session three times per week for 24 consecutive weeks. There was a significant baseline to post-intervention treatment effect relative to the control group for sleepiness, suggesting sleepiness is affected by alternative meditation techniques. In addition, the present study was the first to find a with-in group effect of yoga on sleepiness. Johnson's (2003) uncontrolled study also found music therapy to produce beneficial baseline to post-treatment effects on sleepiness. Our study was able to replicate this finding in Johnson's study, with an addition of a control group, thus extending Johnson's previous study.

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Mood and yoga. The yoga participants as well as the music control participants reported significant baseline (M=17.73; M=21.94) to post-treatment (M=9; 15.94) improvements in mood after each of the respective treatment interventions (yoga and music means listed respectively), as measured by the Total Mood Disturbance (TMD) score of the Profile of Mood States (POMS) measure. Casden's (2005) study showed greater improvement in mood symptoms for yoga participants (an average 28.59 decrease) after the yoga program, as compared to wait-list controls (an average 2.19 decrease). Casden (2005) randomly assigned 48 participants in a yoga intervention group or a wait list control. Participants in the yoga group were assigned to attend two yoga classes per week over a six week period. The control group was wait-listed for 6 weeks, and given the opportunity to take yoga after the first cohort was completed. The present study differed from Casden's (2005) study in that it used an active treatment control group to compare the effects of treatment on sleep disturbance; hence the improvement in both groups suggest that while yoga is a useful intervention for sleep disturbance, when compared to another active treatment, it fairs only slightly better. Participants in both the present study and Casden's (2005) study were comparable in sample characteristics. Both studies recruited volunteers from the San Diego community, participants were between the ages of 18 and 35 and both studies included individual's with a higher education level. However one difference was that the current study recruited individuals with a sleep disturbance while Casden's (2005) study recruited healthy participants.

Interestingly, a yoga-based study used to assess mood benefits for healthy college students revealed pre-to post mood improvement in two active treatment groups (yoga

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and swimming) and no improvement in a no treatment control group; which is similar to our study that found improvement on mood for both active treatments. Berger and Owen (1992) conducted a study to assess mood benefits of Hatha yoga. Eighty-seven college students were divided into one of three groups (swim, yoga, or lecture control). Swimmers and yoga participants exercised for approximately 60 minutes per week in class settings for 14-weeks. The lecture control class met in 50-minute class sessions three days a week. Both the yoga and swimming participants reported greater pre- and post-test decreases in Angst, Confusion, Tension, and Depression than the control group. The difference between pre and post-test mood scores of the two treatment groups versus lecture controls was significant at ($p < .0002$). Although all the means for the yoga group improved more than the swimmers, the differences were not significant between the two groups. The larger sample size in this study may attribute to the significant findings compared to the relatively lower sample size in the present study.

Further, Lavey and colleagues (2005) findings indicate that participation in a yoga program was associated with significant pre-post improvements in the five negative emotions subscales of the POMS ($p < .001$). One-hundred thirteen participants attended a 45-minute yoga class. Each participant completed the POMS before and after the yoga session. However, the study was not controlled, thus the improvements observed in negative mood could be attributed to factors other than participation in the yoga program. Another important difference from the present study is that the participants in Lavey et al, (2005) study were residents of an inpatient psychiatric unit while participants in the present study were healthy volunteers, with reports of only sleep disturbances. Lastly,

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that study assessed the immediate effects of a yoga class on one occasion, as opposed to the longer-term effects of an 8-week yoga intervention, which was assessed in our study.

Similarly, Shapiro and Cline (2004) found significant pre-post improvements on mood and anxiety measures in an uncontrolled study following a yoga intervention. Eleven healthy participants were enrolled in a biweekly Iyengar yoga class (90 minutes duration) for a total of nine classes. Self rating of 15 moods dealing with positive, negative, and energy related emotional states were obtained before and after each class. Changes over the rating periods (pre, post1, post2) indicated improvement for 9 out of 15 moods. Yoga participants in our study improved on 5 out of 6 mood subscales (POMS-TMD). However, direct comparisons between the two studies cannot be made on mean decreases or increases because two different mood measures were used in both studies. Additionally, participants in our study were recruited throughout the San Diego community if they had disturbed sleep, whereas the participants in their study were healthy volunteers. Thus, the fact that our sample represents a sleep disturbed population (PSQI > 5), suggests that our population was more distressed. In addition, our study excluded individuals who practiced yoga on a consistent basis, while their study recruited participants from yoga classes. Our study excluded participants with extended knowledge of yoga as this was determined to be a potential confound for our study. Also, our study used a treatment control while their study was uncontrolled, making it difficult to attribute mood improvement exclusively to the yoga intervention in their study. Moreover, the small sample size of their study (N=11) makes generalizing to other

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populations difficult. The sample size of the present study (N=32) although small, was substantially larger than theirs.

Although there was no differential improvement between the yoga and music group on negative mood symptoms, within-group improvement on this measure was found in the yoga group. Participants in the yoga group may have benefited from the group atmosphere in a class setting, feeling a sense of belonging and cohesiveness as a group. In addition, participants in the yoga group may have been assisted to a greater degree because of the attention received from the yoga instructor. On the other hand, it may have been that yoga has an effect on mood more so than music listening. Perhaps the yoga group was able to lessen their anxiety and stress during difficult times in their life because of the techniques learned in the yoga class. It may be that the ability to deflect one's worry and stress is developed during participation in yoga, allowing the individual to focus on internal processes such as the breath. Once this focus is developed in class it may be easier to use it in other situations.

Music and Mood. Our study found music listening to be associated with decreases in negative mood on the POMS-TMD. Music therapy has been shown to be beneficial for alleviating negative mood in other studies (Siedlieck & Good, 2006; Voss et al., 2004). Siedliecki and Good (2006) randomly assigned 60 chronic pain patients to three groups (researcher selected music, self-selected music, and control). The music groups listened to one-hour of music per day (for seven days) while the control group received standard care that did not include a music intervention. All groups kept a diary for the seven day period. The music groups reported increased feelings of power (Power as Knowing

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Participation measure, alpha reliability=.94), less pain (measured with McGill Pain Questionnaire), depression (Center for Epidemiology Studies Depression scale), and disability (Pain Disability Index, alpha reliability=.79) when compared to the control group. There were no statistically significant differences between the two music groups.

In the same way, music has been shown to be a beneficial intervention for anxiety. Voss et al. (2004) examined the effects of music therapy on open heart surgery patients reporting anxiety and pain with chair rest. Patients were randomly assigned to receive 30 minute of sedative music, scheduled rest, or treatment as usual during chair rest. Anxiety, pain sensation, and pain distress were measured via visual analogue scales at chair rest initiation and 30 minutes later. Results indicated that in the sedative music and scheduled rest groups, anxiety, pain sensation, and pain distress all decreased significantly, $p < .001$-$.015$; while there was no significant differences found in the treatment as usual group. Further analyses indicated significantly less posttest anxiety, pain sensation, and pain distress in the sedative music group than in the scheduled rest or treatment as usual groups ($p < .001$ -$.006$).

In conclusion, many studies have shown the beneficial effects of yoga and music on mood symptoms. As stated earlier, the difference in our study from others is the fact that an active treatment control group was used as a comparison in evaluating treatment effectiveness. The only other study to have used an active control group when comparing yoga's effectiveness on mood was Berger and Owen (1996). The present study's results indicated significant baseline to post-intervention improvement in both treatment groups which is similar to Berger and Owen's (1996) results, who also found both treatment

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groups (yoga and swimming) to improve similarly in negative mood. Berger and Owen (1996) lecture control group showed no significant improvements as compared to the two treatment groups. Future studies should incorporate not only two or more active treatments but also a no treatment or attention control group to assess for differences. In addition, most studies assessing the effects of music listening on mood have incorporated a no treatment control group, by including an active treatment group we can determine if one treatment is more useful.

Arousal. Both the yoga and music groups improved significantly on the Cognitive Arousal scale. Our study used the Pre-Sleep Arousal Scale (PSAS) to determine if the intervention we used would decrease arousal. The PSAS is comprised of items that deal with both somatic and cognitive complaints. For example, endorsing some of the following questions help determine if one has somatic arousal "a jittery nervous feeling," "a dry feeling in the mouth;" "heart racing;" while cognitive arousal is determined by endorsement of questions such as: "can't shut off thoughts," "worry about falling asleep," "pondering the events of the day." Although no studies with music and yoga have been conducted which measure arousal via the Pre-sleep Arousal Scale, such as our study; many studies have been completed on anxiety and somatic complaints which are very similar to the questions on the PSAS.

