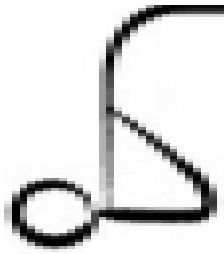

Scientific Evidence on the Therapeutic Efficacy of Iyengar Yoga

A Compilation of Research Papers

Contents

Compilation of abstracts of published research papers

Scientific Evidence on the
Therapeutic Efficacy of Iyengar Yoga

Yoga is one of the systems of Indian philosophy which has been discussed in various Indian scriptures such as the Bhagavad Gita, the Ahirbudhyna Samhita, the Upanishads and the yoga sutra-s of Sage Patanjali. According to Sage Patanjali, there are eight aspects of yoga, referred to as ashtanga yoga, which include yama (social discipline), niyama (personal discipline), asana (moulding the body into various positions), pranayama (regulation of the breath), pratyahara (involution of the senses), dharana (concentration), dhyana (meditation) and Samadhi (state of bliss).

One of the greatest proponents of the ancient science of yoga, in this era, is Yogacharya BKS Iyengar, who has been teaching yoga for the past 74 years. An author of 20 books, each of which, has been translated in various languages. His Light on Yoga, first published in 1966 has been translated into 19 languages. His immense contribution to yoga has been highlighted by the fact that the Oxford English dictionary defines 'Iyengar' as a form of yoga. He has been recognized by TIME magazine amongst the 100 most influential persons of the 20th century. Today, there are certified 'Iyengar Yoga' teachers in over 40 countries.

His style of teaching is marked by extreme precision in the performing the various yogasana-s and innovative use of props. His development of props has made the quote of 11th century yogic text, Hatha Yoga Pradipika come alive i.e the young, the old, diseased the weak and the disabled can all do yoga and attain its benefits. These props include the use of blankets, belts, ropes, chairs, bolsters and wooden formations which make it possible for even the most stiff, sick and disabled to attain perfection in yogic asana-s with ease and gain benefits including good health. Iyengar Yoga is internationally renowned for its therapeutic value in alleviating symptoms of various diseases.

Despite several anecdotal and subjective evidences, modern day health care demands 'evidence-based' medicine and for any form of therapy (be it alternative or complementary) to be recommended as therapy, it is essential that it should go through the very stringent assessment systems of modern science.

The Light on Yoga Research Trust in collaboration with the Bombay Hospital Trust, Indian Medical Association, General Practitioners Association and the Parkinson's Disease and Movement Disorder Society has organized the conference on the "Scientific evidence on the Therapeutic Efficacy of Iyengar Yoga' to highlight the research on Iyengar Yoga on October 12, 2008 with the objective of disseminating knowledge about the science of yoga amongst the medical fraternity.

This publication is a compilation of some of the presentations made at this conference as well as a compilation of the abstracts of published research papers on therapeutic effects of Iyengar Yoga. This publication is being brought out with the generous contributions of the Light on Yoga Research Trust as well as the Parkinson's Disease & Movement Disorders Society.

Light on Yoga Research Trust (LOYRT) &

the Parkinson Disease and Movement Disorder Society (PDMDS)

LOYRT and PDMDS are both charitable organizations with respective interests in propagating yoga and providing support and improve care of patients with parkinson's disease and other movement disorders. Both these organizations have been jointly working towards improving the quality of life of patients with PD through the practice of Iyengar Yoga. Since 2005, both these organizations have jointly organized 6 special workshops for the patients with PD at the Iyengar Yogashraya, Mumbai. Over 120 patients have attained benefits from attending these workshops. Apart from the extensive amount of anecdotal records of qualitative improvement experienced by the patients, the Trust and the Society have also conducted research programmes which objectively substantiate the patients experiences. The findings of this study were presented at the First Asia-Oceana Conference on Neurosciences at Singapore in August 2007 and adjudged one of the 6 best research papers presented at this Conference.

The Light on Yoga Research Trust has been formed by in 1978 with the objective of sharing his teachings and conducting research on Iyengar Yoga. This Trust currently runs over 100 public classes per week in Mumbai at Iyengar Yogashraya and at Home Villa in Gamdevi. These classes are meant for general public, individuals with medical problems as well as special classes for children. The Trust also deputes teachers to conduct classes in various parts of India. It had sent a team of teachers to assist in the emotional rehabilitation of the victims of the Gujarat earthquake in 2001. It also conducts public exams for children and has been regularly conducting classes for street children.

Parkinson Disease and Movement Disorder Society was formed in the year 2001. It is registered under the Societies Registration act of 1860 with the registered office at Mumbai. It is an all India body serving to link the various support groups for Parkinson's disease and other movement disorders in India. The main objectives are to improve the care and treatment of patients with Parkinson's disease and movement disorders and to disseminate knowledge and understanding of Parkinson's disease and movement disorders amongst the medical community, public, patients and the caretakers. It publishes a newsletter called Movement which provides one with information on various aspects of the disease, as well as the activities of the society. It conducts support group meetings on a regular basis at the Regular support groups are conducted at Nair Hospital, Borivali, Hinduja Hospital, Saifee Hospital and Workhardt Hospital.

Donations made to both these Trusts are exempted from Income Tax under section 80(G).

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Iyengar Yoga Increases Cardiac Parasympathetic Nervous Modulation Among Healthy Yoga Practitioners

-- *Kerstin Khattab, Ahmed A. Khattab, *Jasmin Ortak, Gert Richardt,* Hendrik Bonnemeier*

Abstract: Relaxation techniques are established in the management of cardiac patients during rehabilitation aiming to reduce future cardiac adverse events. It has been hypothesized that relaxation training programs may significantly improve cardiac autonomic nervous tone. However, this has so far not been proven for all available relaxation techniques. We tested this assumption by investigating cardiac vagal modulation during yoga. We examined 11 healthy yoga practitioners (7 women and 4 men, mean age: 43 ± 11; range: 26-58 years). Each individual was subjected to training units of 90 minutes once a week over 5 successive weeks. During two sessions they practised a yoga program developed for cardiac patients by B.K.S. Iyengar. On three sessions they practised a placebo program of relaxation. On each training day they underwent ambulatory 24 h Holter monitoring. The group of yoga practitioners was compared to a matched group of healthy individuals not practising any relaxation techniques. Parameters of heart rate variability (HRV) were determined hourly by a blinded observer. Mean RR (R- wave to R- wave) interval was significantly higher during the time of yoga intervention compared to placebo and to control ($p<0.001$for both). The increase in HRV parameters was significantly higher during yoga exercise than during placebo and control especially for the parameters associated with the vagal tone, i.e. mean SD of NN (Normal beat to Normal beat) intervals for all 5-minute intervals (SDNNi, $p< 0.001$ for both) and root mean square successive difference (rMSSD, $p<0.01$ for both). Relaxation by yoga training is associated with a significant increase of cardiac vagal modulation. Since this method is easy to apply with no side effects, it could be a suitable intervention in cardiac rehabilitation programs.

Heart rate variability (HRV) has been established as a non-invasive tool to study cardiac autonomic activity. Reduced HRV has been established as a predictor for increased risk of cardiac mortality and sudden cardiac death (1-6) especially in patients after myocardial infarction.

Several relaxation techniques have been established in the management of patients during cardiac rehabilitation aiming to reduce future cardiac events via cardiac autonomic nervous activity. It has been hypothesized that relaxation training programs may improve the cardiac autonomic nervous tone. However, this has so far not been proven for all available relaxation techniques, such as yoga.

Since more than 60 years B.K.S. Iyengar has been working therapeutically with patients after myocardial infarction. His method offers more than other techniques for relaxation do: the sequence of yoga asanas (exercises) and the individuality they are performed with, are adjusted to the severity of myocardial infarction,

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the stage of recovery and the clinical condition of the patient. Props are used, so that the strain of exercise can be regulated or stopped if desired.

We investigated whether this method has a positive influence on the cardiac vagal modulation compared to a similar setting of conventional relaxation and exercise techniques among healthy yoga practitioners.

Methods

Subjects

We examined 11 healthy yoga practitioners (7 women and 4 men, mean age: 43 ± 11; age range: 26-58 years). They were experienced practitioners with more than 3 years of regular practise of Iyengar-Yoga, four of them were certified teachers of Iyengar Yoga.

Each individual was subjected to 5 training units each of 90 minutes at the same time of the day (around 12.00 – 13.30 p.m.) once a week over 5 successive weeks. During two sessions they practised Iyengar-Yoga; on three sessions they practised a placebo program of relaxation that consisted of resting on the floor and park-walking.

To avoid misinterpretations of our findings due to interindividual and circadian variability (7), the yoga practitioners themselves served as an intraindividual control group.

The group of yoga practitioners was also compared to an age and gender matched group of healthy individuals without evidence of cardiovascular disease who have not been practising any relaxation techniques (n=11), to identify long-term effects.

All volunteers gave informed consent for

Table 1: Sequence of Asana-s (yoga postures)

Shavasana with support
Supta Baddha Konasana with support
Purvottanasana on bench and support
Trikonasana with a trestle
Parshvakonasana with a trestle
Ardha Chandrasana with a trestle
Prasarita Pardottasasana, concave back
Bharadvajasana, sitting on chair, hands on trestle
Adho Mukha Shvanasana with ropes
Shirshasana
Viparita Dandasana with bench
Dhanurasana with or without support
Sarvangasana with chair
Halasana with support
Bhismacharyasana with support
Setubandha Sarvangasana with support
Viparita Karani on Setubandha Bench
Shavasana with support

scientific use of their Holter information.

Intervention

Before the actual examination started, the yoga practitioners had 3-5 sessions where they practised the sequence of yoga asanas chosen for the intervention to make them familiar with the program. Since the yoga practitioners were experienced, the program, which was taken from the work of B.K.S. Iyengar addressed patients after myocardial infarction already at an advanced stage of recovery.

The program started with about 15 minutes resting poses, continued by 60 minutes standing poses, backbends and inverted poses and ended with another 15 minutes of resting poses. The sequence of asanas is shown in table 1.

Usually a training program for cardiac patients ends with the asana Bhismacharyasana; here we changed the series to end the program with Shavasana (lying on the floor). By this change we created three comparable blocks of body position between yoga and placebo program (see figure 1). Asanas were conducted by a certified teacher for Iyengar Yoga (K.K.).

Fig.2: Special support for the thoracic spine in supine positions.

All asanas of B.K.S. Iyengar's work with cardiac patients after myocardial infarction focus on opening the chest, therefore in standing poses a trestle was used and in supine position a special support for the thoracic spine was applied (e.g. wooden plank and small heart brick, figure 2+3). The exact description of the exercises is beyond the scope of this article. Details have been described by B.K.S. Iyengar elsewhere (8-9).

The placebo program was designed to be comparable to the yoga intervention and consisted of about 15 minutes resting on the floor in supine position, 60 minutes park-walking and again 15 minutes of resting on the floor. During park-walking and resting the trainees were also under guidance of the yoga instructor, and were taught to relax certain muscle groups.

