

University of Nevada, Reno

**An Evaluation of Bikram Yoga at Reducing the Level of Back Pain**

A thesis submitted in partial fulfillment of the  
Requirements for the degree of Master of Science in  
Nursing

by

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May, 2012

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THE GRADUATE SCHOOL

We recommend that the thesis  
prepared under our supervision by

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entitled

**An Evaluation of Bikram Yoga at Reducing the Level of Back Pain**

be accepted in partial fulfillment of the  
requirements for the degree of

**MASTER OF NURSING**

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## Abstract

Low back pain is a significant public health problem and one of the most commonly reported reasons for the use of Complimentary Alternative Medicine. In the U.S. 70% to 80% of the population has experienced at least one episode of back pain sometime in their lives. Healthcare workers, in particular, are at an increased risk for back pain; nursing has one of the highest incidences of back injuries of all occupations. With lower back pain affecting so many people, new interventions need to be identified to cope with debilitating back pain in the high risk field of health care. Alternative medicine, such as yoga, has been proven effective to lower or eliminate symptoms in a variety of illnesses. Yoga may be a safer, less invasive treatment for pain in nurses.

The purpose of this study was to identify an alternate method of pain control in those who experience back pain. Bikram yoga, a systematic, hot and humid type of yoga has been identified to alleviate back pain.

Thirty subjects with self-identified back pain voluntarily participated in this research. Subjects attended Bikram yoga once a week while concurrently participating in traditional exercise. Participants were asked to log back pain before and after each intervention. After four weeks participants returned pain assessment logs for review and data analysis. Nurses, as one of the occupations with the highest rates of reported back pain, were evaluated as a subset. Results were evaluated by a paired t-test, with a Cohen's d calculated for effect size. There was a significant reduction in pain scores associated with Bikram yoga when compared with traditional exercise in both the group as a whole ( $p < .001$ , effect size 1.540) and in nurses as a subset ( $p = .007$ , effect size

1.491). Bikram yoga may be initiated to alleviate pain in those who experience back pain.

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## TABLE OF CONTENTS

ABSTRACT .....	i
ACKNOWLEDGEMENT .....	iii
CHAPTER I INTRODUCTION .....	1
Problem Statement .....	1
Background and Significance .....	2
Conceptual Framework .....	3
Purpose of Study .....	5
Chapter Summary .....	5
CHAPTER II LITERATURE REVIEW .....	6
Chapter Summary .....	8
CHAPTER III METHODS .....	9
Sample: Subject Recruitment and Selection .....	9
Inclusion Criteria .....	9
Exclusion Criteria .....	10
Protection of Human Subjects .....	10
Recruitment .....	10
Pain Scale .....	12
Chapter Summary .....	12
CHAPTER IV DATA ANALYSIS .....	13
Data Analysis .....	13
Chapter Summary .....	14
CHAPTER V RESULTS .....	15
CHAPTER VI DISCUSSION .....	17
Limitations .....	17
Recommendations .....	18
Conclusion .....	19
APPENDICES .....	20
Appendix 1: Sierra Bikram Yoga Registration and Liability Waiver .....	20
Appendix 2: General Health Questionnaire .....	21
Appendix 3: Participant Information Sheet .....	22
Appendix 4: Recruitment Flyer .....	24
Appendix 5: Pain Assessment Survey .....	25
REFERENCES .....	26

## **CHAPTER I**

### **Introduction**

#### **Problem Statement**

“Low back pain is a significant public health problem and one of the most commonly reported reasons for the use of Complimentary Alternative Medicine” (Williams et al., 2005, p. 107). According to these authors, 70% to 80% of the United States (U.S.) population has experienced at least one episode of back pain sometime in their lives. “Lower back pain “(LBP) is the second most common reason for sick leave among U.S. workers after the common cold and also the leading cause of job-related disability” (Rhee, Taitel, Walker & Lau, 2007, p. 2). Healthcare workers, in particular, are at an increased risk for back pain; nursing has one of the highest incidences of back injuries of all occupations (Back injury prevention, 2010; Yin Bing Yip, 2004). The occupation of a nurse is very physical and includes lifting, turning, mobilizing patients and equipment throughout the work day. This considered, it is not surprising that nurses experience a high rate of back injuries. Yin BingYip (2004) attributes nursing injuries to the “joint loading and awkward postures” that this particular job requires (p. 431). In addition, nurses also experience a great amount of physical and psychological stress associated with the responsibilities of the job. Back pain is directly linked to psychological stress, causing increased muscle tension and amplified pain sensations (Yin Bing Yip, 2004). Chronic back pain, because of physical demands and stress, is a serious debilitation that affects the general population nationwide.