One such study conducted by Ray and colleagues (2001) randomly assigned 54 trainees into two groups (yoga and control). The yoga group was administered yogic practices for the first five months while the control group did not perform the yoga exercises during this period. From the 6^{th} to 10^{th} month of training both the groups

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performed the yogic practices. Physiological parameters like heart rate, blood pressure, oral temperature, skin temperature in resting condition, were recorded, as were anxiety levels. The continuous yoga group had relatively lower sympathetic activity than the control group, as well as more reduction in self-reported anxiety levels during the 5th and 10th month measurement period.

In the same manner, Mishra and Bihar (2001) examined the effect of yoga and yogic practices on depression and anxiety in 25 participants suffering from gastrointestinal disorders. The patients lived in an ashram, participating in yoga and healthy eating for 15 days. Baseline to post-intervention results showed that both depression and anxiety were positively affected. However, the uncontrolled nature of this study makes it difficult to attribute yoga as the exclusive change agent. It is also difficult to say whether the sample characteristics of the participants in this study were comparable to those of participants in the current study.

Recent literature has also shown music to reduce levels of anxiety. A study conducted by Chang and Chen (2005) investigated the effects of music therapy on women's physiological measures, level of anxiety, and satisfaction during cesarean delivery. Sixty-four women who were planning to have a cesarean delivery were randomly divided into an experimental and control group. The experimental group received routine care and music therapy whereas the control group received routine care only. The means on the visual analogue scale for anxiety (VAS) significantly decreased during the three time periods as follows: pre-test (6.80), post-test I (1.82), and post-test II for the music therapy group; while the means of the control group decreased to a lesser

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extent across the three time periods pre-test (5.54), post-test I (2.93), and post-test II (1.76) indicating that the women in the music listening group had lower anxiety than their peers in the control group.

Likewise, Cooke et al. (2004) examined the effects of music on preoperative anxiety in day surgery. One hundred twenty participants were divided into intervention, placebo, or control group. Pre- and post-test measures of anxiety were carried out using the State-Trait Anxiety Inventory. Participants in the intervention group chose their preferred music and listened to it for 30 minutes, whereas the placebo group wore headphones but received no music for 30 minutes and the control group received routine care only. The mean difference between intervention and control/placebo patients were statistically significant ($p < .001$), but no such difference emerged between the means of control and placebo patients ($p = .077$). Hence, listening to music significantly reduced mean anxiety scores, compared with not listening to music.

In summary, the present study found significant within-groups effects for both the yoga and music group on cognitive arousal. The majority of prior studies assessing arousal changes associated with yoga have been uncontrolled. Hence, significant findings have suggested a relationship between arousal and yoga, though nothing more. One controlled study (Ray et al., 2001) determined a significant impact of yoga on anxiety (cognitive arousal) and sympathetic activity (somatic arousal); coinciding with the present study, where cognitive arousal was significantly reduced from baseline (M =19.20) to post-intervention (M=14.46) by the yoga intervention, when looking at within-group effects only. Music therapy has also been shown to significantly decrease cognitive

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arousal (anxiety) in two previously controlled studies (Chang & Chen, 2005; Cooke et al., 2004). The present study found music to significantly decrease cognitive arousal from baseline (M=21.88) to post-intervention (M=17.29) when looking at the music group. To date there has been no research determining whether music therapy is an effective intervention for somatic arousal. However, our study found significant within-group effects from baseline (M = 13.70) to post-intervention (M=11) in the music group in somatic arousal.

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Exploratory Findings

Drug Studies: Differences between Drug and Placebo Compared to Our Study.

Our study found a significant baseline to post-intervention improvement in WASO for the yoga group, when compared to the music group. Though less notable the other sleep parameters assessed improved in both of our groups. The following will compare the effects of a placebo and drug treatment to determine if the findings from our study are equivalent to that of a placebo group or if we had greater mean changes than a placebo group.

When examining the effectiveness of drugs on insomnia Borge and colleagues (2006) found Zopiclone to be no different than a placebo treatment. A randomized, double-blind, placebo controlled trial of 46 older adults (55 +) with chronic insomnia was used to examine the clinical effectiveness of cognitive behavioral treatment (CBT), and pharmacological treatment (group received either Zopiclone or placebo pill) .Treatment duration lasted 6-weeks. Sleep parameters were assessed via sleep diaries (2-week duration on three assessment period). Participants receiving CBT improved their sleep efficiency from 81.4% at pretreatment to 88.9% at 6-weeks, compared with a decrease from 82.3% to 81.5% in the Zopiclone group, and a decrease from 78.9% to 76.2% in the placebo group. There were no significant differences between the three groups on TST or TWT. Our study's mean SE scores increased for both groups. Both the yoga and music group had a 7-point baseline to post-intervention increase. Hence, our interventions appears to be better than both the placebo and drug group in their study, which decreased SE. However, results from our study may also be attributed to factors such as maturation,

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spontaneous remission, or expectancy, since we did not use a no treatment control group. The changes seen in our treatment groups could also be from the attention received by both groups from the principal investigator; whereas in the placebo-controlled study the placebo and drug group were not given any attention for the 6-week duration of the study.

Another randomized double-blind study was used to compare the effectiveness of a drug versus placebo treatment. Krystal and colleagues (2003) used 3mg of Eszopoclone or a placebo, for 6-month duration, as treatment for chronic insomnia to determine the efficacy of drug treatment. Participants' age ranged from 21 to 69 years old. Efficacy of the following sleep parameters were assessed on a weekly basis: SOL, TST, and WASO. Results demonstrated that nightly use of Eszopoclone resulted in significant baseline to post-intervention improvements in SOL and TST. The Eszopoclone group decreased their SOL by 53 minutes; while the placebo group decreased by 33 minutes. Our finding showed an overall 19-minute decrease in SOL for the yoga group and 15-minute decrease for the music group. Their TST with the usage of Eszopoclone increased 20%; while the placebo group increased by 9%. Our study showed an 8% increase in TST for yoga and a 3% increase in TST for the music group. The findings from Krystal et al. (2003) study showed that both the placebo and drug participants improved substantially more than participants in our study; however our study (12-weeks duration) was much shorter than their (6-month) study, hence their participants had much more treatment provided.

In conclusion, our study found significant baseline to post-intervention improvement on WASO. The other sleep parameters measured also improved, though to a lesser extent. This section compared drug versus placebo treatments to the present

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studies findings to attempt to determine if the results of our treatment groups show the same effectiveness of that of placebo or if our treatments were better than a placebo control. Comparing results of Borge and colleagues (2006) study to that of our study, suggests both our treatment groups improved sleep parameters to a greater degree than placebo, hence the effect in our study is greater than that of a placebo control group. On the other hand, Krystal and colleagues (2003) study had substantially higher improvements in SOL and TST than our study. However, their study's treatment duration was 6-months; while our study's treatment duration was only 2-months. The extended treatment time could potentially increase the effectiveness of treatment. Also their study used individuals diagnosed with insomnia while we used individuals experiencing sleep difficulties; thus our pool of participants may have reached a ceiling effect.

Sex differences: Women Reported Greater Benefits after Yoga than Men.

When correlating gender with delta change scores a significant correlation (.05) was found between gender and WASO. To further explore this difference we looked at WASO means separated by gender. A sex difference emerged when comparing the benefits of yoga and music on WASO. Women in the yoga group reported greater decreases from baseline to mid-intervention in WASO (27 minutes), compared to females in the music group (7 minutes). In addition, females continued to respond to treatment from mid-intervention to post-intervention, though not to a significant degree when compared to males. A 4 minute decrease was seen in the yoga group, and a 6 minute decrease in the music group. Males did fairly similar in both groups (yoga and music), a mean decrease from baseline to mid-intervention in the yoga group of 25 minutes, and in

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the music group of 24 minutes; and an increase from mid-intervention to post-intervention in both groups 6 minutes (yoga) and 1 minute (music). This finding indicates that females benefited more from yoga. Perhaps male participants were not as familiar with yoga practice, or not as comfortable with it as the females in the study. The time x gender interaction split by groups for WASO was significant at $F(1, 28) = 4.70, p = .039$. This unexpected finding is important to note since research shows (Sateia, 2004) higher rates of insomnia are seen in females.