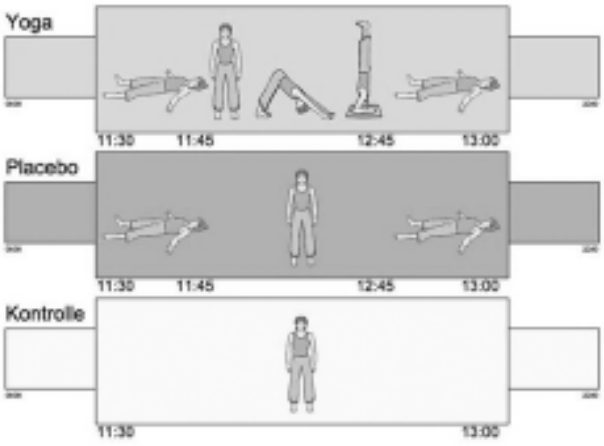


Fig. 1: Comparision of body positions in yoga, placebo and control (kontrole) group.

Data Collection

During 5 successive weeks, once a week all

volunteers underwent 24- hour ambulatory ECG monitoring with two-channel time-tracking Holter recorders (Tracker II, Reynolds, Herford, UK). The Holter Recording was initiated between 11 a.m. and 12 p.m. At around 12 p.m. the intervention program started. During 3 sessions they underwent the placebo program, during 2 sessions the yoga program was conducted.

All Holter recordings were manually edited by an experienced physician (H.B.) for exclusion of artifacts and premature beats. The physician was unaware of the group and the intervention. One R-R interval before and 5 R-R- intervals after an atrial or ventricular premature beat were eliminated from the analysis.

A minimum of 22 hours of analyzable data and a minimum of 90% of analyzable NN intervals were required for a tape to be accepted as valid. The median duration of the recordings was 24 hours, with 96% of valid analyzable NN intervals.There was no drop out.

Analysis of HRV

For each subject, time-domain HRV was measured according to the Task Force of ESC and NASPE (2) using a Pathfinder digital analysis system (Delmar Reynolds).

Mean RR interval and the following HRV parameters were calculated as hourly values and as 24- hour values: square root of the mean of the sum of the squares of differences between adjacent NN intervals (rMSSD), standard deviation of NN intervals (SDNN), mean standard deviation of NN intervals for all 5-minute segments (SDNNi), standard deviation of the averages of NN- intervals for all 5-minute segments (SDANN), absolute count of adjacent successive NN intervals differing by > 50 msec per hour (sNN50), and geometrical triangular index (TI).

Statistical analysis

Statistical analyses were conducted with a commercially available software package (SPSS version 12.0; SPSS Inc). Comparisons between groups were performed utilizing a Mann-Whitney U test. Multiple comparisons were done by Bonferroni corrected analysis of variance for repeated measures. Consecutively an alpha corrected paired Student's t test was performed for interval-to-interval comparisons. HRV-parameters were tested for normal distribution with the Komolgorov-Smirnov goodness-of-fit test for normality. All parameters but sNN50 were normally distributed. Although natural logarithmic transformation could diminish the skewness of the distributions of sNN50, data was not transformed with regard to the lack of comparability with previous published data. HRV-data are presented as mean values ± standard deviation. Statistical significance was set up at $p<0.05$.

Results

The baseline criteria of yoga practitioners and the matched control group are shown in table 2.

There were no significant differences regarding hourly mean values of RR interval and parameters of HRV outside the intervention time.

Mean RR interval was significantly higher during the time of yoga intervention compared to placebo and to control (865 ±119 ms; 746±86 ms; 753±115 ms respectively, $p<0.001$for both).

The increase in the parameters of HRV was significantly higher during yoga exercise than

Table 2: Baseline criteria of healthy yoga practitioners subjected to different

	Yoga practitioners (n=11)	(Controls n=11)
Male (%)	36,4	36,4
Age range (yrs)	26-58	26-57

None of the participants had a history od smolingm hypertension, diabetes or cardiovascular disease.

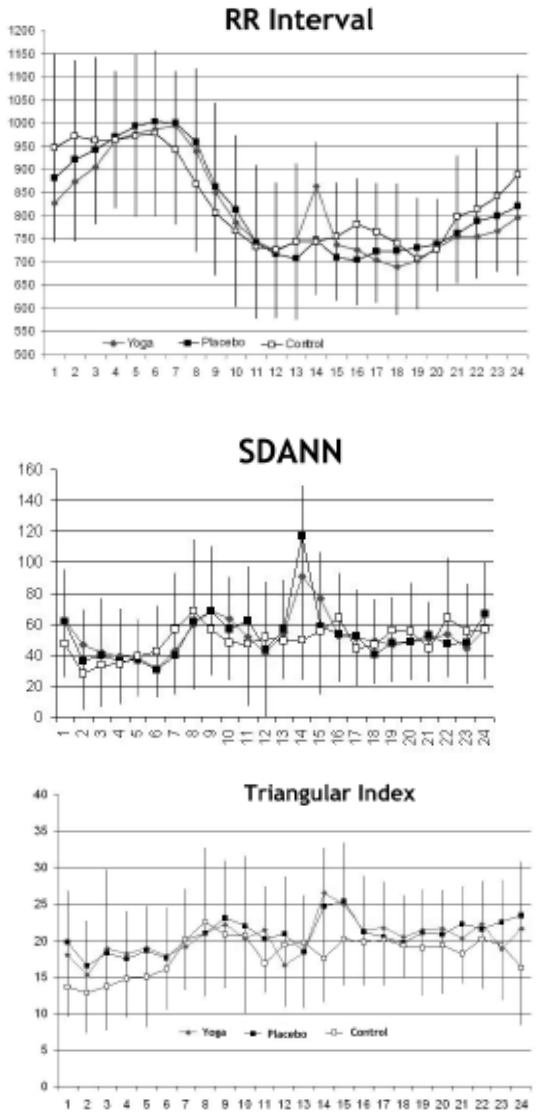
during the placebo program and control especially for the parameters associated to the vagal tone [mean SD of NN intervals for all 5-minute intervals (SDNNi) 86.9 ± 16 vs 62.9± 53.3± 18 ($p < 0.001$ for both); root mean square successive difference rMSSD 37.3 ±10 vs 30.1 ± 9 vs 24.1 ± 12 ($p<0.01$ for both)].

Estimates of overall HRV were significantly higher regarding the geometrical Triangular Index (TI) during yoga compared to placebo and control at time of intervention (26.5 ± 6 vs 24.6 ± 8 vs 17.6 ± 6; $p < 0.001$ for both). SD of NN interval (SDNN) was not significantly different during yoga exercise compared to the placebo program, but was significant for both compared to the control at time of intervention (129.6 ± 22 vs 130.7± 32 vs 78.7 ± 26, $p < 0.001$).

SD of the averages of NN intervals for all 5 min segments (SDANN) - a long term parameter associated with physical activity- was higher

Table3: Results during time of intervention

	Yoga Mean±SD	Placebo Mean±SD	Control Mean±SD	Significance Yoga vs Placebo	Significance Yoga vs Control	Signif. Palcebo vsControl
RR-Interval	864,5±119	746,4 ±86	743,6 ±115	P< 0,001	P< 0,01	n.s.
SDNN	129,6±22	130,7±32	78,7±26	n.s.	P< 0,001	P< 0,001
SDNNi	86,9 ±16	62,9 ±29	53,9 ±18	P< 0,001	P< 0,001	P< 0,05
SNN50	580,3±410	408,7 ±371	246,1 ±300	P< 0,01	P< 0,01	n.s.
SDANN	90,8 ±32	116,6±33,5	49,7 ±25,9	P< 0,01	P< 0,001	P< 0,001
rmssd	37,3 ±10	30,1 ±9	24,1 ±12	P<0,01	P< 0,01	P< 0,05
TI	26,5 ±6	24,6 ± 8	17,6 ±6	P< 0,001	P< 0,001	P< 0,05



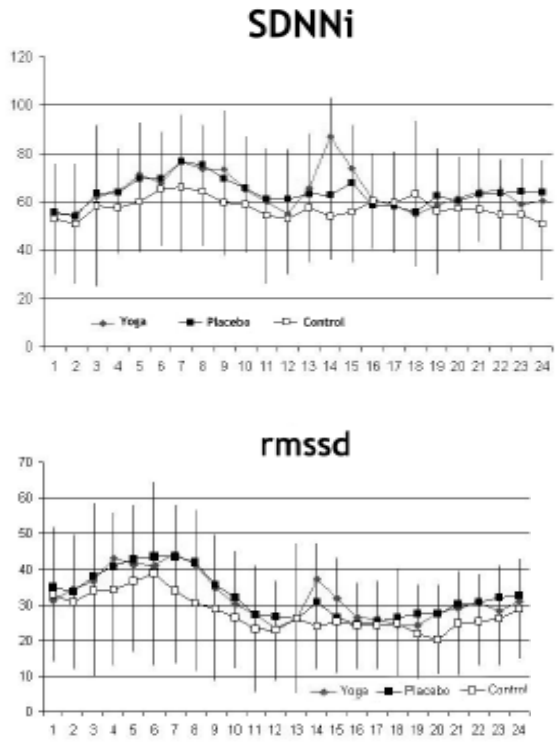


Fig.3: Results during the time of intervention.

during the placebo program of resting and park-walking compared to the yoga program (90.8 ±32 vs 116.6± 33.5; p< 0.01) and significantly higher for both yoga and placebo compared to the control (p< 0.001) (figure 3 and table 3).

A different analysis compared mean HRV-parameters of day and night with the time of intervention. Especially the vagus associated parameters (SDNNi and rMSSD) showed a typical nocturnal arousal as a sign of higher parasympathetic activity during the night. Only the increase during yoga intervention could compare to the peak at nighttime for these parameters (see fig. 4 and table 4).

Discussion

This study demonstrates that relaxation by yoga training is associated with a significant increase of cardiac vagal modulation among healthy yoga practitioners.

Since this method is easy to apply with no side effects, and leads to a deep physical and mental relaxation, it could be a suitable intervention during cardiac rehabilitation to shift the autonomic balance towards an increase of vagal activity and possibly decrease cardiac mortality.

