

Yoga As Medicine

The Science Behind The Benefits

“Yoga’s techniques of concentration and meditation, if mastered, disclose the transcendental possibilities of the mind, which allows us to experience truth at the highest level, as “ultimate Truth” (paramartha-satya) George Feurstein The Deeper Dimension of Yoga

Iyengar sees yoga as an art and a science. He calls Yoga a “disciplinary art which develops the faculties of the body, mind and intellect. Art in its initial stages is science; science in its highest form is art” In other words, at first the artist must master technique, just as the scientist who wants to master science must see beauty in truth.

Swami Rama: 1970 biofeedback lab at Menninger Clinic in Topeka Kansas

To prove the ability of the mind to control the body, did the following:

- Changed the temperature in his hands by selectively widening and narrowing the two major arteries in the wrist. The left side of the hand was rosey red, the right side ashen gray.
- Changed EEG to four brain wave types: alpha, beta, theta and delta. Afterwards he recalled things said while he was in Delta state, things the researchers didn’t even remember saying.
- Slowed down and speeded up his heart rate.
- Placed his heart into atrial flutter which made it seem his heart stopped.

Used breathing techniques, muscular contractions and mental focusing.

How Yoga Works:

- Increases flexibility
- Strengthens muscles
- Improves balance
- Improves immune function
- Improves posture
- Improves Lung Function
- Leads to slower and deeper breathing
- Discourages mouth breathing
- Increases oxygenation of tissues
- Nourishes Intervertebral disks
- Improves Return of Venous Blood
- Increases circulation of lymph
- Improves function of the feet
- Improves proprioception
- Increases control of bodily functions
- Conditions the cardiovascular system

- Promotes weight loss
- Relaxes the nervous system
- Improves the function of the nervous system
- Improves brain function
- Activates the left prefrontal cortex
- Changes neurotransmitter levels
- Lowers levels of the Stress Hormone Cortisol
- Lowers blood sugar
- Lowers blood pressure
- Improves levels of cholesterol and triglycerides
- Thins the blood
- Improves bowel function
- Releases unconscious muscular gripping
- Uses Imagery to effect change in the body
- Relieves Pain
- Lowers need for medication
- Fosters healing relationships
- Improves psychological health
- Leads to healthier habits
- Fosters spiritual growth
- Elicits the placebo effect
- Encourages involvement in your own healing.

Tim McCall, MD ~ Yoga as Medicine

Research Review on the Health Benefits of Hatha Yoga

By Chrys Kub, PT, E- RYT500

INTRODUCTION

Hatha Yoga means “yoga for health” and is the physical aspect of the practice. It renews, invigorates, and heals the body, stretching and strengthening the muscles, joints, and spine and directing blood and oxygen to the internal organs (including the glands and organs and nerves.) Practitioners credit yoga for everything from improving their strength, respiration and fitness levels to “opening energy channels.” While these anecdotal reports passed on through the years are real and meaningful, we must take care to assure that any benefits we express to our practitioners are more than “yogi lore” and are based on expert opinion and scientific research.

It has been hypothesized that yoga may benefit health through mind-body interactions. Scientific research on the effects of yoga began as early as 1924, near Bombay, India at the Kaivalyadhama Yoga Institute and about the same time at the Yoga Institute of Santa Cruz, in Bombay. ¹ Unfortunately, much of the research on yoga has been limited. Many studies have been poorly designed with lack of control

groups or small sample sizes. Continued research is needed to further validate the health benefits that have been proven thus far. At this time, we can pull from current research and make some basic inferences regarding the benefits of the practice of yoga to our health. The preliminary results are promising, but should be shared with the understanding that conclusive benefits have not yet been proven. The studies which have been done have looked at various areas of benefit that one might receive from the practice of yoga. These areas include behavioral, physical, mental, physiological, personality and disease processes. We will look at the latest research findings in each of these areas, discussing their relevance to the general population.