Differences in Outcome Improvement between Groups Post-Treatment

Post-treatment differences between groups were quite small based on group mean averages. This result is interesting considering 69% of yoga participants averaged no practice during the last two weeks of the study, 19% practiced only 1-2 times, and just 12% practiced 6 times during this period; while only 12 % of music participants ceased practice during this same period. The music group had 85% of participants averaging three or more times spent using the intervention. This finding is suggestive of greater improvements potentially occurring in the yoga group had the participants in the yoga program adhered to the protocol. Furthermore, this finding suggests the music protocol is easier to adhere to than the yoga protocol. Future studies should promote adherence to the yoga protocol by scheduling classes more regularly and having classes in more than one location if possible, making location and timing more convenient for participants.

Drop-out and Adherence Rates

Overall, drop out rates were low and yoga class attendance moderate for participants in our study. No participants dropped out of the study once the study began,

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although eight participants dropped out before the actual study began. Furthermore, participants regularly attended the weekly yoga classes, with an average of about 5/8 classes attended (62%). Casden's (2005) study had higher rates of attendance then the present study, with 10/12 classes attended (83%). One difference may be that the present study asked for a longer commitment, our intervention lasted for a total of 8-weeks; while Casden's intervention lasted for a total of 6-weeks. In addition, Casden's study offered yoga classes on four different days (2 classes were required) to accommodate participants' schedule; while the present study offered yoga classes only twice a week. Furthermore, Casden's classes were held at Alliant International University, where the majority of her participants were recruited (68%); whereas the present study recruited participants from all over San Diego Community. Also, Casden's classes were 75 minutes in length, while the present study had a shorter duration (60 minutes). Holmer's study (2004) also had a high attendance rate with an average of 14/16 classes attended (88%); our study had the same intervention length as Holmer's (8-weeks). A difference in our study was the duration and frequency of the class, our classes lasted a total of 60 minutes and was offered two times per week (only one class was required per week); while Holmer's class was 90-minutes in duration and offered two times per week (both classes were required). Holmer's classes were offered at the Naval Medical Center, where most of her patients were recruited; whereas the present study held the yoga classes at Alliant International University, where only 20% of participants were recruited.

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Limitations to Comparisons

It should be noted that direct comparison of the present study to previous research is difficult for various reasons. Previous studies used different: training methods, styles of yoga, frequency and duration of practice, populations, measurements and research design. In addition, this was only the second study completed that compared the effects of two active treatment groups. The current study used a randomized, controlled trial of Kundalini Yoga (once a week, for eight weeks) with a sleep disturbed population. However, while it is clear that more research is needed, the level of symptom improvement found in the sleep disturbed population after yoga/music therapy is encouraging. Two of the measures, QOL and WASO differentially improved in both groups, indicating that yoga was a superior form of treatment over music for these two measures. Improvements were also found in mood, sleep quality, sleepiness, arousal, SE, TWT, TST, and SOL in both treatment groups. Additional research is needed to understand the mechanism responsible for facilitating greater well-being and sleep through yoga.

Further research on yoga's effect on cognitive arousal may be helpful, since there was a significant correlation between the yoga groups' QOLS change score and the CAS in our study. There has been considerable research on the effects of yoga on anxiety, obsessive-compulsive disorder, and worry, yet most of the previous research that has been done lacks control groups (Khalsa, 2004; Shannahoff-Khalsa,1997; Ray et al., 2001) making if difficult to know if yoga truly effects these variables. Additionally, the effects of yoga on situational stress may also be useful. Previous research has shown yoga to

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reduce stress (Sahajpal & Rinpari, 2000), However the study used a small sample size (N=11) and no control group; therefore making it difficult to recognize yoga as effective in reducing stress.

In addition, the current study did not take into account yoga's effect on physiological measures. Previous research has shown a relationship between yoga and breathing style, breath holding and heart rate variability (HRV) (Casden, 2005; Bhargava & colleagues, 1988; and Telles et al., 1997). Findings from Casden's (2005) study revealed significant improvements in abdominal breathing style ($p < .001$, $\eta^2 = .36$) and significant within group improvements in breath holding ($p = .03$, $\eta^2 = .20$). Bhargava and colleagues (1988) found similar within group improvements in breath holding time over the course of a yoga program. In their study a great deal of attention was placed on pranayama, a controlled breathing technique, which is similar to the current studies protocol which also emphasized the breath. Ten male participants were asked to practice yoga pranayama and controlled breathing daily for 30 minutes. Telles and colleagues (1997) found that after an intensive Hatha yoga program (5 days/week, over 6 months) yoga participants had a significant reduction in heart rate when compared to attention placebo control. Taking these studies into consideration brings forth the question: What is yoga's influence on physiological measures. Bhargava and colleagues (1988) study illustrates the importance of breath in yoga, as did the current study. Future studies should observe the effects of yoga versus a breathing only intervention as well as a no treatment control to discern differences among the three groups.

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Furthermore, it would be interesting to determine the association between cognitive functioning and yoga. Casden's (2005) study showed significant improvement in the yoga group's cognitive functioning (digit span score), as compared to the wait-list controls ($p = .05$, $\eta^2 = .08$) on attention focused tasks. Perhaps it is not the actual changing of the breath style that affects the physiological processes, but the focused attention involved in the process of achieving a different breathing style.

Moreover, future research on the underlying mechanism of music may look at cognitive arousal as well. Participants in our study were asked to listen to music nightly before falling asleep. If participants were listening to music in the evening it may have been difficult for them to have ruminating thoughts in their head, as they listened; thus they may have been able to quiet their mind. In addition, music may have a calming ability which assists with sleep. Examining the brain structures which are responsive to music may be helpful in determining what music actually does for us.

Study Limitations and Future Directions

There are several limitations to this preliminary research. First, the small sample size (N=32) was a major limitation. Initially, when calculating power for the study, 32 participants were enough to obtain a large effect size based on Cohen's (1988) research. However, at the beginning of the study, we did not realize what a large effect music would have on all the measures. We believed that music, though beneficial, would not be as valuable a treatment as yoga. Had we known music's usefulness, we would have chosen to use a larger sample size, perhaps allowing us to see more differential effects between the two groups.

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Second, the lack of a non-active control group was another limitation of this research. The current study compared two active treatment groups' effects on sleep disturbance, quality of life, and mood. Both groups received attention and support from the primary investigator either during class (yoga) or through weekly emails/phone calls (music). Had the present study used a non-active control group, comparisons between the treatment group and control group could have been made, thus allowing us to distinguish the effects between the two treatments.

A third limitation to the study was the relatively short duration of the treatment intervention. A brief 8-week yoga intervention with classes offered once a week may not be sufficient to detect possible group differences on variables not found to be significant in the study (i.e., mood, sleepiness, sleep quality). However, our 8-week intervention is in line with the majority of yoga studies (Khalsa, 2004; Holmer, 2004; Cohen, 2004).

A fourth limitation of the study is the type of yoga practiced. However, our study was replicating Khalsa's (2004) study, which also used Kundalini yoga. The majority of participants in our study had no previous experience with Kundalini yoga. If a more well-known form of yoga had been practiced perhaps participants would have been more inclined to continue with the practice once the classes ended. Although the protocol requested participants continue with their practice after the classes ended the sleep diaries revealed that only the music group (100%) continued with practice; the yoga group (20%) rarely practiced after classes ended.

A fifth limitation of the current study is that only one instructor was used to teach the class. Having one instructor restricted the reliability of the Participant Rating Measure

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(PRM). The PRM was scored on accuracy of poses by the yoga instructor. Having an additional instructor would have allowed two raters to check the participant's progress, increasing the reliability of the measure.

Finally, the lack of a long-term follow-up assessment was another limitation. It would be useful to assess long-term symptom outcomes to assess whether improvements would be maintained over time.

Generalizability

The extent to which the study findings may be generalized to other groups of people may be limited somewhat by the sample population used in our study, which consisted mainly of single, graduate students, who volunteered to participate in our research. On the other hand, the mix of gender and ethnicity represented in our sample was better than most other studies (Khalsa, 2004; Sahajpal & Rinpari, 2000). There was a diverse ethnic backgrounds represented in our sample: 47% Caucasian, 31% Asian/Pacific Islander, 9% Other, 6% Hispanic, and another 6% African American. This sample included a representation of both males (34%) and females (66%), with a majority of single participants (84%). This sample was also highly educated, with 51% of participants currently enrolled in a graduate program and 40 % working professionals, having completed 4-years of a college education. Only 9 % reported less than a college graduate education. Participants were informed about the study through recruitment letters, flyers posted around the San Diego community, Craig's list, and by word of mouth. Thus, our participant pool consisted of individuals who responded to study announcements voluntarily and as such may not be representative of the general sleep

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disturbed population. Based on these figures, the findings of this study may not generalize to other individuals who have limited education are or not currently enrolled in higher education classes.