Management of back pain typically consists of physical therapy, pharmacological interventions, and in some instances, surgery. Unfortunately invasive surgery is not

always successful. Tekur, Singpow, Nagendra, and Raghuram (2008) identify that one third of patients who have had surgery for herniated lumbar discs require a second surgery for persistent pain, fatigue, exhaustion, and emotional problems that interfered with their jobs. Of those same surgical patients, only one-third were able to return to work (Tekur et al, 2008). Many chronic back pain patients require massive amounts of narcotics to manage their pain. Rhee et al.(2007) found that over half of the money spent on opioids in 2001 was spent for chronic back pain (48%), as compared to money spent on opioids for cancer (21%). Many occupations, including nurses, are not able to use any controlled substance during work hours to control pain problems. Likewise, concern has been raised about narcotics efficacy, adverse effects, potential abuse, tolerance issues, and addiction when used as a non-cancer pain therapy (Rhee et al., 2007). With lower back pain effecting so many people, new interventions need to be identified to cope with debilitating back pain in the high risk field of health care. Alternative medicine, such as yoga, has been proven effective to lower or eliminate symptoms in a variety of illnesses. Yoga may be a safer, less invasive treatment for pain in nurses.

### **Background and Significance**

Dating back 5000 years, yoga has been used to treat a variety of chronic illness including: osteoarthritis, carpal tunnel, multiple sclerosis, asthma, drug addiction, hypertension, irritable bowel syndrome, depression and back pain (Gallo, 2009; Williams et al., 2005). The utilization of yoga has increased 40% between the years of 1997 to 2002 (Gallo, 2009). In 2002, approximately 14 million people throughout the U. S. participated in yoga, with more than 1 million participating in hopes of relieving back pain (Sherman, Cherkin, Erro, Milglioiretti, & Deyo, 2005). Yoga has proven benefits of

increasing flexibility, endurance, muscular strength and cardiopulmonary function (Gallo, 2009). According to Gallo (2009) the addition of humid heat, as in Bikram yoga, accentuates and deepens flexibility, which aids in back and orthopedic injury prevention. Given the number of people attending yoga throughout the United States, the precise effects of pain control need to be verified.

### **Conceptual Framework**

The relationship theorized between back pain and yoga relief can best be described in terms of “The Gate Control Theory of Pain” (Melzack & Wall, 1965). This theory has two specific concepts to which yoga is applicable; one physical and one psychological and thus provided the conceptual framework for this research.

Wall and Melzack (as cited in Deardorff, 2003) describe the physiological concept of “The Gate Control Theory of Pain” as follows: Two types of fibers participate in pain. The “A- delta fibers” are fast nerve fibers that send messages at 40 miles per hour. Conversely, the “C fibers” are the slow pain conduction system where electrical impulses are only carried at 3 miles per hour (para. 7). This is best characterized by the example provided:

“After hitting one’s elbow or head, rubbing the area seems to provide some relief. This activates other sensory nerve fibers that are even “faster” than A-delta fibers, and these fibers send information about pressure and touch that reach the spinal cord and brain to override some of the pain messages carried by the A-delta and C-fibers” (Wall and Melzack as cited by Deardorff, 2003, para. 8).

In chronic back pain, the nerves are being stimulated by mechanical malfunctions and inflammation found in “the muscles and ligaments, the disks, the vertebrae, and the facet

joints” (Deardorff, 2003, para. 9). Additionally, this same author explains that these nerve impulse pathways can be interrupted changing the interpretation of pain.

Concluding, this type of nerve stimulation explains why non-pharmacological methods such as transcutaneous nerve stimulators, acupuncture, and even massage has been found to help alleviate pain.

Psychologically, pain interpretation is affected by a patient’s mood in the Gate Control Theory of Pain. Melzack and Wall (1965) describe a study in which soldiers with extensive injuries refused pain medication and reported very little pain as they were elated that they had escaped death. Therefore, the brain can change the interpretation of pain based on patient’s mood and experience.