The following summary of scientific studies includes information from reviews performed by several resources which have done literature reviews of published studies on the health benefits of Hatha Yoga. The first scholar is Joan Harrington, PhD., who published a summary in the Research Bulletin of the Himalayan Institute in 1981. The second summary was done by Ralph La Forge, M.S., of Duke Lipid Disorder Training Program at Duke University Medical Center. Another review was provided by the National Standard, which is an organization that produces scientifically based reviews of complementary and alternative medicine topics. The National Standard summary was reviewed by the faculty of the Harvard Medical School and published on their website. Mukunda Stiles has also published a listing of research studies and their outcomes regarding physiological and psychological benefits. (Table 1-2)

FITNESS

We begin our discussion looking at what is usually utmost on the minds of patients who take yoga at the local fitness facility or gym, “fitness.” The population most widely served in these settings may want to know, “will doing yoga make me fit?” Before we begin, let’s clarify some basic concepts.

WHAT IS FITNESS?

According to Dave Costill, PhD, Professor Emeritus at Ball State University, fitness is the “ability to live your life without feeling fatigued.”² An all-embracing definition from the American Council of Sports Medicine (ACSM) states that fitness is related not only to maintaining physical activity but also relating to your health, (for example, someone reducing their risk of heart disease by becoming more fit.) The ACSM describes fitness as consisting of the following: cardio respiratory fitness, muscular fitness, flexibility and body composition. Experts have long recommended that we do at least three different types of activity to improve our fitness level. So, according to the latest studies, how does Hatha Yoga fit into today’s prescription for fitness?

Hatha Yoga: More than Just Stretching

Does yoga increase fitness as well as other types of exercise do? The answer is yes, if done within certain parameters. For example, in a study conducted looking at physiological changes in adult women, researchers looked at the short-term effects of four weeks of intensive yoga practice in six healthy adult female volunteers measured using the maximal exercise treadmill test. Yoga practice involved daily morning and evening sessions of 90 minutes each. In this group, the maximal workout increased by 21%, oxygen consumption per unit of work decreased, demonstrating an increase in cardio respiratory efficiency.³ In another study, a comparison was made between the effects of yoga and the effects of physical exercise in athletes. This inquest focused on the effect of pranayama (controlled breathing). This study was a well-done investigation which lasted for two years, examining a control group and an experimental group. The results showed that the subjects who practiced pranayama could achieve higher work rates with reduced oxygen consumption per unit work than the control group, and without an increase in blood lactate levels.⁴ In a study conducted which looked at aerobic capacity and perceived exertion after practice of Hatha yogic exercises, investigators found that the practice of Hatha yogic exercises along with games helps to improve aerobic capacity like the practice of conventional exercises (PT), along with games. The yoga group practiced yoga for one hour every morning (six days a week) for

six months. Interestingly, the yoga group performed better than the PT group in terms of lower ratings of perceived exertion after exhaustive exercise⁵, bringing in the mind-body connection which is so unique to yoga.

What about the other parameters of fitness? In a study performed at the University of California at Davis, students performed eight weeks of yoga training after which muscular strength and endurance, flexibility, cardiorespiratory fitness, body composition and lung function was tested. Each week, the students attended four sessions in which they performed 10 minutes of pranayama (breath work), 15 minutes of warm-up exercises, 50 minutes of asanas (physical postures), and 10 minutes of meditation. Significant improvements were noted in muscular strength (31%), muscular endurance (57%), flexibility (up to 188%), and VO₂max (7%). The VO₂ increase was particularly interesting as this study lasted eight weeks while the ACSM recommends that exercise research last at least 15-20 weeks, in order to see VO₂ max improvements.⁶ Other studies reviewed by our resources indicated increases in respiratory efficiency and competence, cardiovascular efficiency and competence, and decreases in oxygen consumption.