La Rovere et al showed that exercise training by bicycle ergometry, an established training method in cardiac rehabilitation programs, increases vagal activity in patients after myocardial infarction (10), investigating baroreflex sensitivity as an autonomic marker. However, they reported that exercise training alone does

HRV Interval	Group	Day +S	Night +S	Intervention +S	Significance Day vs night	Significance Day vs Intervention	Significance Night vs Intervention
RR-Interval	Yoga	740.4±77	966.7±102	864.5±119	P<0001	P<0.001	P<0.001
	Placebo	746.3±95	954.4±143	746.4±86	P<0001	NS	P<0.001
	Control	770.8±100	954±159	743.6±115	P<0.01	NS	P<0.001
SDNN	Yoga	87.9±13	86±17	129.6±22	NS	p<0.001	p<0.001
	Placebo	89.6±13	82.5±20	130.7±32	NS	p<0.001	p<0.001
	Control	83.5±23	78.3±26	78.7±26	NS	NS	NS
SDNNi	Yoga	61±10	66.7±16	86.9±16	NS	p<0.001	p<0.001
	Placebo	60.7±11	66.9±16	62.9±29	p<0.05	NS	NS
	Control	57.2±19	57.7±22	53.9±18	NS	NS	NS
SNN50	Yoga	377.5±254	741.6±530	580.3±410	p<0.001	p<0.01	NS
	Placebo	370.5±191	737.6±501	408.7±371	p<0.001	NS	p<0.01
	Control	246.2±306	440.3±463	246.1±300	NS	NS	NS
SDANN	Yoga	56.1±13	42.3±12	90.8±32	p<0.001	p<0.001	p<0.001
	Placebo	55.5±12	41.1±14	116.6±33.5	p<0.001	p<0.001	p<0.001
	Control	53.6±14	42.4±13	49.7±25.9	NS	NS	NS
Rmssd	Yoga	27.2±6	40.4±14	37.3±10	p<0.001	p<0.001	NS
	Placebo	28.2±5	40.3±13	30.9±8	p<0.001	NS	p<0.001
	Control	24.9±13	33.8±20	24.1±12	NS	NS	NS
TI	Yoga	21.3±2	18.2±4	30.5±6	p<0.001	p<0.001	p<0.001
	Placebo	21.5±3	18.5±4	21.9±8	p<0.01	NS	p<0.01
	Control	19.5±4	15.3±4	17.6±6	p<0.05	NS	NS

Table 4: Mean HRV analysis during the day and night with time of intervetion in different groups.

not seem to be the only determinant of improved survival. It was only the combination of exercise with an increase in baroreflex sensitivity that predicted better survival. From experiments with dogs, Billmann et al considered the possibility that even independently from physical training, increased baroreflex sensitivity would be associated with a reduced risk for cardiac mortality after myocardial infarction (11).

Also in experiments with dogs after healed myocardial infarction, Kukielka et al (12) reported that submaximal long duration exercise reduced cardial vagal regulation initially, but further exercise training attenuated the initially exercise induced reductions in heart rate variability, suggesting a maintained higher cardiac vagal activity during exercise in the trained state.

On the other hand, Duru et al (13) found no significant effect of high-intensity exercise training on HRV indexes among patients with new-onset left ventricular dysfunction after myocardial infarction after 1, 2 and 12 months of training in a rehabilition center, despite beneficial effects on clinical variables.

These findings suggest, that after myocardial infarction with resulting left ventricular dysfunction which makes up the majority of post-infarction patients, exercise training remains

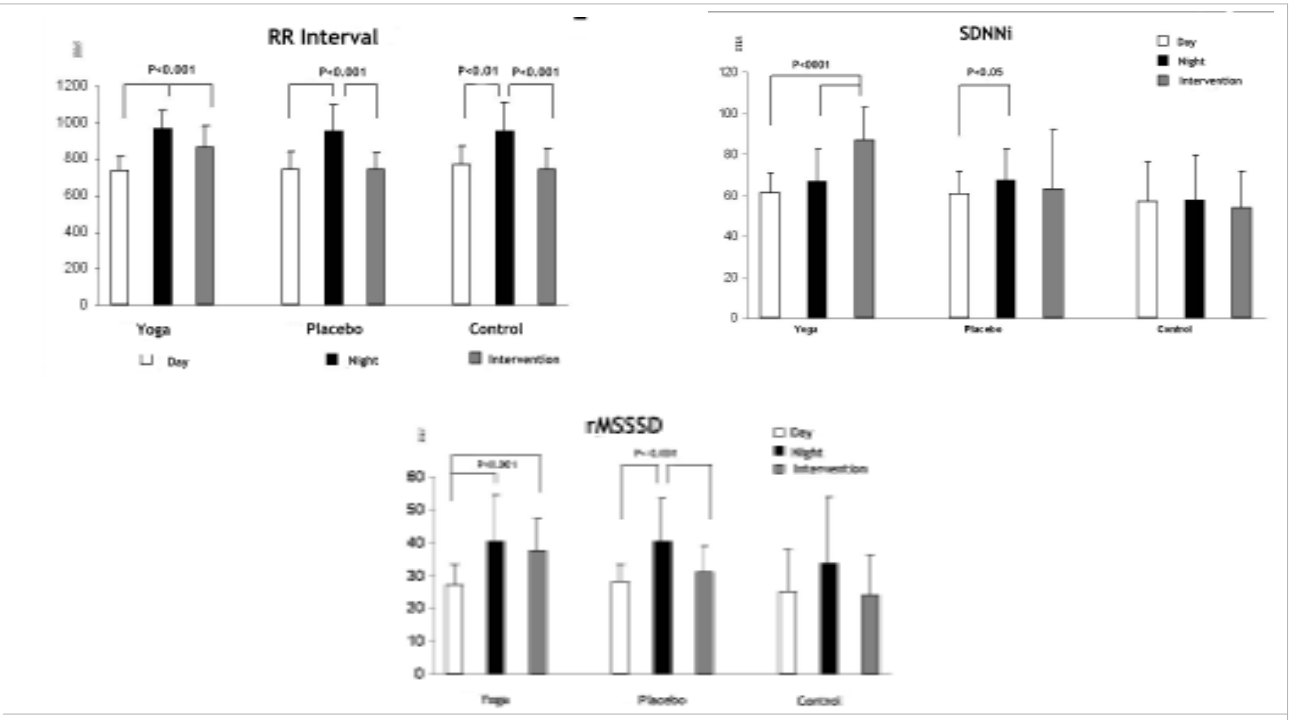


Fig.4: Comparision of HRV during day, night and intervention in the yoga, placebo and control group.

of limited value on HRV improvements. Furthermore, it seems that in an previously untrained condition, the subject needs first to develop a trained state, before exercise training can have a positiv influence on cardial vagal regulation, and that during the phase of building-up exercise capacity an unwanted counter-effect might occur.

There is a risk that especially young and untrained patients tend to go beyond their (cardiac) exercise capacity. We also experience patients having reduced left ventricular function or comorbidities, who cannot tolerate regular exercise on bicycle ergometry.

In these cases, training by relaxation programs could be a suitable alternative and are already established in many rehabilitation centers as an additional training.

A systematic meta-analysis about relaxation therapy for rehabilitation and prevention in ischaemic heart disease by Dixhoorn et al of 27 controlled trials in which patients with myocardial infarction were taught relaxation therapy revealed that intense supervised relaxation practise enhances recovery from an ischaemic cardiac event (14). This meta-analysis included relaxation techniques such as progressive muscle relaxation, autogenic training, biofeedback, breath relaxation, hypnosis and psychological training.

Among these 27 controlled trials 3 studies investigated and revealed a positive effect on HRV (15-17). The applied techniques of relaxation were progressive muscle relaxation, breath relaxation, deep breathing, cue controlled relaxation and biofeedback

In our study we could show, that training after the method of B.K.S. Iyengar among healthy yoga practitioners was superior to a simple relaxation program that consisted of resting on the floor and mild exercise like park-walking. We think that his method might be superior to other

relaxation techniques since it is a unique combination of relaxation (achieved by components like muscle stretching and relaxing, deep breathing, awareness [comparable to biofeedback], psychological aspects, concentration and meditation) and very exact therapeutical physical work that can be tailored for any limiting condition or co-morbidity.

The postures for cardiac patients are chosen and modified in a way to improve the loading – unloading conditions of the heart, which could positively influence remodelling and healing. In every asana the chest is kept open to improve respiration and achieve a higher oxygenation of blood. Backbending actions give a lenghtwise stretch to the mediastinum.

Depending on stage of recovery and condition of the patient, the body is gradually brought to more inverted postures which increase venous return to the heart.

During yoga exercises the trainees had a lower heart rate than during the alternative program.

Even during postures that build up body tension like standing poses or backbends, using slow and more isometric muscle contraction, the heart rate did not rise much.

A slow heart beat prolonges the diastolic filling of the heart, decreases myocardial oxygen consumption and increases myocardial perfusion.

A study among 24.913 patients by Diaz et al clearly identified a high resting heart rate (which also reflects cardial autonomic imbalance towards sympathetic activity) in patients with suspected or proved coronary artery disease as an independent predictor for total and cardiovascular mortality (18). Furthermore, a recently published study introducing deceleration capacity of heart rate – a novel Holter-ECG-based marker for vagal activity - underlines the crucial role of cardiac vagal modulation regarding cardiovascular mortality in post-infarction patients undergoing modern treatment, particularly treatment involving acute revascularization procedures (19).

Further studies are required to investigate whether the demonstrated positiv effect of therapeutical yoga on the cardiac vagal modulation can be transfered to cardiac patients and introduced into cardiac rehabilitation programs.

Study Limitations

The study cohort (regular yoga practioners) warrants drawing conclusions about long lasting effects of yoga on HRV parameters. However, the 24 hour circadian rhythm of the yoga practitioners e.g. for SDNNi and rMSSD was higher than in the control group, yet the study population was too small to show a significant difference.

Additional studies are required to investigate long term effects of yoga training on cardiac autonomic nervous modulation.

Acknowledgement

We like to thank Mr. B.K.S. Iyengar for his guidance during this study. He tailored the sequence of asanas for this investigation and gave us a glimpse of his knowledge and experience of therapeutic yoga.

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Beneficial effects of Iyengar yoga in patients with stress, stress-related disorders and cardiovascular risk - implications of recent research

-- *Andreas Michalsen, Gustav Dob*

Abstract: Emotional distress is an increasing public health problem and related to a series of stresss-related complaints, e.g. chronic pain syndromes and cardiovascular disease. Iyengar yoga has been claimed to induce stress reduction and empowerment in practicing subjects. We aimed to evaluate potential effects of Iyengar yoga on stress, stress-related complaints, psychological outcomes and atherosclerotic risk in a series of studies with distressed patients. Two controlled prospective studies were conducted in self-referred female subjects who perceived themselves as emotionally distressed. In the first study n=16 subjects attended two 90-min Iyengar yoga classes weekly for 12 consecutive weeks and the effects were compared to a waiting list control. In the second study n=72 females stressed subjects were randomized to intensified Yoga (twice weekly) , moderate Yoga (one class per week) or waiting list control. In a third study 30 subjects were randomized to very intensified yoga (two and more classes per week) and compared to waiting list. Outcomes in the first two studies included a battery of psychological and quality-of-life assessement tools and the severity of complaints. In the third study, additional markers of cardiovascular risk and endothelial function (Flow-mediated-vasodilation, FMD) were measured. In the first study, women who participated in yoga-training demonstrated clear and significant improvements in perceived stress, emotional well-being, quality of life and complaints (chronic pain, head ache). In the second study both yoga groups (moderate and intensified) showed comparable and significant improvements in psychological well-being, stress-symptoms and quality of life compared to waiting list controls. In the third study Iyengar yoga participants showed improved parameters of cardiovascular risk factors, results of FMD are currently anlayzed. Iyengar yoga seems to be a highly effective intervention for subjects that suffer from stress, stress-related syndromes/disorders and chronic orthopedic or neurological pain. Moreover, it is a promising therapy in the prevention and treatment of cardiovascular disease.