This study hypothesized that Yoga could be used in both the physical and mental treatment of pain and Bikram yoga may provide the nerve stimulation impulse needed to detract from the pain as described in the Gate Control Theory of Pain. Bikram yoga is a set of 26 Hatha yoga poses created by Bikram Choudhury in 1973. The 26 meticulously patterned poses are done over 90 minutes in a temperature controlled room set at 105 degrees Fahrenheit (Peters, 2010). The repetitive postures of Bikram yoga are focused on the back and stimulation of the spine, along with muscles and nerves throughout the body. The heat theoretically allows for increased cardiopulmonary benefits, as well as further expression of the poses within the series and injury prevention (Gallo, 2009). Flexion and extension of the spine combined with activation of the musculoskeletal system by the variety of poses practiced may provide benefit specifically to the neurological system. Additionally, the Gate Control Pain Theory is applicable for mediating the psychological aspect of chronic back pain. Stress, a significant variable in

the nursing profession, can exclusively contribute to back pain (Yin Bing Yip, 2004). The breathing, meditation, and focus components of Bikram yoga have an effect on relaxation, mood improvement and release of exercise endorphins. The ability of yoga to improve ones' mood may change a patient's perception of pain and decrease overall stress (Lamb, 2001). The Gate Control Pain Theory provided a solid theoretical framework to research the effects of Bikram yoga on the reduction or alleviation of chronic back pain.

### **Purpose Statement**

The purpose of this study was to evaluate the effect of Bikram yoga and traditional exercise at reducing the level of pain in those individuals with back pain.

### **Chapter Summary**

Back pain is a predominant problem among all U.S. occupations. As an essential function of the healthcare system, nurses are one of the highest incidences of back pain. In the U.S., complementary and alternative medicine is receiving new interest in care of the chronically ill. Bikram yoga is a popular form of exercise that focuses on the repair, strength and stimulation of the spine that might be included in the care regimen of a chronic pain patient. The theoretical framework of "The Gate Control Theory of Pain" was used to explain how Bikram yoga may be a potentially beneficial treatment for those, including nurses, who experience back pain.

## CHAPTER II

### Literature Review

A search for information pertaining to chronic back pain in nursing and Bikram yoga began with a computerized review of the literature in CINHALL, Pub Med, Academic Search Premier, ERIC, and Google™. A total of five articles dating from 2006 to current times were found concerning the effects of yoga on back pain. There is a paucity of research related to the effectiveness in utilization of Bikram yoga for treatment of chronic back pain. Only one scholarly article related to the health benefits of Bikram yoga was identified.

Gallo (2007) conducted a study with an *n* of 16 that compared flexibility gained by subjects after a single session of Ashtanga with a single session of Bikram yoga. Subjects participated in both Bikram and Ashtanga yoga and were measured for flexibility after each yoga session. Findings indicated that each of the yoga methods were equally effective in increasing trunk flexion and flexibility. Limitations of this study are the small sample size, thus limiting generalizability.

Five studies were found that compare traditional treatments of back pain with the effects of regularly practiced yoga. Tekur et al. (2008) in a randomized control study compared the effects of traditional exercise and yoga on chronic lower back pain. Eight Subjects were divided into two groups. One group participated in traditional exercise and lifestyle courses for one week. The second group participated in yoga, meditation, and philosophical teaching for the entire week. Pain and flexibility through self-report were measured in both groups before and after the week long intervention. Although both groups had statistically significant improvements in pain and flexibility; the yoga group

reported lower pain-related disability scores and improved spinal flexibility than the traditional exercise group (Tekur et al., 2008). Similar to the Gallo (2007) study, generalizability is limited due to the small number of subjects participating in this research.

Saper et al. (2009), evaluated the effects of yoga on chronic low back pain among minorities. Thirty predominantly minority subjects (83%) participated in yoga weekly for 12 weeks and reported pain and disability via questionnaire for this randomized control study. Within the 12 week period, pain scores, disability scores, and reported narcotic use decreased with an overall increase in quality of life as compared with the control group. The decrease in pain intensity and pain medication use in the test group was noted to be statistically significant. Self-report, lack of blinding, and small sample size are identified as limitations of the study.

Researchers from West Virginia University (*Harvard Women's Health Watch*, 2009) conducted a study in which 90 adults compared yoga therapy with traditional medical care. The test group subjects attended Iyengar yoga twice a week along with practicing yoga following DVD instruction on the days they were not in class. The control group continued their usual medical care along with follow up phone calls by the researchers. The subjects from the test group reported less disability, pain, depression, and medication use. Six months after the study, 68% of the yoga group was still practicing yoga. Limitations of this study included self-reporting regarding pain and disability as well as a longer history of back pain within the control group.