So, can we tell our patients if they just do yoga, they will be “fit?” Well, that depends. As one can note by looking at the few studies described above, these positive results came only after practicing yoga according to certain guidelines. Studies have included more than an hour of practice at least two to four days a week. The yoga sessions included pranayama work in addition to the typical yoga poses. The asanas included Sun Salutations and challenging standing and balancing poses. Of course, the practitioner needs to practice several times a week, for at least 60 minute sessions, to incur the benefits proven so far by scientific studies. If one is able to do this, not surprisingly, the fitness benefits fall in line with the benefits achieved by other forms of exercise.

An example of practicing “unbalanced” activities and their effect on the body can be easily seen in other sports or recreation activities. For example, baseball players and swimmers frequently develop shoulder pain from repetitive practice of the same movements. Cyclists can develop low back pain from sustaining lumbar flexion for long periods of time. These patients are certainly fit in their area of performance, but can develop weakness and injuries from an imbalanced activity. Yoga is unique in that it can offer a totally balanced program, and do so effectively within each class.

Another fitness benefit which is unique to yoga is that fact that we are not only stretching muscles that have shortened, but equal emphasis is placed on correcting muscles that have lengthened. For example, we know that in forward bending, lumbar flexion can be a compensatory motion for limited hip flexion when the hamstrings are short. According to Shirley Sahrmann, PhD, PT, FAPTA; Director, Program in Movement Science at Washington University School of Medicine, the most effective intervention is to address length changes of all the muscles around a joint, not just the shortened muscles. Thus, if the lumbar spine flexes excessively (>20°) with knee extension, the back extensor muscles should be shortened along with stretching the hamstring muscle.⁷ The Seated Forward Fold with active back extension effectively addresses this issue. An instructor’s cuing to maintain an erect spine in forward bending poses is especially important as motion will occur earlier at the more flexible segment in situations where movement involves both joints. A long term consequence of continually allowing this to happen is increasing flexibility in an area which is already hyper-flexible, as well as training the lumbar spine to move into flexion whenever flexion should be occurring at the hip joint. Also, combining strengthening with flexibility ensures that we protect the joint. Dave Coulter states in *Anatomy of Hatha Yoga*, “if you merely stretch the connective tissue of the joint capsule without at the same time building strength in the associated muscle, the joints may become susceptible to injury.”⁸

Finally, and importantly, in order to help prevent injury in our clients, The teacher must continue to emphasize proper alignment. . Why is alignment so critical? Ideal alignment facilitates optimal movement. The better the alignment is in a pose, the less chance we have of causing micro trauma to the joints and supporting structures. Studies have shown that spinal segments subjected to the most movement are segments that show the most degenerative changes.⁷ Physical therapy is based on

exercises that include repeated movements and sustained postures designed to affect tissues positively. Those expected positive results are to improve flexibility, strength and movement patterns. Yoga can accomplish a similar result, if done with proper alignment. On the other hand, the cumulative effect of repetitive movement, when movement deviates from the optimal kinesiological standard for movement can be tissue damage.⁷ Most of the adult population has some limitations in flexibility or strength which keeps them from utilizing optimal movement patterns in their daily activities. Routine daily movements that are repeatedly performed incorrectly due to these limitations or dysfunctions can result in a pain syndrome. Yoga assists in improving these areas of limitation or deficit. The added benefit that yoga has is the mind-body awareness which is practiced in each session. This can assist the participant in developing an awareness of their own body and how it moves to continue moving in a more efficient manner outside the yoga class and throughout their daily activities. One could certainly hypothesize that those who perform Hatha Yoga regularly are less likely to develop pain syndromes or require physical therapy intervention.

INVERSIONS

Many practitioners have questions about the benefits of doing inversions. Inversions such as the headstand, and shoulderstand can increase the risk factors in practicing yoga if these poses are not done correctly and with care. These two poses can put compressive force on the cervical spine, especially when done by those just beginning their practice of hatha yoga. One should develop strength in the arms and shoulders to keep the weight off the head, and to avoid injury to the neck and spine, prior to attempting the headstand. For those patients who have cervical degeneration, doing these poses may cause nerve irritation. Many people do not realize they have cervical degeneration until symptoms arise. Also, one may have an old injury or mal alignment that may cause nerve irritation.