Large numbers of Americans and Europeanshave recently adopted the practice of yoga for its proposed health benefits. By 1998, an estimated fifteen million, mostly female American adults, had used yoga at least once in their lifetime, and 7.4 million reported practising yoga during the previous year. Featured in the lay press yoga continues to be marketed as a method to empower well-being and to reduce stress ("Power-Yoga"). Indeed, some health professionals refer their patients to Yoga teachers for help in managing a variety of stress-related ailments. Of the many styles of yoga taught in the US and Europe, Iyengar yoga is the most prevalent (2) and promising regarding its clincial efficacy. It is based on the teachings of the yoga master, B.K.S. Iyengar, who has

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applied yoga to many health problems, using a system descending from Ashtanga yoga.

A number of controlled studies exist on the effectiveness of yoga. These investigations include such conditions as osteoarthritis, carpal tunnel syndrome, multiple sclerosis, bronchial asthma, hypertension, irritable bowel syndrome, mild depression and lower back pain. Five of these studies evaluated Iyengar yoga and reported positive results. However, little is known about the putative impact of Iyengar yoga on distress, stress-related disease and cardiovascular risk. As recent research has emphasized the negative impact of mental distress on health, i.g. cardiovascular health, we undertook a series of studies to examine the clinical effects of a 8- to 12-week Iyengar yoga program in distressed subjects with stress-related disorders and cardiovascular risk.

Methods

Two controlled prospective studies were conducted in self-referred female subjects who perceived themselves as emotionally distressed.

The first study is separately published (Michalsen et al., Medical Science Monitor 2005). In brief, n=16 subjects attended two 90-min Iyengar yoga classes weekly for 12 consecutive weeks and health-related effects were compared to a waiting list control.

In the second study n=72 female stressed subjects were randomized to intensified Yoga (twice weekly), moderate Yoga (one class per week) or a waiting list control. In this study we aimed to test the efficacy of iyengar yoga on stress-related complaints and diseases, and to evaluate if this form of yoga is only effective if practiced on a high-intensity level.

In a third study, male and female 30 subjects were randomized to an intensified Iyengar yoga program (two and more classes per week) and compared to waiting list.

Outcomes in the first two studies included a battery of psychological and quality-of-life assessement tools and the severity of complaints. Moteover , levels of salivary cortisol were measured before and after yoga classes, and, before and after the 3 month programs. In the third study, additional markers of cardiovascular risk (blood lipids, blood pressure) and endothelial function (Flow-mediated–vasodilation, FMD) were measured.

Results

The results of the first study are reported separately (see Michalsen et al. 2005). In brief, the great majority of women who participated in yoga-training demonstrated clear and significant improvements in perceived stress, emotional well-being, quality of life and complaints (chronic pain, head ache) leading to very high effect sizes of Iyengar yoga regarding the overall health effects.

Iyengar yoga induced improvement of depression and anxiety scores up to 50% and 30%, respectively, well-being improved by 65% and sleep by 50%, together indicating a substantial effect of this yoga form on psychological outcome. Moreover, cortisol levels dropped significantly after a 90 min Iyengar training class. .

In the second study both yoga groups showed clear and highly significant improvements of quality-of-life, body symptoms as back pain, headache or sleeping disturbances. Specifically, perceived stress (Cohen Stress Scale), hostility, depression, fatigue (assesssed by profile of mood states, POMS), anger, and a global score of health symptoms were significantly improved in

Table 1: Outcomes: Group 1 and Group 2 = yoga; Group 0 = wait list control

	Group 0	Group 1	Group 2	1 vs 0	2vs0	2 vs 1
Cohen Stress	-0.3	3.0	2.3	0.006	0.056	ns
Hostility	-0.5	-11	-8.5	0.001	0.01	ns
Depression	-0.6	-9.5	-10.1	0.016	0.037	ns
Fatigue POMS	-1.3	-3.4	-1.9	0.001	0.01	ns
Anxiety	-2.3	-9.4	-9.3	0.008	0.027	ns
Anger	-0.2	-1.4	-1.9	0.004	0.003	ns
Symptoms	-0.2	-05	-03	0.006	ns	ns

both groups compared to a waiting list control group. Between the two yoga groups we found no significant differences. However, also the group that was scheduld to have only one 90-minute Iyengar Yoga class per week started to practice yoga several times a week at home. Therefore, training differences between both yoga groups were not as great as preplanned. The results of the specific questionnaires of this study are summarized in table 1:

Finally, there were no adverse effects associated with yoga practice for all subjects and the majority of subjects wanted to continue with Iyengar yoga.

In the third study we found a significant decrease of blood pressure and heart rate after a 8-weeks high-intensity Iyengar yoga training. Blood lipids were not altered. Results of endothelial function are currently analyzed.

Conclusions

The demonstrated marked reduction in perceived stress and related anxiety/depressive symptoms and the improvements of quality-of-life, cardiovascular risk factors and general well-being in our yoga practising participants are of clear clinical importance. In view of its safety and low costs, further research should evaluate the value of Iyengar yoga for the prevention and treatment of disease, e.g. stress-related disease and cardiovascular disorders.

Iyengar Yoga for Chronic Low Back Pain

-- *Williams KA, Petronis J, Smith D, Goodrich D, Wu J, Ravi N, Doyle E, Jucket R, Kolar M, Gross R Steinberg L.*

Abstract: Low back pain is a significant public health problem and one of the most commonly reported reasons for the use of Complementary Alternative Medicine. A randomized controlled trial was conducted in subjects with nonspecific chronic low back pain comparing Iyengar yoga therapy to an educational control group. Both programs were 16 weeks long. Subjects were primarily self-referred and screened by primary care physicians for study inclusion/exclusion criteria. The primary outcome for the study was functional disability. Secondary outcomes including present pain intensity, pain medication usage, pain-related attitudes and behaviors, and spinal range of motion were measured before and after the interventions. Subjects had low back pain for 11.2 $\pm$ 1.54 years and 48% used pain medication. Overall, subjects presented with less pain and lower functional disability than subjects in other published intervention studies for chronic low back pain. Of the 60 subjects enrolled, 42 (70%) completed the study. Multivariate analyses of outcomes in the categories of medical, functional, psychological and behavioral factors indicated that significant between groups differences existed in functional and medical outcomes but not for the psychological or behavioral outcomes. Univariate analyses of medical and functional outcomes revealed significant reductions in pain intensity (64%), functional disability (77%) and pain medication usage (88%) in the yoga group at the post and three month follow-up assessments. These preliminary data indicate that the majority of self-referred persons with mild chronic low back pain will comply to and report improvement on medical and functional pain-related outcomes from Iyengar yoga therapy.

Low back pain (LBP) is a public health problem that has reached epidemic proportions (Shelerud, 1998). In the US, 70-85% of the population has had at least one episode of back pain sometime in their life (Andersson, 1999). LBP is one of the most commonly reported reasons for use of Complementary Alternative Medicine (CAM) (Eisenberg et al., 1993; 1998). An estimated 14.9 million Americans practice yoga, 21% of which use it for treating neck and back pain (Saper et al, 2002).

Astanga yoga is comprised of 8 limbs including moral injunctions, rules for personal conduct, postures, breath control, sense withdrawal, concentration, meditation and self-realization (Taimini,1986). Of the many styles of yoga taught in the US, Iyengar yoga is the most prevalent (Signet Market Research, 2000). It is based on the teachings of the yoga master B.K.S. Iyengar, (1976) who has taught yoga for 70 years and has applied yoga to many health problems including chronic low back pain (CLBP). Although his system descended from Astanga Yoga, it is distinguished from other styles of yoga by the emphasis on precise structural alignment,

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the use of props, and sequencing of poses, and by the incorporation of all aspects of Astanga Yoga into the practice of postures and breath control (Iyengar, 1989). Iyengar yoga was chosen for this study because a high prevalence of Americans practicing Iyengar yoga (Signet Market Research, 2000) and the expectation of yielding the best possible outcome. The method is supported by a national credentialing organization with high teaching standards, (IYNAUS Certification Committee 2002) and a standardized protocol for LBP (Iyengar,1976).

A number of randomized controlled studies exist on the efficacy of yoga. These include osteoarthritis (Garfinkel et al., 1994), carpel tunnel syndrome (Garfinkel et al. 1998), multiple sclerosis (Oken et al., 2004), bronchial asthma (Nagarathna and Nagendra 1985; Vedanthan et al. 1998),?FQUOTE "" pulmonary tuberculosis (Visweswaraiah and Telles, 2004), drug addiction (Shaffer et al. 1997), hypertension (Murugesan et al., 2000), irritable bowel syndrome (Taneja et al., 2004), lymphoma (Cohen et al., 2004) and mild depression (Woolery et al., 2004). Four of these studies evaluated Iyengar yoga (Garfinkel et al., 1994, 1998; Oken et al., 2004; Woolery et al., 2004) and reported positive results.

Only three peer-reviewed studies of yoga and CLBP have been published. Two of the studies evaluated an unspecified method of hatha yoga. One study lacked a control group (Vidyasagar et al., 1989) while the other was not powered to reach statistical significance (Galantino et al., 2004). The third was a feasibility analysis of Iyengar yoga presenting only baseline data and adherence rates to therapy (Jacobs et al., 2004).

Although the therapeutic application of Iyengar yoga for CLBP is currently offered at Iyengar Yoga Centers, there has been no published scientific evaluation of the intervention. The purpose of this exploratory study was to determine the efficacy of Iyengar yoga therapy on pain-related outcomes in persons with CLBP. It is hypothesized that the yoga therapy group will report a greater reduction in a number of pain-related measures.

Iyengar yoga was chosen for this study because of a high prevalence of Americans practising Iyengar Yoga and the expectation of yielding the best possibly outcomes.

Method

Subjects

The study was approved by the Institutional Review Board at West Virginia University. Subjects were recruited through physician and self-referral. Local physicians were informed about the study through lectures and mailed announcements. The project was announced to the public through flyers, public radio, and local university list serve for faculty and staff. The inclusion criteria were: history of nonspecific LBP with symptoms persisting for ≥ three months. Subjects had to be > 18 years of age, English-speaking, and ambulatory. Individuals were excluded if their LBP was due to nerve root compression, disc prolapse, spinal stenosis, tumor, spinal infection, alkylosing spondylosis, spondylolisthesis, kyphosis or structural scoliosis, or a widespread neurological disorder. Individuals were excluded if they presented as pre-surgical candidates, were involved in litigation or compensation, displayed

a compromised cardiopulmonary system, were pregnant, had a body mass index > 35, were experiencing major depression or substance abuse and were practitioners of yoga. Eligibility also was contingent on subjects' agreement to randomization and to forgo other forms of CAM during the study.