Groessler, Weingart, Aschbacher, Pada, and Baxi (2008) conducted an experimental single subject design study involving 33 veterans with back pain who attended variable

amounts of yoga classes along with home yoga. Subjects were asked to complete questionnaires which rated pain, energy, and depression levels before and after the study. This study found “sizeable decreases in pain and depression along with increases in energy levels and the mental health summary score[s]” ( p. 1127). Limitations in the study are related to a very specific subgroup (veterans) that are not necessarily representative of the entire population.

Sorosky, Stilp, and Akuthota (2008) provide a literature review of the effects of yoga and pilates on chronic low back pain. These authors found consistent themes of increased flexibility, strength, balance, and agility by lengthening and strengthening muscles throughout the studies reviewed. In addition these authors noted increased body awareness, stress reduction, and enhanced mood as side effects reported in the evaluated studies. This literature review identified a paucity of research on the effects of yoga. Based on these findings, there is a need for further research in evaluating the effects and benefits of yoga especially Bikram yoga in relation to chronic back pain.

### **Chapter Summary**

The literature review yielded a limited amount of research devoted to the effect of yoga as an alternative treatment for back pain, with only one study addressing heated yoga. The reviewed studies identified significant results in decreasing pain, disability, and narcotic use, while improving mood and flexibility when utilizing yoga therapy. Further research is needed to quantify the effects of Bikram yoga on back pain.

## **CHAPTER III**

### **Methods**

#### **Sample: Subject Recruitment and Selection**

Convenience sampling was used to recruit subjects who were, at that time, members at Bikram yoga studios in Nevada. This type of sampling enabled this researcher to use the most conveniently available people as subjects. Recruitment was done over a month long period, from December 15, 2011 to January 15, 2012. As nurses have a higher incidence of back pain, an attempt to recruit nurses into this study was made.

#### **Inclusion Criteria**

The inclusion criteria for this study included: At the time of recruitment, subjects must have been experiencing some form of back pain, had a membership to the local bikram studio, and had already participated in a minimum of two classes. Subjects had to have completed the Bikram yoga studio's health screening and waiver (Appendix 1). A general health questionnaire (Appendix 2), the information sheet (Appendix 3), as well as a detailed description of the study was reviewed with the potential subject. In reviewing the general health questionnaire, subjects were asked their occupation, if they were a nurse of any type (registered nurse [RN] or licensed practical nurse [LPN]), and specifications of what type of back pain they were experiencing. They had to be willing to participate in one weekly yoga class and a minimum of 30 minutes of any other type of exercise during the week for four weeks. The goal was to recruit 34 subjects of varying age, ethnicity and background for this study. This number was verified by a power test

analysis for a medium effect size. Forty two individuals were originally recruited into the study.

### **Exclusion Criteria**

The exclusion criteria for this study included a history of unmonitored cardiac disease or hypertension, kidney or liver disease of any kind, previous stroke, neurological disorders, previous spinal surgery, current musculoskeletal injury, heat stroke or intolerance, inexperience to Bikram yoga and pregnancy. These chronic or serious illnesses were ruled out in reviewing the health questionnaire form (Appendix 2).

### **Protection of Human Subjects**

Approval of this study was sought from the Institutional Review Board (IRB) for the University of Nevada, Reno. In addition to IRB approval, permission to recruit from the selected Bikram yoga studios was also solicited and obtained. An addendum was filed with the University of Nevada, Reno IRB two weeks into recruitment of subjects, which extended recruitment to other Bikram yoga studios, which helped in successfully recruiting the needed subjects for the this study.

### **Recruitment**

Upon gaining permission from the IRB committee and the Bikram studio owners, flyers (Appendix 4) were posted throughout three yoga facilities. Interested subjects, who were already participating in yoga, were asked to contact the student investigator. Two instructors made announcements at the end of classes in an attempt to help recruitment. After making contact with interested individuals, either over the phone or in person, the student investigator verbally summarized the information sheet (Appendix 3) and then emailed it to the potential subjects. Subjects were prescreened by

verbally reviewing the health questionnaire (Appendix 2) to ensure inclusion criteria. In addition, the purpose of the research, maintenance of confidentiality, pre-screening questionnaire, handling of data, reporting of data at the end of the research, and how to use the pain log (Appendix 5) were explained. Any additional questions subjects had pertaining to the research and to determine eligibility for the study were answered during these contacts. Consent was implied when subjects returned the completed instruments.