So, why bother doing inversions at all? Ralph LaForge, M.S., states that there are only two clinical trials in this country which were designed to determine the physiological benefits of inversions, and both these studies were too "statistically under-powered" to draw clear conclusions.⁹ Thus we must rely on expert opinions, case studies and educated reasoning to ascertain the benefits/effects of inversions.

The most obvious effect of inversions is to upend one's relationship to gravity. Our bodies are sensitive to the fluctuations in gravity due to the fact that we are made predominately (60%) of water. David Coulter, PhD, states that after 3-5 minutes, the tissue fluids will flow more efficiently from the lower extremities and trunk, up into the abdominal and pelvic organs, creating a healthier exchange of the nutrients and wastes between cells and capillaries.¹⁰ In a study by Dr. DF Chandia, a lecturer on physiological and psychological effects of yoga, they found that the headstand could affect the baseline opening of blood vessels. This increases the efficiency at dilating and constricting so that the body shunts blood more quickly and efficiently to the active areas of the brain. This also may affect the cerebrospinal fluid, a fluid which flows from the brain to the spinal cord. The increased pressure on the top of the skull may increase the elasticity of cranial bones and stimulate the productions of the cerebrospinal fluid.¹⁰ Many times; practitioners will claim that headstands and shoulderstands improves the endocrine system. For example, these postures may assist in the metabolism by stimulating the parathyroid and thyroid glands. This has not yet been proven; however, inversions do increase blood flow to these glands, increasing their efficiency. Pat Layton, physiology teacher for the Iyengar Yoga Institute of San Francisco's Advanced Studies Program, postulates that inversions ensure healthier and more effective lung tissue. Lower lung tissue is more compressed (secondary to gravity) than the upper lung tissue. When we invert, we cause the blood to perfuse the well-ventilated upper lobes which ensures more efficient oxygen to blood exchange and healthier lung tissue¹⁰

So, in summary, inversions may increase the efficiency of the cardiovascular, respiratory, lymphatic and endocrine systems, according to expert opinion. Scientific validation of these benefits has not yet been performed. We can certainly communicate to our patients the benefits we believe the inversions can impart. The instructor should always inform students of possible risks of injury to their cervical region

and thus they can weigh the benefits versus the risks themselves. There certainly are safer partial inversions which may result in similar benefits, at this time, we do not yet know. Let the research continue!

BODY-MIND CONNECTION

Yoga students frequently speak about how they feel after a yoga session, relaxed, de-stressed and invigorated. There are some variables which have been measured which help to tell us why one may feel this way, other than subjective, anecdotal reports. The postures are able to assist in balancing the autonomic nervous system. This allows the body to be less “reactive” to changes in stress levels, or even vigorous exercise resulting in a calmer, less anxious physiological environment. Joan Harrington, PhD, states that based on study results, one can reasonably assume that fewer psychosomatic complaints will manifest in regular yoga practitioners. This is due to the direct manipulation of the muscles and viscera, the autonomic nerve system balance and the decreased anxiety.¹¹ In fact, in a study investigating physiological changes after 3 months of training in yoga, investigators found that practicing yoga resulted in decreased autonomic arousal and more psycho physiological relaxation (heart rate and respiratory rate reduction) in the 40 subjects studied.¹² In studies reviewed by Ralph LaForge, M.S., he found that in selected clinical trials using Hatha Yoga as therapy they found decreased resting blood pressure, increased parasympathetic tone, reduced physiological and psychological response to threat and improvement in baroreflex function/sensitivity. These are all indications of the body’s improvement in regulating reactions through the autonomic nervous system. Yoga may also affect levels of brain or blood chemicals, including melatonin and stress hormones.¹³

Through literature review of studies performed, Joan Harrington, PhD, found that studies showed that yoga can facilitate personality change. Yoga is highly effective in dealing with psychosomatic complaints and enhancing the feelings one may have of well-being. Patients are able to improve their feelings of physical health, reduce their anxiety, and enhance their self-concepts and emotional tone.