Study Design

During the pre-intervention assessment, subjects signed an informed consent and completed a battery of psychosocial questionnaires, and spinal range of motion (ROM) measurements. Data collectors were blind to the subject's treatment status. Subsequently, subjects were randomized to control or yoga groups using a random number generating program from JMP 4.0 statistical software (SAS, 2000; see Figure 1). Randomized subjects were assigned to one of three subgroups of 10 (i.e., Groups I, II, and III) during the fall 2001 and spring 2002 based on the date of their enrollment. Both groups received 16 weekly newsletters on back care written by senior entry-level physical therapy students while also being permitted to continue medical care for LBP. In the two weeks preceding the start of the program, the control and yoga groups received two one-hour lectures of occupational/physical therapy education regarding CLBP. Instructional handouts were given to help subjects use the information they received.

Yoga group subjects were required to attend one 1.5-hour class each week taught by a yoga instructor for 16 weeks at a community yoga studio. Yoga subjects were also encouraged to practice yoga at home for 30 minutes, 5 days per week. Both groups were asked to attend a 1.5-hour post-intervention assessment 16 weeks following the start of the program to complete questionnaires, and spinal ROM measurements. Data collectors were blind to the subject's treatment status. Three months after program completion, a third battery of questionnaires was mailed to all subjects. Subjects were asked to complete and return the questionnaires in stamped, self-addressed envelopes to the researchers. Results from the post-treatment and three-month follow-up assessments were compared to baseline measurements.

It was posited that Iyengar Yoga therapy would progressively rehabilitate low back pain by addressing imbalances in the musculoskeletal system that affect spinal alignment and posture.

Yoga Therapy Intervention

The yoga therapy intervention is based on the teachings of *BKS Iyengar* who has taught yoga for 70 years and has applied therapeutic variations of classical poses to many health problems including CLBP (Iyengar, 1976). It was posited that Iyengar yoga therapy would progressively rehabilitate LBP by addressing imbalances in the musculoskeletal system that affect spinal alignment and posture. The wide range of postures and supportive props employed by this method serve to enhance alignment, flexibility, mobility and stability in all muscles and joints that affect spinal alignment and posture. A variety of props are used including sticky mats, belts, blocks, chairs, wall ropes, benches, boxes, stools, trestler and

weights. These props are used to provide external support, to facilitate relaxation, to provide traction and to bring awareness to a specific regions of the body. Many muscle groups are targeted by Iyengar yoga with the aim of lengthening constricted or stiff muscles and strengthening core postural muscles that are underutilized including muscles of the abdomen, diaphragm, hamstrings, quadriceps, hip adductors and lateral rotators, buttocks, muscles of the lumbar and thoracic areas of the back.

The yoga intervention was developed with the

Table 1: Asana-s (yoga postures) used in yoga therapy

1. Savasana II with bolster and sandbag; with sacral traction
2. Prone **S**avasana with 25 lb weight on buttocks; with two 15lb plate weights and 3 10 lb sandbags between **plate weights**
3. Prone Supta **P**adangusthasana with raised knee bent and supported
4. Supta Pavanmuktasana – 1 knee to chest, both knees to best
5. Supta Padangusthasana I and II – bent knee & straight leg with support of the wall; with assisted traction; traction with 2 straps
6. Pavanmuktasana on the bench
7. Uttanasana on the stool
8. Ardha uttanasana onto halasana box with double traction
9. Adho Mukha Svanasana using simhasana box and upper wall ropes; with lower wall ropes and heels on wall
10. Lumbar traction with straight legs and bent legs
11. Adho Mukha Virasana over bolster
12. Parsva Pavanmuktasana on the bench
13. Prasarita Padottanasana on bench with traction on the upper thighs (concave back)
14. Parsvottanasana (concave back)
15. Maricyasana III at trestler
16. Tadasana with block between the legs
17. Utthita Hasta Padangusthasana I and II with bent knee and straight leg
18. Parivritta Hasta Padangusthasana III straight leg supported on stool at trestler
19. Utthita Padmasana–forward bend (adho mukha) and lateral stretch (parsva)
20. Adho Muhka Sukasana
21. Parsva Sukasana
22. Trikonasana (at trestler with traction)
23. Virabdrasana II (at trestler with traction)
24. Parsvakonasana (at trestler)
25. Parivritta Trikonasana (trestler)
26. Bharadvajasana (chair)
27. **Supported** Urdhva Prasarita Padasana
28. Supported Baddha Konasana
29. Supported Halasana

consultation of senior Iyengar yoga instructors who had experience with B.K.S. Iyengar's protocol for treating CLBP. The principal investigator, an Iyengar student for 14 years and teacher in training for 9 years, was introduced to the protocol for CLBP by Geeta Iyengar at Ramamani Memorial Institute in Pune, India in 1998. Since then she has utilized this therapeutic protocol and studied under senior Iyengar teachers with a minimum of 25 years of experience.

The yoga instructors have trained in the Iyengar method for over 10 years, teaching yoga for 8 years and have experience teaching persons with CLBP. Although the PI served as one of the yoga instructors, she was not involved in data collection or data analysis of the results.

The intervention consisted of 29 postures (see Table1). Poses from the following categories were used: supine, seated, standing, forward bends, twists, and inversions. No back bending poses were introduced at this stage of recovery to reduce the risk of re-injury. Back bending poses require a proper progression of musculoskeletal retraining and can be harmful if done without implementation of complex musculoskeletal actions (Williams et al, 2003). Initially, restorative poses were done to relieve pain and muscle tension. Then poses were introduced that lengthened muscles attaching to the spine and pelvis in positions with the spine fully supported. Next standing poses were introduced to open the hips and groins and to teach students how to use their legs and arms to lengthen pelvic and spinal tissues.

Twists were taught to access the deeper layer of back muscles to help realign the vertebra, increase intervertebral disc space and decrease possible impingement of nerve roots. Inversions were included to reverse the compressive effects of gravity on the intervertebral disc space. Subjects were gradually progressed from simple poses to progressively more challenging poses. Throughout the intervention, instructors focused on correcting imbalances in muscles affecting spinal alignment and posture as they were revealed in the poses. At the program end, yoga subjects were encouraged to continue yoga therapy at home and through community classes.

Outcome Measures

Functional Disability

Functional disability was the primary outcome variable and was measured using the 7-item Pain Disability Index (PDI) (Tait et al., 1990) that assessed the degree (1-10 scale) that chronic pain disrupts performance or function of seven general areas of normal activities including family and home responsibilities, recreation, social activity, occupation, sexual behavior, self-care, and life-support activity (Tait et al., 1990). A total disability score was calculated by summing all items for a maximum score of 70 points with higher scores indicating higher levels of disability. The PDI has been found to be both reliable (Tait et al., 1990) and valid (Jerome and Gross, 1991, Chibnall and Tait, 1994).

Clinical Pain

Clinical levels of pain were assessed using the Short Form-McGill Pain Questionnaire (SF-MPQ) (Melzack, 1987). The SF-MPQ measures present pain intensity with a standard horizontal 10 cm visual analogue scale (VAS) (Huskisson, 1983) and the Present Pain Index (PPI) (Melzack, 1987). The VAS is a bipolar line scale with the descriptive anchors of no pain on the left side of the line and worst possible pain on the right side of the line. The PPI is a rating scale from zero = no pain to five = excruciating that requires each patient to endorse their pain with one check.

Fear of Movement

Pain-related fears to movement were quantified by the Tampa Scale of Kinesiophobia (TSK) (Kori et al., 1990, Crombez et al., 1999a; Crombez et al., 1999b; Goubert et al., 2002; Lethem et al., 1983; McCracken et al., 1992;Vlaeyen et al., 1995; Waddell et al., 1993). The TSK is constructed on a 4-point scale with anchors ranging from 'strongly disagree' to 'strongly agree.' Higher scores are associated with greater pain-related fear of movement (Vlaeyen et al., 1995). Internal consistency of the TSK is fair (alpha = 0.68 and 0.80) (Vlaeyen et al., 1995) while demonstrating good validity among CLBP patients (Crombez et al., 1999a).

Pain Attitudes

Beliefs associated with adjustment to chronic pain were assessed with the Survey of Pain Attitudes (SOPA) (Jensen et al., 1994). The SOPA is a 57-item questionnaire that rates level of agreement on a 0-4 scale with statements concerning perceptions of seven attitudinal areas related to pain including Control, Disability, Harm, Emotion, Medication, and Medical Cure. Higher scores indicate an increase in the beliefs or attitudes that influence chronic pain and disability in a negative way with the exception of the control and emotion subscales. The validity of the SOPA is good (Strong et al., 1992) while demonstrating moderate to good reliability (Jensen et al., 1994).

Coping Strategies

Various coping strategies were assessed using the Coping Strategies Questionnaire – Revised, (CSQ-R) (Robinson et al., 1997; Riley, III and Robinson, 1997). The CSQ-R consists of 27 items and uses a 0-6 rating scale to rate perceived use of six types of coping strategies for pain when pain is experienced including: Distraction, Catastrophizing, Ignoring Pain, Distancing, Cognitive Coping, and Praying. The psychometric properties of CSQ-R are well established (Robinson et al., 1997; Riley, III and Robinson, 1997).

Self-Efficacy

Subjects' perception of their confidence to actively cope with CLBP at the time of assessment was measured with the Back Pain Self-Efficacy Scale (BPSES) (Anderson et al., 1995). The BPSES presents 22 statements about coping strategies for pain and rates self-efficacy using a 10-point scale from 10 *low certainty* to 100 *totally certain*. Higher scores correspond to greater self-efficacy beliefs toward LBP. Three subscales exist including self-efficacy for pain management, functional ability and controlling symptoms. Evidence indicates this scale has good concurrent and construct validity (Anderson et al., 1995) and good internal consistency.

Range of Motion

Spinal ROM was measured using a Saunders Digital Inclinometer, which is a portable, hand-held device with a liquid crystal screen that does not require calibration. The curve-angle method for measuring spinal ROM was utilized. The method more effectively isolates ROM of lumbar flexion and extension because it takes into consideration each individual's different standing lumbar posture in determining its zero reference point for measurements. Testing was performed with awareness of common measurement errors identified by Mayer et al. (Mayer et al., 1997). Assessments were performed in the standing position and included hip flexion and extension, lumbar flexion, extension, and right and left lateral flexion (side bending).

Pain Medication Usage

Subjects were interviewed about their current pain medication usage (within the past 3 months) during the telephone-screening interview. Questions were asked to determine the use of "pain relieving" prescription and nonprescription medications as well as the use of herbal and dietary supplements for pain management prior to the intervention. Changes from the baseline in drug consumption were evaluated at post-intervention and at 3-month follow-up. Subjects were given a list of their medications reported at baseline and asked to specify whether there was a change. Responses were coded in either one of four categories: no change from baseline, an increase or a decrease in usage, or cessation of medication. If a subject changed to a drug regimen that was equivalent to the pre-intervention drug regimen with respect to medication class and/or dosing period, and which was expected to yield a similar analgesic response, the drug usage was considered unchanged. Changing the dose or stopping of one or more components of a multiple drug regimen was also considered an alteration in drug usage. For example if two analgesics were being used, and one was stopped, it was recorded as a reduction in pain medication usage.