Once recruitment was completed subjects were required to attend at least one Bikram yoga class per week at a certified Bikram Yoga studio, for a total of four weeks starting January 15, 2012. Subjects participated in Bikram yoga classes led by experienced and certified yoga instructors. They were asked to complete the 90 minute course of Bikram yoga. Subjects also participated in a traditional form of exercise of their choice for a minimum of 30 minutes within the same week as they participated in their yoga class. The research subjects were asked to rotate their schedule, alternating Bikram yoga then exercise, and reverse sequence the following week. Although once a week of each Bikram and traditional exercise was preferred, if subjects participated in either more than once a week, they were asked to log their pain for every time they participated in either intervention. Exercise diaries were provided along with a separate pre-postaged paid envelope, labeled only with the student researchers address for return. Those stated as nurses, were given a diary labeled "N". Diaries included date, exercise/yoga, pre/post pain ratings and any comments of concern for the subjects to include. Subjects were emailed weekly reminders in an attempt to increase adherence and retain those in the study. To maintain anonymity, logs were mailed back, unlabeled, in the self addressed, pre-postaged paid envelope provided.

**Pain Scale (0-10)**

A likert-type scale with rankings of 0 through 10 was used to self report each subjects rating of pain. This descriptive, pain scale is very commonly used in the medical field and used in many hospitals to aid nurses in assessing and treating pain. As a subjective measurement of pain, it allows a patient to rank the severity of pain based on their experience. Zero being no pain, 1 to 3 is mild pain, 4 to 6 is moderate pain, 7 to 9 is significant pain, and a rating of 10 is severe pain when compared to the subjects history of pain. Subjects were educated on how to use this pain scale and asked to record their pain level immediately before and after both their exercise of choice and Bikram yoga class.

**Chapter Summary**

After obtaining permission, flyers were posted in various locations of the three chosen Bikram studios. Utilizing convenience sampling subjects were recruited. Inclusion/exclusion criteria and details of the study were reviewed with interested subjects. Pain logs were given to the interested subjects, along with instructions of how to fill them out. Weekly reminders were sent to encourage ongoing participation.

## CHAPTER IV

### Data Analysis

Data were analyzed using a paired t-test. As parametric statistics are considered more “powerful”, the data obtained is considered quasi-interval. Cohen (2001) states that if a scale has sufficient quantitative meaning to be considered “quasi-interval” parametric tests should not be avoided as “they will be valid and usually more powerful and more easily appl[ied] to complex designs than non-parametric alternatives” (p. 309). In previous quantitative research, Likert scale data has been analyzed parametrically and has “contributed significantly to the body of knowledge and theory development” (Jamieson, 2004, p.38). Many Likert scale type studies have utilized parametric testing. Authors DeWinter and Dodon (2010) compared research that used the t-test versus research that used a Wilcoxon signed rank test. The results were found to be equivalent.

Data from this study was analyzed in the following way: each pre pain score was subtracted from the post pain score in both the yoga group and the traditional exercise group to obtain a difference score. Many subjects included more than one intervention per week; therefore the first yoga intervention and the first exercise intervention of each week were used to calculate the difference scores for each subject. To avoid negative numbers and to aid in data interpretation, eleven was added to this number as a constant. The four difference scores were added together to get a total difference score, one yoga and one exercise, for each subject thus providing the raw data needed for the paired t-test. This then allows for a total possible range of scores 4 to 84. For the purpose of interpretation, the higher the calculated number, the greater the decrease in pain (this is calculated by taking the post-score and subtracting the pre-score). Inversely, as the pain

worsened, the subjects calculated raw data was numerically lower. Surveys were labeled #1 through #30. Surveys #19 through #30 were marked with an “N” to signify these diaries were completed by nurses. Subjects’ final calculated scores were entered and analyzed via paired t-test. A paired t-test was used to compare the mean difference scores. This was an appropriate test since each subject had both a yoga and exercise difference score and the data is thus dependent in nature. As nurses are the population of particular interest, a separate analysis was conducted on the scores of those who were identified as a nurse. Cohen’s d was calculated as it is a measure of effect size and is commonly used to compare groups.

### **Chapter Summary**

Data for this study is considered “quasi-interval” and as such the t- test was used to analyze data. Each participants scores were calculated to provide two “raw data” scores, one for yoga and one for traditional exercise. Nurses scores were calculated separately and evaluated as a subset. The higher the scores the better the improvement in pain.