IDENTIFYING QUALIFIED YOGA TEACHERS

One can certainly see that it is essential for our patients to obtain maximal benefits from the practice of hatha yoga and to prevent injury, that they must be taught by a qualified teacher. The numerous approaches to yoga and the wide variation among teachers and practitioners can confuse both the physician and patient. Some credentialing is available for instructors, but there is little agreement in the field as to what credentialing would mean or what it would encompass. Many Western-oriented yoga practices are quite intense and can be unsafe for the participant with health or musculoskeletal issues. Programs that gradually build from the simplest postures are most reasonable. Yoga is not simple stretching, as many unfamiliar with today’s practices believe. It is essential that the health care provider referring their patient to practice yoga be aware of qualified teachers in the area. An instructor with a health care background or training in yoga therapy is most highly recommended to ensure safety and maximal benefit for the patients.

HEALTH BENEFITS

When speaking of health benefits, we are referring to benefits which relate to prevention of the onset of disease or even assistance in the treatment of disease or pathological processes. We already discussed how using proper alignment along with the hatha poses greatly affects the amount of any micro trauma to the joints and supporting structures caused by repetitive movements, even if those movements are in and out of yoga poses. What about other benefits which have been studied and validated relating to health benefits of yoga?

Balance

Many poses in yoga utilize various positions that challenge balance. Numerous studies show that maintenance of balance is essential for functional mobility as we age. Also, in yoga practice, we work on transitional movements which helps maintain functional movement.

Single Limb Stance:

Numerous yoga poses incorporate a single limb stance or at least a period of single limb stance. The ability to maintain single limb stance has been related to the risk of falling.

Postural Endurance

The ability to maintain posture is a function of type 1 muscle fibers. To improve our postural endurance, training must be specific to endurance training of the muscles involved in the core of the body. Due to the nature of the position of the poses and how long they are held, the postural muscles are specifically trained. With time, this can aid in improved posture and decreased back pain associated with endurance limitations. Additionally, through the controlled initiation of the muscles of the core, the sequencing of the activation of the core can be modified, again to promote increased trunk and spine endurance and decrease pain and risk of injury.

Osteoporosis

It is well known amongst practitioners that weightbearing is essential in the fight against the onset of osteoporosis and osteopenia. Yoga is an excellent means of achieving weightbearing through both upper and lower body joints, with minimal impact. A trained instructor would emphasize in clients with osteoporosis to avoid lots of flexion movements and incorporate extension.

Musculoskeletal Impairments

Yoga's use of static postures and transitional movements in multi-planar patterns with full body participation can aid in improving many musculoskeletal problems and frailty issues due to its ability to strengthen and stretch muscles.

Asthma

Many studies in humans suggest benefits of yoga (such as the breathing exercises) when used in addition to other studies for mild-to-moderate asthma. Research has demonstrated improved lung function, overall fitness and airway sensitivity and decreased need for asthma drugs.¹³ One study at the Northern Colorado Allergy Asthma Clinic in Fort Collins, used a control group and an experimental group to look at any changes after practice of asanas, pranayama, and meditation for 16 weeks at a frequency of three times per week. While pulmonary functions did not show a significant variance between the two groups, "analysis of the data showed that the subjects in the yoga group tended to use their beta adrenergic inhalers less.¹⁴ Better research is needed in this area.

Cardiovascular Disease

Several studies in humans suggest that people with heart disease who practice yoga may have decreased angina (chest pain). Yoga may decrease risk factors for heart disease, including high blood pressure, cholesterol and blood sugar levels. It is not clear if yoga reduces the risk of heart attack or death or if yoga is any better than other forms of exercise.¹³ A three-month residential study treating patients with yoga, meditation and a vegetarian diet at Hanover Medical University in Germany, found a substantial reduction in risk factors including blood pressure and cholesterol in patients.¹³ In a study published in the March 2000 issue of "Stroke" magazine, it was noted that transcendental meditation (not hatha yoga) practiced for 20 minutes, two times per day was able to reduce fatty build-ups in artery walls as

effectively as the drugs. It also decreased the thickness of artery walls by 1 millimeter and decreased the risk of heart attack by 11%.¹⁵ Again, more studies are warranted in this area before strong recommendations can be made to practice yoga as a tool to help to address heart disease.