Adherence

Subjects in the yoga group were asked each week to report the frequency and duration of their yoga therapy practice at home. The total practice time was calculated each week and an average score was determined for the 16 week intervention period.

Statistics

Unpaired t-tests were conducted to determine if baseline differences in demographics, medical history and outcome measures existed between groups. Unpaired t-tests were also conducted to assess whether study completers differed significantly on outcome measures at baseline from non-completers. A non-completer was a subject who either failed to complete the program or failed to complete post-treatment assessment of study outcomes.

Repeated measures mulitivariate analysis was conducted on functional (functional disability and pain intensity), psychological (pain attitudes, fear of movement and self-efficacy), and behavioral (coping strategies) outcomes to control for type I error. For spinal range of motion, only pre and post-intervention scores were obtained and included in the multivariate analysis. If the outcome of the multivariate analysis was significant an ANCOVA was conducted that controlled for baseline scores of study outcomes to assess whether changes from baseline were significantly different between the yoga and control groups at post-treatment and the three-month follow-up. Changes in pain medication usage were analyzed with Chi-squared analysis and were assessed for their significance after Bonferroni correction of the significance level for the number of outcomes included in the analysis.

Results

Subject characteristics

Of 210 candidates who called in or were referred by their physician to participate in the study (Figure 1), 70 (33%) met the inclusion criteria and 60 (29%) agreed to enroll. One hundred-forty candidates were excluded before enrollment for the following reasons: logistical conflicts (72.8 %); contraindicated medical conditions (13.6 %); or unwillingness to forgo

other forms of CAM (13.6%).

Of the 60 subjects starting the study, 42 completed the study giving a 70% completion rate. Ten subjects were excluded from the analysis in the yoga group for the following reasons: 3 for not showing up to intervention after attending the baseline assessment, 3 quit, 1 adverse event in a subject with symptomatic osteoarthritis who was diagnosed with a herniated disc during the study, 2 medically ineligible (pregnant, scoliosis), 1 subject with symptomatic osteoarthritis who was unwilling to perform active yoga postures for fear of aggravating her condition. Review of the adverse event by a medical panel summoned by the Institutional Review Board determined that it was unrelated to the performance of yoga postures. Eight subjects were excluded from analysis in the control group for the following reasons: 4 were lost to follow-up, 2 became ineligible because of other CAM treatment for CLBP, 1 no show at baseline assessment and 1 elderly subject died. Of the 20 subjects completing the yoga intervention, an attendance rate of 91.9% was achieved for the 16-week protocol.

Forty-four subjects (control + yoga) completed the 16-week intervention. The mean age was 48.3 $\pm$ 1.5 with a range of 23 to 67 years. Subjects reported an average duration of LBP

Table 2: Demographic and medical characteristics of subjects.

Characteristic	Control (N = 24)	Yoga (N=20)	P value
Mean Age-yr (m$\pm$SE)	48.0 ± 1.96	48.7 ± 10.6	0.81
Gender (%)			
Female	70.8	65.0	.68
Male	29.2	35.0	
Ethnicity			
African Am	01	01	0.57
Asian	01		
Native Am	0	01	
Caucasian	22	18	
Education Level (%)			
High School	29.2	20.0	.48
College	70.8	80.0	
Income (%)			
$10 –19,000	16.7	5.0	35
$20 – 49,000	50.0	45.0	
$50 – 100,000	33.3	50.0	
History of LBP (yrs)	11.0 ± 2.07	11.3 ± 2.37	0.92
% Taking Meds	50.0	45.0	.71
% Using CAM	25.0	35.0	.49

No significant differences were found between groups (P>0.05) on demographics and medical history at baseline.

of 11.2 ± 1.54 years**,** 48% reported using pain medication, and 30% used some form of CAM for LBP at baseline (see Table 2). A one-way ANOVA (unpaired t-test) revealed no significant differences in demographics and medical history between the yoga and control groups ($P > 0.05$; Table 2). No significant between group differences were found at baseline on outcome variables with the exception of significantly higher functional ability on the BPSES (P=0.005), lower catastrophizing as a coping strategy (P =0.007), and less perceived disability (P =0.002) and harm (P =0.02) on the SOPA by the yoga group compared to the control group.

One-way analysis of demographic factors,

Table 3: Analyses of study outcomes to correct Type I error

Outcome	Variables	Correction for multiple outcomes	P-value
Functional outcomes (Pre, post & follow-up)	PDI PPI VAS	Manova	.004
Pain medication usage (Pre, post & follow-up)	Success Failure	Bonferroni Correction	(P<.025) Post .002 3MFup .007
Psychological factors (Pre, post & follow-up) Survey of pain attitudes	Pain Attitudes -Pain Control -Disability -Harm -Emotion -Medication -Solicitude -Medical Cure	Manova	.004
Fear of Movement	fear of movement		
Self Efficacy	Self-Efficacy -managing symptoms -functional ability -controlling symptoms	Manova	.15
Behavioral factors (Pre, post & follow-up) Coping Strategies Questionnaire	Distraction Catastrophizing Ignoring Pain Distancing Cognitive Coping Praying	Manova	.52
Spinal Range of Motion (Pre and post)	Lumbar Extension Lumbar Flexion Left Lateral Flexion Right Lateral Flexion Standing Hip Extension Standing Hip Extension	Manova	.15

medical history, baseline pain intensity, and disability comparing subjects who completed the study (N=42) and subjects who either dropped out or were lost to follow-up (n=18), revealed no significant between group differences in demographics, baseline disability or pain intensity. However, non-completers had LBP for a longer period of time (16.4 ± 2.5 yrs) compared to completers (10.21 ± 1.51 yrs).

Comparison of Study Outcomes in the Yoga and Control Groups

A multivariate analysis of functional, psychological and behavioral outcomes determined that significant group x time differences existed in the primary outcome, functional disability and the secondary outcome, pain intensity (P=.0036; Table 3). No significant differences were found in the other secondary outcomes including spinal range of motion, psychological or behavioral factors. Significant between group differences were observed in the changes in pain medication usage using a Bonferonni corrected significance level. Both the post and three-month follow-up P values were less than the Bonferroni corrected significance level of .025 (Table 3).

Univariate analysis of functional disability indicated that the yoga group has less functional disability post treatment than the control group (Table 4). At baseline, the mean functional disability was 14.3 (13.6) and 21.2 (20.5) for the control group and the yoga group, respectively. After 16 weeks, the mean score fell to 3.3 (5.1) in the yoga group (76.9%) and to 12.8 (11.9) in the control group (39.6%). Three months after the intervention, the mean score was 3.9 (5.3) in the yoga group (72.7%) and 12.7 (11.4) in the control group (40%). A one way ANCOVA that controlled for baseline score, indicated that functional disability was significantly lower in

Table 4:Comparison of changes in functional disability and pain intensity from baseline in the educational control and yoga groups at the post and 3-month follow-up assessments

	Control		Yoga		Between Group	
Variable	Mean+SD	Mean change	Mean+SD	Mean change	Unadjusted P-value	Adjusted P-value
PDI						
Pre	21.2 (20.5)	-	14.3(13.6)			
Post	12.8 (11.9)	-8.4	3.3(5.1)	-11.0	0.611	0.834
3-month	12.7 (11.4)	-8.5	3.9 (53)	-10.4	0.005*	0.009*
PPI						
Pre	1.6 (1.1)	-	1.4(0.9)			
Post	1.2 (1.2)	-0.4	0.5(0.6)	-0.9	0.061	0.018*
3-month	1.1 (0.9)	-0.5	0.5 (0.6)	-0.9	0.140	0.013*
VAS						
Pre	3.2 (2.3)	-	2.3 (1.6)			
Post	2.1 (2.3)	-1.0	1.0 (1.1)	-1.3	0.671	0.146
3-month	2.0 (2.1)	-1.2	0.6 (1.1)	-1.6	0.398	0.039*

Significant differences between groups * P <0.05

Adjusted P-values from ANCOVA that controlled for the baseline score of outcome variables

Table 5 : Comparison of changes in pain medication usage in the educational control and yoga groups after post and 3-month follow-up assessments

Assessment	Outcome	Group Control (n)	Yoga (n)	P-value
Post	Success	6	14	0.002*
	Failure	11	2	
3-month follow up	Success	10	15	0.007*
	Failure	9	1	

Success =stopped or decreased medication use; Failure - no change or increaed medication use
* Significant differences between groups P<0.025)

the yoga group compared to the control group (P =0.005) immediately after the intervention. The greater improvement in functional disability by the yoga group was maintained at the three-month follow-up (P=.009).

Univariate analysis of present pain revealed that yoga subjects reported two times greater reductions in pain than the control group (Table 4). At baseline, the mean VAS score was 2.3 (1.6) and 3.2 (2.3) for the yoga group and the control group, respectively. After the 16-week intervention, the mean score fell to 1.0 (1.1) for the yoga group (56.5%) and to 2.1 (2.3) for the control group (31%). At the three month follow-up, the mean VAS score was 0.6 (1.1) for the yoga group (69.6%) and 2.0 (2.1) for the control group (37.5%). The difference between the two groups became statistically significant at three-month follow-up when the yoga group reported a 70% decrease in present pain compared to the 38% reduction reported by the control group (Table 4).

Pain medication was used by 17 of 24 subjects in control and 18 of 20 subjects in yoga. The subjects used non-steroidal anti-inflammatory drugs (NSAIDS) or acetaminophen. However, one participant in the control group also used a narcotic and muscle relaxant while another used only a muscle relaxant. In the yoga group, four subjects reported using muscle relaxants in addition to NSAIDS with one subject using a narcotic occasionally. Drug usage reported immediately following completion of the study treatments decreased significantly in the yoga group compared to the control group (P =0.002) (Table 5). Upon completion of the 16-week intervention, 88% of the subjects in the yoga group reported decreasing or stopping their medication compared to 35% in the control group. One patient in the control group reported an increase in drug use. None of the patients who used a regimen with multiple analgesic medications reported reducing or stopping a pain medication, while increasing another in the regimen. At the three-month follow-up, both groups reported further decreases in pain medication usage, but the yoga group continued to report significantly greater reductions than the control group (P=0.004, Table 5).

An average of the weekly reported adherence to yoga at home indicated that subjects (n=20) in the yoga group who completed the study practiced 52.3 (7.5 min) minutes per week.