## CHAPTER V

### Results

A total of 42 individuals were initially recruited for this study. Of the 42 recruited into the study, 30 surveys were returned as the actual sample. During the initial contact, subjects identified many types and areas of pain to include but not limited to cervical, thoracic, lumbar, and sciatic areas of pain and chronic, intermittent, and fatigue-related as types of pain. Subjects logged varying numbers of entries related to pain. During the month long research period a minimum of 8 and a maximum of 67 entries (multiple work outs per day) were recorded as related to pain. Traditional forms of exercise included but not limited to: running, non-Bikram yoga, weight-lifting, skiing, hiking, kickboxing and cross-training classes. The self-reported pain scores ranged from 0 to 8 during the course of the study. All subjects initially recruited were residents of Northern Nevada. Demographics included 34 female and 8 male participants, a majority were caucasian, and employed. All subjects had previous yoga experience, ranging from only a few classes to 20 years experience. Eighteen of the subjects were self identified as registered nurses. There were no adverse events reported during the length of the study. Three of the original 42 subjects immediately dropped from the study due to illness and family issues.

Results calculated from the 30 returned surveys (#1 to #30), were analyzed utilizing a paired t test to evaluate the impact of both yoga and traditional exercise activities on pain. There was a statistically significant difference between the pain ratings of the yoga intervention versus the exercise intervention (p value of  $<.001$  [two-tailed]). The mean of the scores in the yoga intervention are higher ( $M = 48.766$ ,  $SD = 5.550$ )

than the mean scores of the exercise intervention ( $M = 41.100$ ,  $SD = 4.334$ ) with the  $t(29) = 5.603$ . The mean difference between the scores was 7.667 with a 95% confidence interval from 4.868 to 10.465. Cohen's  $d$  for this study is 1.023 correlating with a large effect size. This data supports the hypothesis that back pain is significantly decreased when using Bikram yoga as an intervention in comparison to traditional exercises.

Results for those who were identified as a nurse (#19 to #30), were analyzed utilizing a paired  $t$ -test and evaluated as a subset. Once again, the mean yoga scores ( $M = 48.917$ ,  $SD = 1.685$ ) are higher than the exercise scores ( $M = 40.833$ ,  $SD = 1.435$ ) and are statistically significant ( $p = .007$ [two tailed]) with a  $t(11) = 3.340$ . The mean difference between the scores is 8.083 with a 95% confidence interval from 2.757 to 13.409. Cohen's  $d$  is calculated at .964 and also correlating with a large effect size. Although the mean scores are slightly lower, the hypothesis that Bikram will improve back pain scores is once again supported among nurses when evaluated as a subset.

### **Chapter Summary**

The means of the yoga intervention in total subjects, as well as within nurses alone, were both higher than in the traditional exercise group. The elevation in scores supports the hypothesis in both groups, that Bikram yoga does, in fact, improve back pain. Both nurses and the total subjects findings were statistically significant and had a very large effect size based on Cohen's  $d$ .

## **CHAPTER VI**

### **Discussion**

In this month long experimental study, findings indicated that Bikram yoga significantly reduced back pain when compared with traditional exercise in both a sample of the general population and in a subset of nurses. Pain ratings were sizeably decreased in those subjects who reported any kind of back pain. It is reasonable to imply that the stretching and strengthening sequence of yoga along with the heat and humidity specific to Bikram offers an increased effect.

When evaluated as a subset, the nurses mean scores were slightly lower than the group as a whole. This might be attributed to an increased use and better knowledge of the pain scale. Nurses, being medically trained, may also be more critical of utilizing a complementary therapy for pain. DeKeyser, Cohen and Wagner (2001) report nurses are “wary” or “suspicious” of many forms of complementary alternative medicine (p.47)

Although the previous research is limited, the results of this study are consistent with similar studies identified in the review of the literature. This research thus adds supportive information to the existing body of knowledge as it relates to the use of Bikram yoga as a complimentary alternative medicine approach at reducing the level of pain in those individuals with back pain.

### **Limitations**

Limitations identified in this study included the following: retention, sample size, research bias, sample bias and intervention bias. Originally 42 subjects identified a desire to participate, but only 30 returned their pain surveys. The goal of 34 returned surveys as calculated was not met, accounting for a smaller sample size than intended. A post hoc