Carpal Tunnel Syndrome

Carpel Tunnel Syndrome (CTS) is a syndrome which includes inflammation of the tendons in the tight canal or “tunnel” through which the tendons and nerves must pass on their way from the forearm to the hand and fingers. The Carpal Tunnel is normally quite snug and there is just barely enough room in it for the tendons and nerves that have to pass through it. Inflammation of the tendons can occur secondary to repetitive strain injuries. Stressful hand, arm and neck positions only aggravate the potential for damage. Some sports can bring on repetitive stress injuries, rowing, golf, tennis, and downhill skiing are just a few that stress the hand and wrist joints. Injuries and ailments that cause swelling or compression of soft tissue on the nerves, such as sprains and rheumatoid arthritis, can lead to stress injuries. Yoga therapy has been studied for carpal tunnel syndrome, but it is not clear if there are beneficial effects. In one study a randomized, single-blind, controlled trial was held which compared a group of CTS sufferers who practiced yoga to a control group who simply wore wrist splints with their current treatment. The yoga intervention was specifically designed for strengthening, stretching and balancing each joint in the upper body, along with relaxation. This was given twice weekly for eight weeks. Subjects in the yoga groups had significant improvement in grip strength and pain reduction. The consensus was that the yoga-based regimen was more effective than wrist splinting or no treatment in relieving some symptoms and signs of carpal tunnel syndrome.¹⁶ Further research is needed before a clear recommendation can be made.

Arthritis

In a study of osteoarthritis of the hands, at the University of Pennsylvania School of Medicine, a yoga-treated group with arthritis in the hands improved significantly more than the control group in “pain during activity, tenderness, and finger range of motion.” This study was published in the *Journal of Rheumatology* in 1994.¹⁷ Of course; further studies are needed to compare this with other treatments and to examine long term effects.

Other conditions

Preliminary studies have shown that yoga therapy may help in children with mental retardation to improve IQ and social behavior. It may be beneficial when added to standard therapies for the treatment of heroin or alcohol abuse. Early studies also note that yoga may improve posture in children. Also, it has been found that yoga may reduce the intensity and frequency of tension or migraine headaches, decreasing the need for pain-relieving drugs.²

Dr. Timothy McCall, a board certified internist and *Yoga Journal*'s medical editor, states that he believes that some of yoga's most profound effects on health have to do with its ability to alter long-standing dysfunctional behavior. People who may have unhealthy habits of thought and deed that undermine their health can benefit from yoga practice. In addition to the above mentioned direct health benefits of asana, pranayama, and meditation, it is not uncommon for regular practitioners to start eating better, to cut back on caffeine or alcohol and to lead a more stress-free lifestyle. ¹⁸

Yoga has been recommended for the prevention and treatment of many medical conditions. There is some preliminary evidence that yoga can be helpful when it is practiced in addition to standard treatments for several conditions. These conditions include anxiety disorders or stress, asthma, high blood pressure, heart disease and depression.^{9,11,13} It is not clear if yoga is any more or less effective than other forms of exercise. Unfortunately, much of the research on yoga is limited with poor design. Continued research is needed to prove the above health benefits and rule out other variables. Research into yoga has had poor funding in the past, but this is slowly improving with the establishment of the

Office of Alternative Medicine (1992) and the National center for Complementary and Alternative Medicine (NCCAM) in 1998. With these in place, more funding may become available to allow further research to be conducted into the benefits of yoga. The health benefits of yoga are promising; however, if we emphasize this one side of the practice, are we not missing the entire point? As Elliot S. Dacher, MD, author of *Whole Healing: A Step-by-Step Program to Reclaim Your Power to Heal* wrote, “Yoga is a way to get to the source of ourselves. The challenge is not to see yoga as a treatment for disease, but as an opportunity to see something deeper in the self. To reconnect with the body is one way of artfully facing the reality of pain in our life and a means for accepting and being in our lives more deeply.”