Strengths and Contributions

This study has enhanced our understanding of techniques which can be used to improve not only the quality of sleep, but also mood, quality of life, and arousal states. Even though the design characteristics limit the generalizability, the results are an important contribution to research on healthy individuals who report sleep disturbance. The current study recruited young (18-35) individuals in the San Diego community reporting sleeping difficulty. Patients were excluded from the study if they had a severe medical, orthopedic, or mental disorder that would preclude physical exercise, if they had been diagnosed with a substance abuse disorder, if they were pregnant, if they reported participation in regular yoga, or meditation practices. If patients were drinking 830 milligrams of caffeine per day they were also excluded from the study. The current sample was primarily Caucasian, single, well-educated, females. Despite the strict inclusion and exclusion criteria, this sample was an interesting one to investigate because of the high percentage (49%) of people in the general population reporting dissatisfaction with their sleep (Gallup, 1995). Based on our findings it is clear that there are effective, low-cost, non-pharmacological treatments available to the general public to alleviate symptoms of sleep disturbance. A clear contribution of our study is the fact that a control group was used. Hence, causal inferences can be made based on the results of our findings. A further strength of the current study was that we used a daily diary to monitor

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sleep. A daily diary should minimize memory problems inherent in self report measures. Thus, data collected on the sleep parameters are thought to be accurate, based on previous findings.

Clinical Implications

Numerous negative consequences exist for those suffering from sleep disturbance. Growing evidence shows that chronic unremitting insomnia may lead to the development of psychiatric disorders. These findings have shown that sleep disturbed individuals are at an increased risk for depression, anxiety, and substance abuse (Sateia, 2004). Insomnia has been associated with increased motor vehicle accidents, decreased work performance, and increased hospitalization rates. Ringhdahl and colleagues (2004) reported cost estimates for lost productivity due to insomnia to exceed $100 billion per year. Due to the high prevalence and cost rates of insomnia it is important to attempt to assess and diagnose individuals suffering from a sleep disturbance before it culminates into insomnia.

The present study highlights the potential effectiveness of two treatments which both decreased sleep disturbance. Although most variables were not uniquely affected by either treatment, there were a few within group improvements demonstrating music and yoga's individual effects. An 8-week program of yoga/music listening was shown to be effective in increasing sleep efficiency, decreasing total wake time, sleep onset latency, and cognitive arousal. The music group showed within group improvements in total sleep time and daytime sleepiness, while the yoga group showed within group improvements on negative mood symptoms.

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Our research findings may have particular relevance and application for primary care physicians, psychologists, psychiatrists and other health professionals who have the most access to individuals suffering from sleep disturbances. Yoga and/or music listening can be implemented by these professionals to reduce anxiety, depression, sleepiness, and amount of time spent awake in clients, as well as increasing their client's sleep time and sleep efficiency. However, as stated earlier, our sample included volunteers, and thus may not be representative of the general sleep disturbed population. Therefore, it is unclear whether patients/clients experiencing sleep difficulty will attend/adhere to the recommendation. Nonetheless, yoga/music are effective means to reduce symptoms of insomnia and therefore seem to be an important part of a treatment regime.

Although both treatments (music and yoga) have shown to be effective in the management of sleep disturbance, it is important to note the popularity of both in today's society. Music listening has been a popular pass time in many cultures and societies for a long time. The majority of the population has easy access to different types of music; most even have the means to listen to it in the convenience of their own home. Another important consideration is the low cost of purchasing a classical/other soothing music compact disc. Most can be purchased for twenty dollars or less. In addition, yoga has recently gained popularity, and today is a well-accepted practice for stress reduction, relaxation, and exercise. Yoga is also relatively inexpensive, and can be performed in the convenience of one's own home. However, before beginning at home practice of yoga, it may be important to attend a few classes to learn proper form and breathing techniques. Yoga classes are generally between ten to fifteen dollars per class, still relatively

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economical. Both aforementioned treatments appear to offer relatively low cost, effective treatment options for improving sleep and mood.

Our research suggests that an 8-week program of either yoga/music could be used by young healthy adults experiencing sleep disturbance to promote psychological health with improved mood and sleep quality, decreased daytime sleepiness, and improved sleep parameters. Health professional could use either/both treatments to address psychological disorders such as depression and anxiety; or physical complaints such as sleep difficulties.

Conclusion

In conclusion, the results of this randomized, controlled study supports the use of music and yoga programs for the treatment of sleep disturbance. The study demonstrates the beneficial effects of both treatments. There was an increase in sleep time and sleep efficiency, improvement in sleep quality and mood, and a decrease in wake time, awakening once sleep began, and sleep latency. The findings also suggest that yoga is superior to music listening in improving quality of life and decreasing total awakenings once an individual has fallen asleep. However, the underlying mechanism by which quality of life is affected more so by yoga than music still remains unknown. Future research recommendations include the addition of a non-active control group, long-term follow up assessment, increased sample size, and the implementation of a well known form of yoga. Our study shows that the addition of a regular yoga/music program to conventional medical care may be a beneficial, inexpensive treatment option for individuals experiencing sleep difficulties.

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References

Backhaus, J, Junghanns, K, Broocks, A., Rieman, D. & Hohagen, F. (2002). Test-retest reliability and validity of the Pittsburgh sleep quality index in primary insomnia. *Journal of Psychosomatic Research, 53*, 737-740.

Baker, F., Denniston, M., Zabora, J., Polland, A., Dudley, W.N. (2002). A POMS Short form for cancer patients: psychometric and structural evaluation. *Psycho-Oncology, 11*, 273-281.

Ban J.D. & Lee J.T. (2001). Sleep duration, subjective sleep disturbance and associated factors among university students in Korea. *Journal of Korean Medical Science, 16,* 475-480.

Bernardi, L., Passino, C., Wilmerding, V., Dallam, G.M., Parker, D.L., Robergs, R.A., & Appenzeller, O. (2001). Breathing patterns and cardiovascular autonomic modulation during hypoxia induced by simulated altitude. *Journal of Hypertension, 19,* 947-958.

Berger, B.G. & Owen, D.R. (1992). Mood alteration with yoga and swimming: aerobic exercise may not be necessary. *Perceptual and Motor Skills*, *75*, 1331-1343.

Bonnett, M.H. & Arand, D.L. (1996). The consequence of a week of insomnia. *Sleep, 19,* 453-461.

Borge, S., Omvik, S., Pallesen, S., Bjorn, B., Odd, E.H., Gerd, H.N., Geir, H.N., & Inger, N.H. (2006). Cognitive behavioral therapy vs zopiclone for treatment of chronic Primary insomnia in older adults. *Jama, 295*, 2851-2858.

Brown, F.C., Bulboltz, W.C., & Soper, B. (2006). Development and evaluation of the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

sleep treatment and education program for students (STEPS). *Journal of American College Health, 54,* 231-237.

Burckhardt, C.S., & Anderson, K.L. (2003). The Quality of Life Scale (QOLS): reliability, validity, and utilization. *Health and Quality of Life Outcomes, 1,* 60.

Buysse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R., & Kupfer, D.J. (1989). The pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Research, 28,*193-213.

Carlson, L.E., Speca, M., Patel, K.D., and Goodey, E. (2004). Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate (DHEAS) and melatonin in breast and prostate cancer outpatients. *Psychoneuroendocrinology, 29,* 448-474.

Casden, D.R. (2005). *The effects of ashtanga yoga on autonomic, respiratory and cognitive functioning; psychological symptoms & somatic complaints: A controlled study.* Unpublished doctoral dissertation, Alliant International University, California.

Caspi, A., Bolger, N., & Eckenrode, J. (1987). Linking person and context in the daily stress process. *Journal of Personality and Social Psychology, 52*(1), 184-195.

Chang, S.C. & Chen, C.H. (2005). Effects of music therapy on women's physiologic measures, anxiety, and satisfaction during cesarean delivery. *Research in Nursing and Health, 28,* 453-461.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Chilcott, L.A. & Shapiro, C.M. (1996). The socioeconomy of insomnia: An overview. *Pharmacoeconomics, 10,* 1-14.

Cohen, L., Warneke, C., Fouladi, R., Rodriguez, A., & Chaoul-Reich, A. (2004). Psychological adjustment and sleep quality in a randomized trial of the effects of a Tibetan yoga intervention in patients with lymphoma. *American Cancer Society, 100*, 2253-2260.

Cooke, M., Chaboyer, W., Schluter, P., & Hiratos, M. (2005). The effect of music on preoperative anxiety in day surgery. *Journal of Advanced Nursing*, *52*, 47-55.