A social validation questionnaire was administered at post-intervention and at 3-month follow-up to all subjects for evaluation of potential confounds and to rate perceptions of the efficacy of the interventions. Possible

confounds probed included use of medical or non-medical treatment, lifestyle changes, or other activities that could impact their LBP. Non-significant differences were found between groups for the above four areas. In addition, both groups were asked whether they read, implemented suggestions in the newsletters or found the information helpful to their recovery from LBP. Overall, 82.2 % read greater than half of the 16 newsletters distributed (n=37), 68% (n=30) reported implementing between half to all of the suggestions recommended in the newsletters, and 79.5% (n=35) of respondents indicated the newsletters were of some to no importance to aiding in the management and recovery from CLBP. No significant between group differences were found on responses to the above three questions. In the yoga group, 95% of subjects (n=19) rated yoga as having either some (n=2) or a large impact (n=17) on their LBP. Moreover, on a 1 to 5 scale with 1= "no importance" and 5 = "great importance", 75% respondents rated yoga of great importance (n=15) while the remaining 25% rated yoga as of "some importance." The entire group rated the yoga treatment as important for managing and recovering from LBP.

It was demonstrated that a 16-week yoga therapy intervention caused a signifcant reduction in self-reported disability and pain and reduced use of pain medication compared to the group in the educational programme.

Discussion

This is the first study to present results of the efficacy of Iyengar yoga on CLBP using a randomized controlled trial. The results support the hypothesis that yoga therapy confers greater benefits to CLBP patients than an educational program. It was demonstrated that a 16-week yoga therapy intervention caused a significant reduction in self-reported disability and pain, and reduced use of pain medication compared to the group in the educational program. The significant improvements by yoga subjects were maintained at the 3-month follow-up, indicating that the yoga intervention is associated with longer lasting reductions in disability and pain outcomes than an educational intervention.

Since both groups improved after their respective interventions in this relatively healthy population of subjects with CLBP, one possible reason for the reported improvement is regression to the mean. However, we think this is unlikely since the control group did not show the same degree of improvement and subjects with such a long medical history of CLBP would be unlikely to improve in 16-weeks in the absence of an intervention. In addition, the majority of subjects in the yoga group rated yoga as having a large impact on their LBP and as having great importance to the management and recovery of LBP.

Improvements in several outcome variables compared favorably to similar studies using active treatment strategies such as exercise, physical therapy protocols incorporating flexibility and strengthening exercises, and cognitive behavioral therapy. The reduction in functional disability due to yoga was greater in 4 out of 5 high quality studies of exercise and CLBP (Frost et al. 1995; Kankaapää et al., 1999; ?FQUOTE "" (Risch et al., 1993; Torstensen et al., 1998; O'Sullivan et al., 1997). The reduction in pain intensity due to

yoga was greater or equal to the reduction reported in 3 of the 5 exercise studies reported above. The effect size (ES) for functional disability and present pain intensity due to yoga in the current study were 2.6 and 0.5, respectively. These ESs were lower than the ES of the treatment group in the above exercise studies but were similar to or higher than the ES from a meta-analysis of cognitive behavioral interventions for adult chronic pain (Morley et al., 1999). A large part of the lower ES due to yoga in the current study reflects the much higher changes from baseline in the control group compared to controls in the above exercise studies. In the current study, the ES of yoga on functional disability (Bombardier et al., 2001) but not on pain intensity (Hagg et al., 2003) meets the reported criteria for being minimally clinically significant. In the current study, reductions in pain medication usage by the yoga group of 25% were comparable to those reported with massage therapy (26%), chiropractic and physical therapy (24-27%), slightly greater than acupuncture(18%), and substantially larger than patient self-care (1%) (Skargren et al., 1997; Cherkin et al., 2001).

We can only compare the results of this study in a general way to those reported in the three published studies evaluating yoga on nonspecific CLBP because of differences in study design, measurement outcomes, instruments and yoga intervention. Present findings of decreased pain and improvement in functional disability following yoga reflect reported decreases in pain status (Vidyasagar etal.,1989) and improvement in disability (Galantino etal., 2004) after yoga. Although Jacobs et al (2004) has some similar outcomes to the current study, they were not published at the time of submission of this manuscript. We expect differences in efficacy of Iyengar yoga from Jacobs et al. (2004) because a different selection of poses was used. The main difference in the Iyengar yoga intervention between the current study and the study by Jacobs et al (2004) is the lack of a resting phase of treatment prior to introducing more active poses and the inclusion of back bending poses in the later study.

The lack of treatment effect on the psychological and behavioral subscales is likely due to the study not having enough power to obtain statistical significance on these secondary outcomes. In addition, the duration of time necessary to change long-held negative cognitions and beliefs about CLBP such as movement-related fear, may be longer than the time required for improved perceptions of pain or disability. It is also possible that the inclusion of a large number of difficult standing postures that require repeated practice to obtain correct pelvic alignment diminished the efficacy of the intervention. Although BKS Iyengar (1976) claims that the standing poses are crucial for recovery from LBP, it is challenging to obtain the correct alignment in the posture that is necessary for pain relief in the learning phase. In such a short intervention, discomfort from improper alignment may have reduced the perceived efficacy of the yoga intervention on long-held negative cognitions and beliefs about the efficacy of yoga on CLBP. It is also possible that the impact of the yoga intervention would have been greater with a more experienced instructor.

The present study revealed methodological issues to address in future studies. In general, baseline measures for pain and functional disability were lower and ratings of back related self-efficacy were higher in the current study than many comparable studies in the literature for patients with CLBP (Grachev et al., 2002, McDonald and Weiskopf 2001; O'Sullivan et al., 1997; Wright et al., 2001). As a result, the study

population was relatively healthy in terms of pain and functional disability and is likely due to the self-referral of subjects. This finding reduces the absolute magnitude of improvement due to border effects and limits the generalizability of the findings to less severe LBP populations. We recommend including cutoffs on outcome measures in the inclusion/exclusion criteria so that a more disabled population is recruited and there is room for measuring improvement. We also recommend the use of fewer outcomes to increase the power of the study and to reduce demand characteristics, testing expectancies, or testing fatigue.

An additional major constraint of the study is the lack of control for attention and physical activity, both of which could be responsible for the significant effects observed in the yoga group. Thus, in future studies, in addition to a standard medical care control, a second control group should be included that controls for attention, group support and physical activity. It is also possible that the treatment effects could be due to therapist bias since the principal investigator of the study was also involved in the delivery of the yoga therapy intervention. We have attempted to minimize this bias by having the data collection and data analysis conducted by other members of the research team. The attrition in this study was twice as high as expected. In a study comparing the effect of medical exercise therapy to conventional physiotherapy and self-exercise, Torstensen et al. (1998) reported a 15.8% drop-out compared the 30% drop-out reported in this study. The attrition in this study drops to 18.3% when subjects are eliminated who discontinued in the study because they didn't show up after the baseline assessment or turned out to be medically ineligible. In future studies, the attrition could be reduced by implementing a more rigorous physician screening to decreased the risk of medically ineligible subjects becoming enrolled in the study and by replacing subjects who don't show up for the first session of treatment. We also believe that the efficacy of the yoga intervention would be enhanced by doing fewer and less challenging poses. We recommend excluding patients with symptomatic osteoarthritis to increase compliance to the yoga intervention and to decrease the likelihood of adverse reactions to the active yoga postures.

Although the duration of the yoga intervention was short, significant results were manifested in a short time and adherance rates to yoga therapy were high.

In spite of the aforementioned limitations, this pilot design demonstrated several methodological strengths. The current design used an objective and standardized screening process to randomize eligible subjects into a longitudinal, experimental design. Moreover, the experimental design incorporated a more realistic, active educational control condition rather than a passive wait-listed group in order to help maintain the motivation of this group and control for positive expectancy. In addition, subject assessment was multidimensional including both objective and subjective tests of disability, pain, and cognition, which enabled the researchers to better assess instruments and tests

for a large scale, clinical trial. Potential confounding factors (age, gender, duration of LBP) were controlled for using an ANCOVA and by determining if there were differences between groups in medical and CAM treatment, and lifestyle changes that could account for the reported changes in pain-related outcomes. Although the duration of the yoga intervention was short by the standards of Iyengar yoga philosophy, significant results were manifested in a short time and adherence rates to yoga therapy were high. Poses and methods used for the treatment program were standardized and documented so that replication of the study is possible (Williams et al. 2003). Future studies should incorporate the above methodological changes. In addition, there is a need for clinical studies that determine whether yoga therapy can decrease medical utilization and for basic science studies that determine the mechanisms responsible for the therapeutic effects of Iyengar Yoga therapy on CLBP.

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Yoga as treatment for chronic pain conditions:
A literature review

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Abstract: Yoga is a popular modality of complementary and alternative medicine (CAM), and yet a relatively small body of literature examines the efficacy of yoga in addressing health problems. This review details the existing studies on yoga for chronic health conditions associated with pain in individuals across the lifespan. Overall, there is compelling preliminary evidence about the beneficial aspects of yoga in addressing a variety of pain conditions including osteoarthritis, back pain, headaches, and irritable bowel syndrome. Problematic to the literature as a body is the lack of detail offered by most researchers about the branch of yoga chosen, the specific postures employed, and the qualifications of yoga teachers in these studies. Also of issue is the typically small sample size as well as an absence of theoretical models to inform interventions and assessments. These shortcomings have conceivably impeded greater wide-scale replication and dissemination of yoga programs for health conditions. Yoga offers a relatively low-cost and easily accessible CAM intervention for people with chronic pain conditions, and would likely be of public health benefit if it were studied more rigorously in the future.

Recent surveys point to the increasing popularity of complementary and alternative medicine (CAM) (Barnes, 2004), particularly for chronic health and pain conditions that may not respond well to conventional medicine. This increase in CAM use is evident in adult as well as pediatric populations (Tsao, & Zeltzer, 2005). Yoga is among one of the more popular CAM treatments, and estimates suggested that approximately 5% of adults in the US practice yoga (Barnes, 2004). A recent study of CAM preferences for children aged 8-18 years with chronic pain found yoga to be amongst the top three CAM treatments (Tsao et al., 2007). Despite its popularity, limited research has explored the empirical efficacy of yoga as a treatment for chronic pain conditions. This review examines the extant literature that does so, and includes studies on yoga and any chronic health condition associated with pain in individuals across the lifespan.

Yoga developed in ancient India incorporating and uniting principles of posture, breathing, and meditation that are thought to bring physiological and psychological benefits to its practitioners. Characterized as a science of self-development through a series of specific asanas (body postures), pranayama (proscribed patterns of breathing), and meditation, yoga has been embraced in modern Western settings as a form of exercise and a technique for relaxation/stress reduction. Currently, yoga programs are relatively low cost and widely available to the public in the form of classes or at home video/book programs. When performed properly, little risk of adverse effects appear to exist. Nevertheless, there is a dearth of empirical research on the

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specific effects of yoga for chronic pain conditions.

Yoga, as a discipline, is divided into many branches. Traditionally Hatha yoga refers to the eight limbs of yoga, but is often used to describe yoga practices that deal with the physical body, and emphasize asana and pranayama. Hatha yoga consists of numerous styles, and some are more suited to the safe treatment of chronic conditions. Iyengar yoga is frequently used in studies of yoga for chronic pain. This tradition emphasizes precision in performing poses and individualizes the practice to each participant's ability and mobility level through the use of props, including blocks, straps and cushions,. Iyengar instructors are required to complete extensive training and certification processes. Because the poses are precise, Iyengar interventions, if detailed appropriately, can be widely and accurately replicated.Hatha yoga styles are varied and the existence of many traditions can create difficulties in standardizing treatment without detailed information about the type of yoga and specific practice employed in studies.