analysis for large effect size was performed and a power of .862 was identified. In the sample size of this study, differences, if they exist, would be present 86% of the time. Small sample size is a limitation of this study. Length of the study, anonymity, and limited contact with researcher may have contributed to lack of adherence and sample size. Research bias must be considered secondary to self-reporting. It is impossible to assess pain without subjects knowing they are reporting pain, therefore biasing the subjects to possibly rate their pain according to what the researcher hopes to find. The reliability of the pain scale, can vary from subject to subject based on pain perception. Sample bias may also be prevalent in this study secondary to self-selecting. As subjects were recruited, and as part of the inclusion criteria requiring a membership in Bikram yoga, the participating subjects are already open to the benefits of yoga. Another consideration in the study is the effect of the previous interventions score on the next intervention. For example, if a subject performed strenuous activity during their traditional exercise intervention, it may have had an effect on their rating for that weeks yoga intervention. The student researcher attempted to account for this by having subjects rotate their schedule, alternating Bikram yoga then traditional exercise activity, and reverse the sequence the following week. One of the strengths in choosing Bikram yoga is that the yoga routine and conditions are consistent nationally. Although the population in Bikram yoga might vary from class to class, this consistency aides in the generalizability of this study.

### **Reccomendations**

It is the hope of this researcher that the findings from this study will spark dialogue among practitioners and inspire future research in this area. The findings could

be tested on specific demographics for their validity and compared with specific forms of traditional exercise. In addition, a larger sample size would contribute to the generalizability of the findings.

Further research is needed related to Bikram yoga to involve more subjects. Studies might be conducted to look at the effect of Bikram on specific types of back pain, chronic, neurological, and musculoskeletal pain and also other ailments such as fibromyalgia, depression and anxiety and include various demographics such as age, region, and ethnicity. Investigation using more objective measurement such as lab results, MRI and Xray may offer more insight and effect of Bikram on the human physiology.

This study has a significance of tying traditional medicine with alternative complementary medicine. Pain, specifically back pain, is a prevalent problem facing practitioners today. Current traditional treatments have many side-effects and are limited. Bikram yoga may be offered as an intervention in the treatment of back pain and hence providing a life-enhancing treatment option nationwide.

### **Conclusion**

This month long comparative study found a statistically significant difference between Bikram yoga and traditional exercise activities at decreasing back pain in the 30 participating subjects. Nurses, one of the highest reported occupations with back pain, used as a subset for this study, also reported statistically significant decreases in back pain when doing Bikram yoga. Bikram yoga may be an alternative treatment to be used as monotherapy or adjunct therapy in the treatment of back pain.

# Appendix 1

## Registration and Liability Waiver (Please Print)



Name \_\_\_\_\_ Mailing Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ Email Address \_\_\_\_\_

Would you like to receive email updates on class schedules/events? (circle one) Yes No

Cell Phone \_\_\_\_\_ Home Phone \_\_\_\_\_ Date of Birth \_\_\_\_\_

Emergency Contact Name \_\_\_\_\_ Emergency Contact Phone \_\_\_\_\_

Please list any physical conditions (including pregnancy), illnesses or medications: \_\_\_\_\_

Have you ever done Bikram Yoga before? (circle one) YES NO How did you hear about BYS? \_\_\_\_\_

In consideration of and as inducement to your enrolling as a student of the BYS Yoga College of India, 11090 Trails End Rd, CA 96161 and 631 Sierra Rose Dr. Reno, NV 89511, you represent and agree as follows:

- (1) I have been examined by a licensed physician within the past six months and have been found by such physician to be in good physical health and fully able to perform all Yoga exercises which I am to learn and perform during my enrollment with you.
- (2) I will faithfully follow all instructions given me by you and your instructors as to when, where, and how to perform and not to perform Yoga exercises, it being understood that any deviation by me from such instructions shall be at my own risk.
- (3) I will not hold you, your partners, instructors, or employees responsible for any injuries suffered by me caused whole or in part by my failure to faithfully follow the instructions of you or your instructors or by any physical impairment of mine and not fully disclosed to you in writing.
- (4) I understand and acknowledge that I am to receive instruction in Yoga theory and exercises only, and I will not hold you, your partners, instructors, or employees to any higher standard of care than that applicable to school of Yoga theory and exercises.
- (5) The tuition paid herewith and such registration fees paid hereafter are non-refundable; such refunds if any, as are made shall be entirely within the discretion of the BYS Yoga College of India.

Signature \_\_\_\_\_ Date \_\_\_\_\_ Signature of Parent or Guardian (if under 18) \_\_\_\_\_

Staff Use Only: Date entered \_\_\_\_\_ Initial Email Sent (date) \_\_\_\_\_ Staff Initials \_\_\_\_\_

## Appendix 2 General Health Questionnaire

Do you have or have ever been told you have any of the following health conditions:

- |   |   |
|---|---|
| <input type="checkbox"/> cardiac disease or hypertension<br><input type="checkbox"/> stroke<br><input type="checkbox"/> spinal surgery<br><input type="checkbox"/> heat stroke or intolerance | <input type="checkbox"/> kidney or liver disease of any kind<br><input type="checkbox"/> neurological disorders<br><input type="checkbox"/> musculoskeletal injury<br><input type="checkbox"/> currently are pregnant |
|---|---|

If so are you being seen by a physician? Have you been cleared for Bikram by this physician?