Curran, S.L., Andrykowski, M.A., Studts, J.L. (1995). Short form of the profile mood of states (POMS-SF): Psychometric information. *Psychological Assessment, 7*, 80-83.

Cushman, F. (2005). Caffeine. Retrieved April 27, 2006 from http://www.psychologytoday.com/conditions/caffeine.html.

Espie, C.A. (2002). Insomnia: Conceptual issues in the development, persistence, and treatment of sleep disorder in adults. *Annual Review of Psychology, 53,* 215-243.

Freedman, R & Papsdorf, J.D. (1976). Biofeedback and progressive muscle relaxation treatment of sleep-onset insomnia. A controlled-all night investigation. *Applied Psychophysiology and Biofeedback, 1*, 253-271.

Friedman, L., Bliwise, D.L., Yesavage, J.A. & Salom, S.R. (1991). A preliminary study comparing sleep restriction and relaxation treatment for insomnia in older adults. *Journal of Gerontology, 46*, 1-8.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Li, F., Fisher, K.J., Harmer, P., Irbe, D., Tearse, R.G. & Weimer, C. (2004). Tai chi and self-rated quality of sleep and daytime sleepiness in older adults: A randomized controlled trial. *Journal of the American Geriatrics Society, 52*, 892-906.

Garfinkle, M.S., Schumacher, H.R., Husain, A., Levy, M., & Reshetar, R.A. (1994). Evaluation of a yoga based regimen for treatment of osteoarthritis of the hands. *Journal of Rheumatology, 21*, 2341-2343.

Garfinkle, M.S., Singhal, A., Warren, A.K., Allan, D.A., Reshetar, R. & Schumacher, R. (1998). Yoga-based intervention for carpel tunnel syndrome. *Jama, 280,* 1601-1603.

Gitanjali, B. Effect of the Karnatic music raga "Neelambari" on sleep architecture. (1998). *Indian Journal of Physiology and Pharmacology, 4,* 119-122.

Greenwell, B. (1990). *Energies of transformation: A guide to the kundalini process.* Saratoga, CA: Shakti River Press.

Gross, C.R., Kreitzer, M.J., Russas, V., Treesak, C., Frazier, P.A. & Hertz, M.I. (2004). Mindfulness meditation to reduce symptoms after organ transplant: A pilot study. *Alternative Therapies, 10,* 58-65.

Grossman E, Grossman A, Schein M.H., Zimlichman R,& Gavish B. (2001). Breathing-control lowers blood pressure. *Journal of Human Hypertension, 15,* 263 – 269.

Guzzetta, C. (1989). Effects of relaxation and music therapy on patients in a coronary care unit with presumptive acute myocardial infarction. *Heart and Lung, 18,* 609-616.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Hicks, R.A., Fernandez, C. & Pellegrini, R.J. (2001). Striking changes in the sleep satisfaction of university students over the last two decades. *Perceptual Motor Skills, 93*, 660.

Hoch, C.C., Reynolds, C.F., Buysse, D.J., Monk, T.H., Nowell, P., Begley, A.E., Hall, F. & Dew M.A. (2001). Protecting sleep quality in later life: A pilot study of bed restriction and sleep hygiene. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 56,* 52-59.

Holmer, M. (2004). *The effects of yoga on symptoms and psychosocial adjustment in fibromyalgia syndrome patients*. Unpublished doctoral dissertation, Alliant International University, California.

Jacobs, G.D., Benson, H., & Friedman, R. (1996). Perceived benefits in a behavioral Medicine insomnia program: A clinical report. *The American Journal of Medicine,100*, 212-216.

Jean-Louis, G., Kripke, D.F. & Ancoli-Israel, S. (2000). Sleep and quality of well-being. *Sleep, 23 (8),* 1115-1121.

Johns, M. (1991) A new method for measuring daytime sleepiness: The epworth sleepiness scale. *Sleep, 14*, 540-545.

Johnson, J.E. (2003). The use of music to promote sleep in older women. *Journal of Community Health Nursing, 20,* 27-35.

Johnson, L.E. & Chernik, D.A. (1982). Sedative hypnotics and human performance. *Psychopharmacology, 76*, 101-113.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Kartman, L.L. (1984). Music hath charms. *Journal of Gerontological Nursing, 10,* 20-24.

Khalsa, S.B. (2004). Treatment of chronic insomnia with yoga: a preliminary study with sleep/wake diaries. *Applied Psychophysiology and Biofeedback, 29*, 269-279.

Khalsa, S.B. (2004). Yoga as a therapeutic intervention: A bibliometric analysis of published research studies. *Indian Journal of Physiology and Pharmacology, 48,* 269-285.

Khalsa, S.K. (2001). *KISS Guide to Yoga*. London, Great Britain: DK Publishing.

Khalsa, S.K. & Emerson-Roberts, G. (2001) Kundalini Yoga as Taught by Yogi Bhajan. New York: DK Publishing.

Koch, U., Volk, S., Heidenreich, T., & Pflug, B. (1998). Yoga treatment in psychophysiological insomnia. *Journal of Sleep Research, 7,* 137-140.

Krystal, A.D., Walsh, J.K., Lasks, E., Caron, J., Amato, D.A., Wessel, T.C., & Roth, T. (2003). Sustained efficacy of eszopiclone over 6 months of nightly treatment: results of a randomized, double-blind, placebo-controlled study in adults with chronic insomnia. *Sleep*, *26*, 793-799.

Kumar, R. (2000). *Kundalini for beginners*. St. Paul, MN: Llewellyn Publications.

Lacks, M.P. (1992). Recent advances in the assessment and treatment of insomnia. *Journal of Consulting and Clinical Psychology, 60,* 586-594.

Lai, H.L. & Good, M. (2005). Music improves sleep quality in older adults. *Journal of Advanced Nursing, 49,* 234-244.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Lavey, R., Sherman, T., Mueser, K.T., Osborne, D.D., Currier, M. & Wolfe, R. (2005). The effects of yoga on mood in psychiatric inpatients. *Psychiatric Rehabilitation Journal, 28,* 399-402.

Lee, S.W., Mancuso, C.A., & Charlson, M.E. (2004). Prospective study of new participants in a community based mind-body training program. *Journal of General Internal Medicine, 19,* 760-765.

Lichstein, K.L. & Fischer, S.M. (1985). Insomnia. In M. Hersen & A. S. Bellack, *Handbook of clinical behavior therapy with adults* (pp. 319-352). New York: Plenum Press.

Lichstein, K.L., Durrence, H.H., Taylor, D.J., Bush, A.J., & Reidel, B.W. (2003). Quantitative criteria for insomnia. *Behavior Research and Therapy, 41,* 427-445.

Mahajan, A.S., Reddy, K.S., & Sachdeva, U. (1999). Lipid profile of coronary risk subjects following yogic lifestyle intervention. *Indian Heart Journal, 51,* 37-40.

McGee, W. (2005). Caffeine intake. Retrieved April 28, 2006, from http://www.nlm.nih.gov/medlineplus/ency/article/002445.htm#Recommendations

McNair, D.M., Heuchert, J.W., & Shilony, E. (2003*). Research with the Profile of Mood States (POMS) 1964-2002: A comprehensive bibliography*. Toronto, Canada: Multi-Health Systems.

McNair, D.M., Maurice, L. & Droppleman, L.F. (1992). *Edits Manual for the Profile of Mood States, Revised 1992,* San Diego, CA: Edits/Educational and Industrial Testing Service.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

McNair, D.M. & Shilony, E. (1994). *Research with the Profile Mood of States (POMS) 1964-1992: A comprehensive bibliography.* San Diego, CA: Educational and Industrial Testing Service.

Monk, T.H., Reynolds III, C.F., Kupfer, D.J., Buysse, D.J., Coble, P.A., Hayes, A.J., Machen, M.A., Petrie, S.R., & Ritenour, A.M. (1994). The pittsburgh sleep diary. *Journal of Sleep Research, 3,* 111-120.

Moss, V.A. (1988). Music and surgical patient. *AORN Journal, 48 (1),* 64-69.

Murtagh, D.R., & Greenwood, K.M. (1995). Identifying effective psychological treatments for insomnia: A meta-analysis. *Journal of Consulting and Clinical Psychology, 63,* 79-89.

Murugesan, R., Govindarajulu, N., & Bera, T.K. (2000). Effect of selected yogic practices on the management of hypertension. *Indian Journal of Physiology Pharmacology, 44,* 207-210.

Naimi, T. (2005). Moderate drinking may not deliver health benefits, says CDC. Retrieved April 27, 2006 from http://www.nutraingredients.com/news/ng.asp?id=59525-moderate-drinking-may.