ENDNOTES

- (1) Mukunda Stiles, *Structural Yoga Therapy*: (Boston: WeiserBooks, 2000), 75.
- (2) Alisa Bauman, “Is Yoga Enough to Keep you Fit?” (article on-line) *Yoga Journal*, (September/October 2002, accessed 22 June 2003); available from http://www.yogajournal.com/practice/739_1.cfm; Internet.
- (3) Raju PS and others, “Influence of intensive yoga training on physiological changes in adult women: a case report,” *Journal of Alternative and Complementary Medicine* 3 (3) (1997 Fall) : 291.
- (4) Raju PS and others, “Comparison of effects of yoga and physical exercise in athletes,” *Indian Journal of Medical Research* (100) (1994 Aug): 81.
- (5) Ray US and others, “Aerobic capacity and perceived exertion after practice of Hatha yogic exercises,” *Indian Journal of Medical Research* (114) (2001 Dec): 215.
- (6) Tran MD and others, “Effects of Hatha Yoga Practice on Health-Related Aspects of Physical Fitness,” *Prevention in Cardiology* 4 (4) (2001 Autumn): 165.
- (7) Sahrman, Shirley A., PhD, PT, FAPTA, *Diagnosis and Treatment of Movement Impairment Syndromes*. (St. Louis: Mosby, Inc. 2002) , 27.
- (8) Coulter, H. David, PhD, *Anatomy of Hatha Yoga*. (Honesdale, PA: Body and Breath, Inc. 2001) , 591.
- (9) Ralph La Forge, M.S., “Physiology of Hatha Yoga in Health and Disease,” lecture given at the ACSM Health and Fitness Summit, 9 April 2003.
- (10) Yoko Yoshikawa, “Everybody Upside Down,” (article on-line) *Yoga Journal*, (September/October 2000, accessed 10 May 2003); available from <http://www.yogajournal.com/practice/214.cfm>. Internet.
- (11) Joan Harrington, PhD. (Arpita), “Physiological and Psychological effects of Hatha Yoga: A Review of the Literature,” *Research Bulletin*, (Honesdale, PA: Himalayan Institute, 1983), vol. 5, nos. I and II, p.38-39.
- (12) Telles S and others, “Physiological changes in sports teachers following 3 months of training in Yoga,” *Indian Journal of Medical Research* 47 (10) (1993 Oct): 235.
- (13)National Standard, “Yoga”, (resource on-line) Reviewed by Faculty of the Harvard Medical School,(accessed 21 June 2003); available from <http://www.intelihealth.com>; Internet.
- (14)Elaine Lipson, “Yoga Works!,” (article on-line) *Yoga Journal*, (Winter 1999-2000, accessed 7 July 2003); available from <http://www.yogajournal.com/health/115.cfm>; Internet.
- (15) Kathryn Black, “Yoga Under the Microscope,” (article on-line) *Yoga Journal*, (Winter 2000-2001, accessed 5 July 2003); available from <http://www.yogajournal.com/health/114.cfm>; Internet.
- (16) Garfinkel, MS and others, “Yoga-based intervention for carpal tunnel syndrome: a randomized trial,” *Journal of the American Medical Association* 281(22), (9 June 1999): 2087.
- (17) Garfinkel MS and others, “Evaluation of a yoga based regimen for treatment of osteoarthritis of the hands,” *Journal of the Rheumatology* 21 (12), (Dec 1994): 2341.
- (18) Timothy McCall, “The Scientific Basis of Yoga Therapy” (article on-line) *Yoga Journal*, available from <http://www.yogajournal.com/teacher/2016.cfm>; Internet