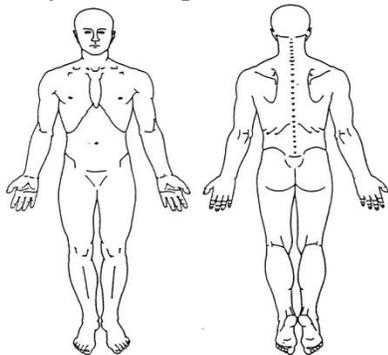
Any other pertinent problems, disorders, recent surgeries or hospitalizations?

Do you take any medications, what do you take?

How many Bikram classes have you attended in the past?

When was the last time you attended Bikram?

Describe your back pain. Where is it ? How long have you had it?



What is your occupation (be specific, ie if you're a lawyer or in business what type)? Is your job physical?

## **Appendix 3**

### **Participant Information Sheet**

#### **Purpose of the Study**

You are invited to participate in a research study. The purpose of this study is to investigate the effect of various forms of exercise on back pain.

#### **Subjects**

You are being asked to participate in this study because at the time of recruitment you met the following inclusion criteria: you actively participate in yoga, you experience some sort of back pain, you have participated in previous Bikram classes, and you participate in another form of exercise. Having participated in a minimum of 2 classes, you understand the techniques, poses, intensity (105 degree, 60% humidity), and length of the Bikram yoga class.

You understand that subjects who have any of the identified health conditions: history of unmonitored cardiac disease or hypertension, kidney or liver disease of any kind, previous stroke, neurological disorders, previous spinal surgery, current musculoskeletal injury, heat stroke or intolerance and pregnancy, unless cleared by a physician. If you have never participated in Bikram (high temperatures and humidity) previously you will be excluded from this study.

#### **Procedures**

If you volunteer to participate in this study you will be asked to do the following: continue participation in a Bikram yoga class once a week and alternate one other type of exercise of your choice, for a minimum of 30 minutes, at another time during the same week for a total of four weeks.

You will be given a diary in a manila envelope and asked to rate and record your back pain before and after each type of exercise (yoga and traditional) utilizing a scale of 0 through 10, where zero is considered no pain, 1-3 is mild pain, 4-6 is moderate pain, 7-9 is significant pain and ten is severe pain. The order of yoga and traditional exercise will alternate week to week. You'll be asked to log this information for four weeks.

The student investigator will send you a self-addressed, stamped envelope for you to use to return your completed diary. Please DO NOT send the diary to me via email and do not write any identifying information on the diary. It is important to maintain anonymity and protect your privacy.

#### **Benefits of Participation**

There may not be direct benefits to you as a subject in this study. Participation in the study will help to increase the knowledge related to this form of complementary medicine.

**Risks of Participation**

Risks are present in any study. As inclusion in the study is experience in the practice of Bikram (heated) yoga, risks should be minimal. Bikram does include high temperatures and humidity. The subject assumes the responsibility of adequate hydration and preparation as in previous experienced classes. You may withdraw from the study at any time.

**Cost**

There will be no new cost to you as a subject. Inclusion into the study requires an already existing membership to the local yoga studio.

**Contact Information**

If you have any questions or concerns about the study, you may contact Dr. Stephanie DeBoor at 775-682-7156.

For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted you may contact the **UNR Office of Research Protection 775-327-2367**

**Voluntary Participation**

Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your relations with the university. **You are encouraged to ask questions about this study at the beginning or any time during the research study.**

**Confidentiality**

All information will be kept confidential. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNR for 3 years after completion of the study. After the storage time the information gathered will be destroyed.

## Appendix 4



**Do you like to exercise? Do you do Bikram yoga? Do you have back pain?**

**I NEED YOUR HELP!!**

University of Nevada, Reno research study for Nurse Practitioner Graduate Student.

Subjects will be contacted to review study, inclusion criteria, and answer any questions. Subjects to attend Bikram once a week, and participate in another form of exercise once a week and record pain level in diaries based on these experiences for one month. After one month, physically mail diary back in provided manila envelope.

Your help would be deeply appreciated!

Jenny Keller  
blondydance@hotmail.com  
775-741-2369



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