Nicassio, P.M., Mendlowitz, D.R., Fussell, J.J., & Petras, L. (1985). The phenomenology of the pre-sleep state: The development of the pre-sleep arousal scale. *Behavior Research and Therapy, 23,* 263-271.

Nofzinger, E.A., Buysse, D.J., Germain, A., Price, J.C., Miewald, J.W., & Kupfer, D.J. (2004). Functional neuroimaging evidence for hyperarousal in insomnia. *American journal of Psychiatry, 161,* 2126-2129.

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Nyenhuis, D.,L., Yamamoto, C., Luchetta, T., Terrien, A., & Parmentier, A. (1999). Adult and geriatric normative data and validation of the Profile Mood of States. *Journal of Clinical Psychology, 55*, 79-86.

Oken, B.S., Zajdel, D., Kishiyama, S., Flegal, K., Dehen, C., Hass, M., Kraemer, D., Lawrence, J. & Leyva, J. (2006). Randomized, controlled, six-month trial of yoga in healthy seniors: Effects on cognition and quality of life. *Alternative Therapies in Health and Medicine, 12*, 40-47.

Patel, C. (1975). Yoga and biofeedback in the management of hypertension. *Journal of Psychosomatic Research, 19,* 355-360.

Raub, J.A. ((2002). Psychophysiologic effects of hath yoga on musculoskeletal and cardiopulmonary function: A literature review. *Journal of Alternative and Complementary Medicine, 8,* 797-812.

Ray, U.S., Mukhopadhyaya, S., Purkayastha, S.S., Asnani, V., Tomer, O.S., Prashad, R., Thakur, L., & Selvamurthy, W. (2001). Effect of yogic exercises on physical and mental health of young fellowship course trainees. *Indian Journal of Physiology and Pharmacology, 45*, 37-53.

Ringdahl, E.N., Pereira, M.D. & Delzell, J.E. (2004). Treatment of primary insomnia. *The Journal of the American Board of Family Practice, 17,* 212-219.

Ruyak, P.S. (2004). A survey of insomnia treatment at Canadian sleep centers: Are there a role for clinical psychologists? *Canadian Psychology, 45,* 165-177.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Sahajpal, P. & Rinpari, R. (2000). Impact of induced yogic relaxation training on stress level, self-concept and quality of sleep among minority group individuals. *Journal of Indian Psychology, 18,* 67-73.

Sateia, M.J. & Nowell, P.D. (2004). Insomnia. *The Lancet, 364,* 1959-1973.

Sayar, K., Arikan, M., Yontem, T. (2002). Sleep quality in chronic pain patients. *Canadian Journal of Psychiatry, 47,* 844-848.

Seeman, M.V. (1995). *Gender and Psychopathology.* American Psychiatric Press, Inc. Washington D.C.

Selvamurthy, W., Sridharan, K., Ray, U.S., Tiwary, R.S., Hegde, K.S., Radhakrishan, U., Sinha, K.C. (1998). A new physiological approach to control essential hypertension. *Indian Journal of physiological pharmacology, 42*, 205-213.

Shacham, S. (1983). A shortened version of the profile of mood states. *Journal of Personality Assessment, 47,* 305-306.

Shannahoff-Khalsa, D.S. Yogic meditation techniques are effective in the treatment of obsessive-compulsive and disorders. In: Hollander, E. and Stein, D. *Obsessive Compulsive Disorders: Etiology, diagnosis, and treatment.* New York: Marcel Dekkar, Inc., 1997:283-329.

Shannahoff-Khalsa, D.S., & Beckett, L.R. (1996). Clinical case report: efficacy of yogic techniques in the treatment of obsessive compulsive disorders. *International Journal of Neuroscience, 85 (1-2),* 1-17.

Siedliecki, S.L. & Good, Marion. (2006). Effect of music on power, pain, depression and Disability. *Journal of Advanced Nursing*, *54*, 553-567.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Speca, M., Carlson, L.E., Goodey, E.A. & Angen, M.A. (2000). A randomized, wait-list controlled clinical trial: the effect of a mindfulness meditation based stress reduction program on mood and symptoms of stress in cancer outpatients. *Psychosomatic Medicine, 62,* 613-622.

Spielman, A.J., Caruso, L.S., & Glovinsky, P.B. (1987). A behavioral perspective of insomnia treatment. *Psychiatric Clinic of North America, 10,* 541-553.

Stepanski, E.J. & Wyatt, J.K. (2002). Use of sleep hygiene in the treatment of insomnia. *Sleep Medicine Reviews, 7,* 215-225.

Taneja, I., Deepak, K.K., Poojary, G., Acharya, I.N., Pandey, R.M., & Sharma, M.P. (2004). Yogic versus conventional treatment in diarrhea-predominant irritable bowel syndrome: A randomized controlled study. *Applied Psychophsiology and Biofeedback, 29,* 19-33.

Whitlock, E.P., Polen, M.R., Green, C.A., Orleans, T., Klein,J. (2004). Behavioral counseling interventions in primary care to reduce risky/harmful alcohol use by adults. Originally in *Annals of Internal Medicine, 140,* 558-569. Retrieved April 27, 2006 from http://www.ahrq.gov/clinic/3rduspstf/alcohol/alcomissum.html.

Williams, K.A., Petronis, J., Smith, D., Goodrich, D., Wu, J., Ravi, N., Doyle, E., Juckett, G., Kolar, M.M., Gross, R., & Steinberg, L. (2005). Effect of Iyengar yoga therapy for chronic low back pain. *Journal of Pain, 115,* 107-117.

Violani, C., Lucidi, F., Robusto, E., Devoto, A., Zucconi, M., & Strambi, F.L. (2003). The assessment of daytime sleep propensity: a comparison between the Epworth

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sleepiness Scale and a newly developed Resistance to Sleepiness Scale. *Clinical Neurophysiology, 114*, 1027-1033.

Voss, J.A., Good, M., Yates, B., Baun, M.M., Thompson, A., Hertzog, M. (2004). Sedative music reduces anxiety and pain during chair rest after open-heart surgery. *Pain, 112*, 197-203.

Yang, C.M., Wu C.H., Hsieh, M.H., Liu, M.H., & Lu, F.H. (2003). Coping with sleep disturbances among young adults: a survey of first year college students in Taiwan. *Behavioral Medicine, 29*, 133-138.

Zimmerman, L., Pozehl, B., Duncan, K., & Schmitz, R. (1989). Effects of music in patients who had chronic cancer pain. *Western Journal of Nursing Research, 11*, 298-309.

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Appendices

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Appendix A

Recruitment Flyer

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MIND/BODY TECHNIQUES

We are Seeking participants who are having difficulty sleeping to be a part of a research study investigating the use of Mind/Body Techniques for sleep disturbance.

If you are interested in learning more about being a participant in this mind/body study for sleep disturbance, please leave a message for Sabina Sehgal, M.A. at (858)829.8852

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Appendix B

Recruitment Internet Listing on Craig's list

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Are you having trouble falling asleep?

Take part in an interesting study involving mind/body techniques. Recent research has shown that mind/body techniques are an effective modality for treating sleep disturbance. Meetings will be held at Alliant International University in Scripps Ranch. If interested please email. Study begins in August.

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Appendix C

Recruitment Email Announcement at AIU

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Mind/Body Techniques

Classes starting as soon as mid -July

- Be part of an interesting study for individuals with sleep disturbance
- Recent research shown mind/body techniques to be an effective modality for treating sleep disturbance
- Meetings will be conducted at Alliant International University.

For further information or to volunteer as a participant in this study, contact. Sabina Sehgal
(858) 829.8852
Email:: sabinaecu@yahoo.com

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Appendix D

Telephone Screening Form

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Telephone Screening Form

Date: _____

Phone Number:_____

Subject #: _____

Greeting:
Hello, _____, this is Sabina returning your call regarding the mind/body study at Alliant International University. Do you have a few minutes to talk about the study?

How did you hear about the study?
☐ Flyer ☐ Word of Mouth ☐ Craig's list ☐ Other

Description of Study:
Let me tell you a little bit about the study and what it would mean to participate. The study is being offered to determine if mind/body techniques effect changes in sleep and other measures. So, let me describe what will be required of the study:

- All participants who are eligible and sign up for the study will receive one mind/body technique class for free and a mind/body DVD free of charge.
- Participants will attend either a 60 minute session of mind/body techniques, once a week or listen to classical/new age music. Participants who attend the mind/body session will also be asked to practice mind/body techniques twice daily, following along with a DVD. The classes will be led by an experienced and certified instructor who will tailor each class to the individual needs of the participants. This is a beginners course so don't worry if you have never had experience with mind/body techniques or if you are not very flexible. Participants listening to music will be asked to listen to music daily, upon waking and right before going to sleep.
- However, we do require that you take part in two, one hour assessments. This assessment will be measuring for changes in psychological and physical symptoms. We will also ask you to keep a sleep diary for a six week duration.
- This is an exceptional opportunity for you to try mind/body techniques for the first time or to improve upon your previous mind/body practice.
- Participants will be randomly assigned to either the mind/body group or music group.

Study Eligibility:
Are you interested in being a participant in this study?
☐ Yes
☐ No, reason: _____
☐ Maybe/wants to think about it: Reason:_____

Before we begin can I ask you some information about yourself:

Sex	1	Female	Age _____
	2	Male	

Racial/Ethnic Group (Circle only one)
1. Hispanic
2. African American/Black
3. Asian/Pacific Islander

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4. Native American/Eskimo
5. Caucasian/White
6. Other: _____

Great! I just need to ask you a few questions to determine if you qualify for the study, is that okay?

1. Are you 18-45 years old? ☐ No ☐ Yes

2. Are you currently pregnant? ☐ No ☐Yes

3. Is there any medical, physical, or orthopedic condition that would affect your ability to participate in classes? ☐ No ☐ Yes

4. Have you ever been hospitalized or had surgery? ☐☐

5. How often have you been practicing yoga over the past 3 months? _____

6. Have you been diagnosed with manic depression (bipolar disorder), schizophrenia or other mental health disorder? ☐☐, please describe

7. Have you ever been hospitalized for mental health reasons? ☐ No ☐ Yes, please describe

8. Are you currently taking medications? ☐☐

Name:_____ Purpose:_____
Name:_____ Purpose:_____
Name:_____ Purpose:_____

Do I have permission to ask you questions from a sleep questionnaire? ☐ No ☐ Yes

Permission to administer PSQI attained: date:_____ time:_____

☐ Qualifies for the study
☐ Does not qualify for the study

If Qualifies:
Great! It looks like you qualify to participate in the study. I am so excited to have you start the classes. Tentatively, you can expect to start sometime in July. I will get in touch with you as soon as I know the exact start dates. At that time, I will schedule a time to meet at AIU to complete the first assessment. This should take about an hour.

What is the best time to reach you?_____

Is this the best phone number to reach you at? Do you have an alternate? _____

What is your email address so that I can keep you informed of the study? _____

We would like the classes to be offered at a convenient time for you. What time of day would be best for you?

Tell me if any of the following times of day would work best for you?
☐ Early a.m. (8:00 – 9:00)

What days of the week work best for you?
☐ Monday

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□ Late a.m. (10:00 - 12:00)	□ Tuesday
□ Lunch time (11:30 - 1:00)	□ Wednesday
□ Late afternoon (2:00 - 4:00)	□ Thursday
□ Early Evening (4:00 - 6:00)	□ Friday
□ Evening (6:00 – 8:00)	□ Saturday
□ Late Evening (8:00 – 10:00)	□ Sunday

If Does Not Qualify: I am sorry. Based on the official criteria set up for the study, you do not qualify to be in the study.

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Appendix E

Informed Consent Forms

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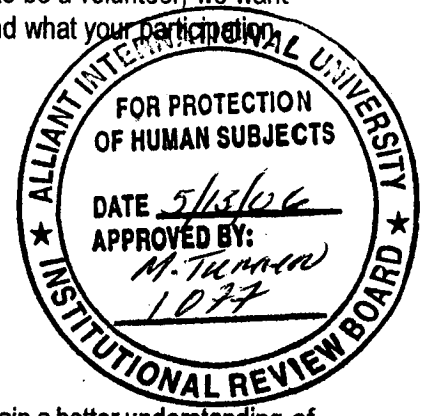
10455 Pomerado Road
San Diego, CA 92131

INFORMED CONSENT AGREEMENT

Click here to add title

You are being asked to participate in a research study. However, before you give your consent to be a volunteer, we want you to read the following and ask as many questions as necessary to be sure that you understand what your participation will involve.



INVESTIGATOR
Sabina Sehgal
(858) 829.8852
Melanie Greenberg, PhD.
(858) 243.4627

PURPOSE OF THE RESEARCH
You were chosen for this study because you have disturbed sleep.The purpose of the study is to gain a better understanding of how Kundalini yoga affects your sleep. You will be assigned at random to one of two groups, Kundalini yoga or Music. The comparison of the two treatments will help me to better understand how your sleep is affected by the group you are in. This study explores the effects of yoga on sleep quality, sleep efficiency, mood, quality of life, and how tired you feel.

DURATION OF PARTICIPATION IN THE RESEARCH (include number of subjects to participate.
To participate in this study, you will be required you to attend one weekly yoga session for eight weeks and particpate in daily home practice. This study is a total of twelve weeks. You will fill out questionnaires two weeks before the intervention begins, immediately before the intervention begins, immediately after the intervention, and two weeks after the intervention ends. You will also be required to fill out a sleep diary two weeks before the intervention begins, two weeks during the intervention, and at a two week follow-up. Approximately fifty participants will be recruited for this study.

FEMALES OF CHILDBEARING POTENTIAL (USE ONLY AS NECESSARY FOR STUDY. Indicate if this and next section does not pertain to your study))
Does not pertain to study.

PREGNANCY RISK
Individuals who are pregnant will be excluded from the study due to the physical nature of the study.

PROCEDURES TO BE FOLLOWED DURING THE RESEARCH
During our first meeting, you will fill out questionnaires that will take approximately thirty minutes to complete. You will then be randomly assigned by chance to one of two study groups. Neither you or the researcher will be able to choose the group to which you will be assigned. You will either be assigned to (1) Yoga Group or (2) Music Group. If you are in the Yoga Group you will be expected to attend 1, 60 minute yoga class per week for 8 weeks.You will also be expected to particiapte in daily home practice. If you are in the Music Group you will be expected to listen to new age music/classical music daily for 8 weeks. During the 12-week period of the study you will fill out questionnaires 4 times (baseline, pre, post, follow-up). In addition to these questionairres you will be required to complete daily sleep diaries for a total of 6 weeks (2-week basline, 2-weeks of the 8-week intervention, and for the 2-week follow up.

EXPERIMENTAL PROCEDURES
The treatment and procedures are the kind that would be standard psychologial practice. Specifially, the experimental part of this research is the effect of Kundalini yoga on physical and psychologial symptoms.

RISKS
Participants in this study are subjected to minimal risk. Minimal risk indicates the risk of harm anticipated is not greater than that ordinarily encountered in daily life or during the performance of routine physical or psychologial examinations or tests. Any potential risks in this study will be minimized by following guidelines designed to protect participants in research. It is

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if you feel pain or discomfort, without any negative reprucussions from the researhcer, the university or any other persons involved in this study.

BENEFITS OF THE RESEARCH

Although it cannot be guaranteed that you will benefit from participation in this study, particiapnts in the yoga group will receive 8 free yoga classes and a free yoga DVD; while participants in the music control group will receive 2 free CD's during the intervention; and a single session of yoga and a free yoga DVD once the study is completed.

ALTERNATIVES TO THIS RESEARCH

There is no alternative treatment other than what has been described. However, you do not have to participate in this research.

CONFIDENTIALITY

You have (your child has) a right to privacy and all information identifying you (your child) will remain confidential, unless otherwise required by law. The results of this study along with any laboratory tests, x-rays, photographs, video tapes, and medical charts (if appropriate) may be published in scientific journals, or be presented at medical meetings as long as you are (your child is) not identified and cannot reasonably be identified from it. However, it is possible that under certain circumstances data could be subpoenaed by court order. It is also not guaranteed that efforts to disguise identifying information with regard to case studies will keep your identity anonymous.

PSYCHOLOGICAL TREATMENT OR QUESTIONS ABOUT THE RESEARCH

If you need medical treatment or have a research-related injury while participating in this study, you must contact your doctor or call 911 in case of emergency (24 hour phone number). Should you have any questions about the research or any additional concerns, please contact Sabina Sehgal, M.A. at (858) 829.8852 during normal working hours.

While you are a subject in this study, you must agree to follow the instructions of the research and to call your research investigator immediately if you become ill or experience any unusual or unexpected side effects.

While enrolled on this study, you should not participate in any other research project. This is for your protection against any possible adverse effects caused by the interaction of multiple study interventions. If you take any medicines (including over-the-counter medicines like cold medicines), or have changes a medication you are taking now, you must inform the research doctor. Are you currently involved in any research projects at this time? ____YES ____NO

MANDATORY REPORTING OF CHILD OR ELDER ABUSE

California law mandates the filing and reporting of reasonable suspicions of child or elder abuse. Participation in this research could result in the investigator being required to report child or elder abuse.

SUBJECT COST or COMPENSATION FOR PARTICIPATION

There is no cost to you for your participation in this study. The yoga classes will be provided to you free of charge.

PREVIOUS RESEARCH PARTICIPATION

I have participated in the following research studies within the last three months:

_____

I have not participated in any research studies in the past three months. _____

SUBJECT RIGHTS AND RESEARCH WITHDRAWAL

Your participation in this study is voluntary. You may refuse to participate or withdraw once the study has started. It may be necessary in the event of early withdrawal for you to follow specific procedures set by your doctor. In either case, you will not lose any benefits to which you are otherwise entitled nor will you be penalized.

We have tried to explain all the important details about the study to you. If you have any questions that are not answered here, your study doctor will be happy to give you more information.

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SIGNATURE AND ACKNOWLEDGMENT **(this section must be on the same page as signatures)**

My signature below indicates that I have read the above information and I have had a chance to ask questions to help me understand what my participation will involve. I agree to participate in the study until I decide otherwise. I acknowledge having received a copy of this agreement and a copy of the **Subject's Bill of Rights**. I have been told that by signing this consent form I am not giving up any of my legal rights.

Signature of Research Participant	**Date**
Sabina Sehgal	858.829.8852
Researcher's Name (typed)	**Contact phone number**
Researcher's Signature	**Date**
Melanie Greenberg, PhD.	858.243.4627
Typed Name of Supervisor or Chair	Contact phone number

For Research Office Only: **IRB#** _____

This study is valid from: _____ **Until** _____

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(To include as component of Informed Consent; DOWNLOAD THIS FORM DIRECTLY FROM SCHOOL WEBSITE. Eliminate references to drugs (#2, 5), or medical treatment (#6), if it's not pertinent to your study.)

As a participant in a research study or as someone who is requested to give consent on behalf of another for such participation, you have certain rights and responsibilities. It is important that you fully understand the nature and purpose of the research and that your consent be offered willingly and with complete understanding. To aid in your understanding, you have the following specific rights:

1. To be informed of the nature and purpose of the research in which you are participating.
2. To be given an explanation of all procedures to be followed and of any drug or device to be utilized.
3. To be given a description of any risks or discomforts which can be reasonably expected to occur.
4. To be given an explanation of any benefits which may be expected to come to the subject as a result of this research.
5. To be informed of any appropriate alternative procedures, drugs, or devices that may be advantageous and of their relative risks and discomforts.
6. To be informed of any medical treatment which will be made available to the subject if complications should arise from this research.
7. To be given an opportunity and encouraged to ask any questions concerning the study or the procedures involved in this research.
8. To be made aware that consent to participate in the research may be withdrawn and that participation may be discontinued at any time without affecting continuity or quality of your medical care.
9. To be given a copy of the signed and dated written consent form if requested.
10. To not be subjected to any element of force, fraud, deceit, duress, coercion, or any influence in reaching your decision to consent or to not consent to participate in the research.

If you have any further questions or concerns about your rights as a research subject, please contact your doctor.

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Appendix F

Participant Information and Demographics Questionnaire

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ID# ____
Date: _____

On the following pages, you will be asked several questions about yourself. Your participation is very important for us to gain a better understanding of yoga's effects on health. All information on this form will remain anonymous and confidential. Please respond honestly to all questions. Thank you for your participation.

Participant Information Form
Yoga Study

First name: _____ Last name: _____

Street address: _____

City: _____ Zip Code: _____ Email: _____

Home Phone: ( ) _____Work Phone: ( ) _____Cell Phone ( ) _____

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Date: _____ ID# _____

Participant Demographic and Health History Form

Please circle the number that indicates the correct choice:

Sex 1 Female Age:____

2 Male Date of Birth: _____

1. Racial/Ethnic Group (Circle only one)2. Marital Status: 3. With whom do you live?

a. Hispanic	a. Single	a. Alone
b. African American	b. Married	b. Roommate
c. Asian/Pacific Islander	c. Separated	c. Significant Other
d. Native American/Eskimo	d. Divorced	d. Parents
e. Caucasian/White	e. Widow	e. Children
f. Other:_____	f. Other: _____	f. Other: _____

4. Number of Children (if any): _____ Ages of children: _____# of children at home: _____

5. Highest education level completed:

a. Elementary b. High School c. Undergraduate d. Graduate e. Other:_____

6. Occupation: _____ Full/Part-time? _____

7. Work Schedule: (9-5, 12-7, 3-11, etc) _____

8. Yearly family gross income: _____

9. In the last six months have you experienced any life changes? _____

_____

10. Have you been under stress lately with regards to: a) home ___ b) relationship ___ c) job ___

d) other (explain) _____

11. What triggered, or seemed to start off your sleep problem? _____

_____

12. How long have had difficulty sleeping? _____

13. Are you currently having any emotional difficulties that you are struggling with? Yes _ No_

If yes, explain: _____

14. Are you currently receiving therapy from a psychiatrist, psychologist, or any other mental health professional for these problems? Yes ___ No___

If yes, start date M/DD/YYYY _____ end date M/DD/YYYY _____

15. When was the last time you had a physical examination? M/DD/YYYY _____

16. Do you currently have any medical problems (e.g. heart disease, chronic pain)? Please list each health related problem and explain: _____

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Appendix G

Participant Program Rating

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ID# _____

Participant Rating of Mind/Body Experience

Mind/Body Study

Instructions: Please place a vertical lime (|) line through whichever point on the scale that best indicates your rating.

The overall quality of the mind/body experience:

Worthless,
_____Optimal,
No Value Very
Valuable

Thank You!

How many times this week did you practice yoga with the DVD from class? (Please do not include Tuesday and Thursday evening class).

A.M. _____ P.M. _____

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Appendix H

Participant Progress Rating Sheet

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Participant Progress Rating Sheet

Mind/Body Study

Instructions: Please draw a vertical line (|) through the point on the scale that best indicated your rating.

Please rate this participant's...

(1) Overall skill and ability in performing the yoga poses in today's class

Struggling to Perform Yoga _____ Easily Performs Yoga Postures

Outward Focus _____ InwardFocus

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Appendix I

Participant Logistic Handout

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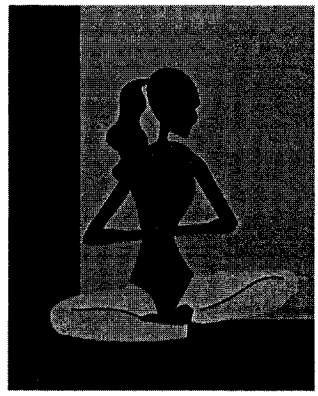
Yoga Study



Follow-up Assessment Appointment:
Date: _____
Time: _____
Location: _____

Please call Sabina Sehgal, M.S. at (858) 829.8852
with questions or if you need to change follow-up appointment

Class Schedule:
To be determined

Location:
Alliant International University

What to wear:
Comfortable exercise clothing that will move with your body

What to bring:
Please bring a towel
Please bring water
Mats will be provided, but feel free to bring your own

THANK YOU!

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Appendix J

Directions to AIU

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Directions to campus:

From I-15:
Exit at Miramar/Pomerado Road. Go east approximately one mile to Willow Creek Road/Avenue of Nations. Turn right into the campus.

From I-5 or 805:
Take the La Jolla Village Drive exit or the Miramar Road exit east. (The name of this road changes from La Jolla Village Drive to Miramar Road and then to Pomerado Road.) Cross over I-15 and proceed one mile to the Willow Creek Road/Avenue of Nations intersection. Turn right into the campus.

Directions to campus:

From I-15:
Exit at Miramar/Pomerado Road. Go east approximately one mile to Willow Creek Road/Avenue of Nations. Turn right into the campus.

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Appendix L

Weekly Music Check-In

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MUSIC WEEKLY TELEPHONE CHECK-IN

Hello! How was your week. How many times this week were you able to listen to the CD before bedtime? How many times this week were you able to listen to the CD when you woke up in the morning?

If not practicing. What do you think is keeping you from listening to the music? How do you think you can overcome these obstacles?

If practicing. Keep up the good work. Have you noticed any differences since you began listening to the music?

THANKS FOR THE UPDATE, I WILL CHECK-IN WITH YOU NEXT WEEK

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