Methods

The effectiveness of search strategies to identify trials using CAM appears to be contingent on the number of databases searched; a variety of different sources are required to identify relevant articles (Pilkington, 2007) . Accordingly, the PubMed, PsychInfo, CINAHL and Cochrane Library databases were searched up to November 2007 using the keywords: 'yoga' 'health' and 'pain.' The focus of this article is to provide an overview of data that has been published in peer-reviewed journals regarding yoga treatments for chronic pain. Due to the limited research available, studies were included if they involved randomized controlled trials (RCTs) or repeated measures without a control group (RM) designs. A number of yoga articles have been published in Indian journals, and despite not being widely circulated, where possible these articles were retrieved and included in the analyses. Examination of the literature revealed three main pain conditions that have been treated with yoga. As grouped below, these conditions included musculoskeletal pain, headache/ migraines and irritable bowel syndrome. Results of the studies are presented in tables 1-3.

Yoga for musculoskeletal conditions

A number of studies have examined the impact of yoga on musculoskeletal conditions and in particular, various forms of arthritis. Most studies have focused on older populations, with few including children, adoles-cents, or young adults. One study in rheumatoid arthritis (RA) patients did include adolescents and young adults but the age range was so broad that extrapolating the findings to specific populations is difficult (Haslock et al., 1994). Despite the small number of participants in this study (n = 10), in each of the yoga and control groups, yoga was found to improve hand grip strength significantly. Hand grip strength was also significantly improved in 20 RA patients following yoga training compared with controls (Dash & Telles, 2001). Garfinkel and colleagues tested Iyengar yoga for patients with osteoarthritis of the hands (Garfinkel, et al., 1994) and carpal tunnel syndrome (Garfinkel et al., 1998). Both studies resulted in the amelioration of pain and improved mobility. The efficacy of Iyengar yoga for osteoarthritis has further been demonstrated by Kolasinski et al (Kolasinski et al., 2005), who found reductions

Study	Pain	Design	Yoga	Participants	Outcome Measures	Sign
Garfinkel, et al (1994)	Osteoarthritis of the hands	RCT Wait-list controls	60-min weekly Iyengar yoga sessn for 8 wks	Yoga (14) Controls (11) Age 52-79 y	Pain, strength, motion, joint circumference,tenderness, hand function	Yoga cont and
Haslock et al (1994)	Rheumatoid arthritis	CT Standard treatment controls	2-hr session 5 d/wk for 3 wks; followed by wkly 2-hr sessions- 3m	Yoga (10) Controls (10) Age 15-72 y	Ring size, stiffness, grip strength Health Assessment Questionnaire General Health Questionnaire	Yoga thar stren
Garfinkel et al (1998)	Carpal tunnel synd.	RCT Standard treatment control	60-90 min biweekly I Iyengar Yoga for 8 wks	Yoga (20) Controls (22) Age 24-77	Grip strength, pain intensity, sleep, Phalen sign, Tinel sign, median nerve motor, sensory conduction time	Yoga Pha im
Dash & Telles (2001)	Rheumatoid arthritis	CT	60-min daily (camp w postures, pranayama) RA patients = 15 d	adults (37) kids (86) Patients (20) Equal n controls women	Hand grip strength	Both in yo cont
Greendale, (2002)	Hyperkyphosis	Repeated Measures	1 hr biweekly Hatha Yoga for 12 wks	21 women Age > 60 y	Anthropomorphic and performance indicators	Incre heig
Galantino et al (2004)	Chronic low back pain	RCT Wait-list controls	60-minute biweekly Hatha yoga for 6 wks	Yoga (11) Controls (11) Age 30-65 y	Oswestry Disability Index, BDI, Sit and Reach Test (SR), Functional Reach Test (FRT),	Tren flexi Yoga
Oken, et al. (2004)	Multiple Sclerosis	RCT 1.Exercise controls 2. Wait list controls	90-min weekly Iyengar yoga for 26 wks	Yoga (22) 1.controls (15) 2. controls (20) Age 37-58 y	Profile of Mood States, State-Trait Anxiety Inventory, Multi-Dimennal Dimensiional Fatigue Inventory, SF-36	Both imp com
DiBenedetto et al (2005)	Stiffness in healthy adults	Repeated measures	90-min biweekly Iyengar yoga for 8 wks	n = 23 (19 completed) Age 62-83 y	Peak hip extension, anterior pelvic tilt, stride length at walking speed.	Pea incre
Kolasinski, et al (2005)	Osteoarthritis of the knee	Repeated measures	90 min Iyengar Yoga once weekly for 8 wks Walk Time	n = 11 (7 completed) Age >50 ys	WOMAC, AIMS2, Patient Global Assessment, 50-foot	Red func
Sherman et al (2005)	Chronic low back pain	RCT 1. Exercise controls 2. Self care book	75-minute weekly Viniyoga for 12 weeks	Yoga (36) 1. controls (33) 2. controls (30) Age 27-57 y	SF-36, Roland Disability Scale, days of restricted activity, medication use	Yoga post & fu cont
Williams et al (2005)	Non-specific chronic low back pain	RCT Educational controls	90-min Iyengar Yoga once weekly for 16 wks	Yoga (30) Controls (30) Age 23-67 y	BPSES , PDI, SF-MPQ, Attitudes, CSQR Tampa Scale of Kinesiophobia, Survey of Pain	Yoga outc stud func

Table 1: Studies examining yoga for musculo-skeletal pain.

Table 2: Studies examining yoga for migraines / headaches.

Study	Pain	Design	Yoga	Participants	Outcome Measures	Significant Finding
Kaliappan & Kaliappan	Migraine	RCT Std treatment controls	16 weeks	Yoga (n=10) Control group (n=10) Age 16-55 years	Headache activity, source of stress, coping patterns,	Improved post-study headaches, medication use, perceived stress and coping for yoga group
	Migraine without aura	RCT Self-care controls	Yoga (n=32) Control (n=33)	60-minute (asana, pranayama, Kriya) 5 times/wk(for 12wks Age 24-44 years	Headache frequency diary), severity numerical scale), McGill Pain Questionnaire, HADS	Yoga group improved headache intensity, frequency, pain, McGill, HADS and medication compared to controls

nificant Findings

a group improved more than
rol group in pain, tenderness
finger range of motion
a group improved more
n control group in hand grip
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a improved over controls in
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ysical functioning, and arthritis
group of patients with osteoarthritis
. That these studies have included
ple sizes (as small as seven) yet still
eficial effects of yoga provides
the efficacy of yoga for arthritis.

rength and flexibility is a recurrent
oss musculoskeletal conditions;
nts in strength and flexibility have
ported in a study of yoga for older
hyperkyphosis (colloquially known
's hump") (Greendale et al., 2002).
l sample of older adults with age-
ness, Iyengar yoga was found to
extension and stride length, further
e flexibility benefits of yoga. These
d repeated measures designs with
ported post-treatment versus pre-
The lack of randomization or
its the strength of the findings. It is
le whether yoga induced
improvement or the mere presence of treatment led to increased functioning.

Studies using RCTs have been reported for multiple sclerosis and chronic back pain. Oken et al conducted an Iyengar yoga intervention for a largely female multiple sclerosis patient population. Although the yoga group showed significantly improved fatigue compared with the wait-list controls, the differences between the yoga intervention and an exercise inter-vention were limited, and no differences were found on mood or cognitive functioning measures. Possibly the condition of the patients deteriorated substantially over the course of the study, which at 6 months is a great deal longer than most other yoga interventions. Health status and disease progression were not controlled in the study. Nevertheless, the findings indicate that yoga is at least as effective as exercise in managing the fatigue of MS, a progressive disease.

A series of RCTs for chronic low back pain revealed mixed results. A six-week hatha yoga class for patients reported non-significant trends toward improved physical and psychological functioning for the yoga group (n = 10) compared with a waitlist control (n = 10) (Galantino et al., 2004). The small sample size and relatively short treatment program may have limited the power to detect significant changes. These null findings can be contrasted with two further studies indicating the benefits of yoga for chronic back pain. In 101 patients, a course of viniyoga yoga led to an improved back-related functioning compared with an exercise control

group and an education group. At 26 weeks post-intervention, the yoga group further demonstrated improved pain levels and functioning compared with the education group (Sherman, et al., 2005). Other positive findings were reported for a similar large group of chronic low back pain patients (Williams et al., 2005). The study found that compared with a control group receiving educational materials on back care, significant improvements occurred in functional and medical outcomes for patients practicing Iyengar yoga. Over half the patients experienced significant reduction in pain, over three-quarters reported improved functionality, and nearly 90% reduced pain medication usage. The latter two studies represent some of the largest RCTs of yoga for chronic pain conditions and provide compelling initial support for the efficacy of yoga in treating chronic low back pain.

Yoga for headache/migraine

Two RCTs have shown that yoga alleviates the physical and psychological aspects of migraine/ headache pain by improving pain severity and psychological functioning and reducing medication use (Kaliappan, 1992) (John et al., 2007). The first of these studies, conducted by Kaliappan and Kaliappan (1992) was limited by a small sample, a heteregenous group of 'headache' sufferers that included tension headaches and migraines, an absence of standardized pain and stress questionnaires, and a lack of description regarding the yoga practice used. The results are still promising and point to the possible role of yoga as a stress reduction technique and an adaptive coping response in alleviating pain.

A larger yoga study conducted for treatment of migraine without aura showed positive benefits (John et al., 2007). Seventy-two patients were randomized to an educational control group or to a yoga treatment the authors termed 'yoga therapy' that combined asanas, pranayama, and kriya, a nasal water cleansing process. After the 3-month intervention, patients in the yoga group reported significant reductions in subscales of the McGill pain questionnaire (frequency, intensity, and sensitivity of pain, an anxiety and depression scale, and medication use compared with controls). The findings support the role of yoga for alleviating the physical and psychological aspects of migraine pain. Nevertheless, which aspects of the yoga therapy were responsible for the improvement or whether such a combined approach is superior to standard yoga involving only pranayama and/or asanas is not known.

Yoga for irritable bowel syndrome

Positive effects have also been found for yoga in irritable bowel syndrome (IBS).. Kuttner et al (2006) provided the only systematic analysis of the use of yoga for pain conditions in children and adolescents (i.e., aged 11-18 years). This limited intervention consisted of a 4-week home practice of yoga, subsequent to an initial training session. To what degree participants actually practiced yoga and to what extent they adhered to the prescribed yoga protocol is unclear. Although the intervention is described as Iyengar yoga, whether a formally trained Iyengar yoga teacher was involved in the intervention and whether the poses taught to children were legitimate Iyengar asanas is unknown. Despite these limitations, Kuttner et al found that the yoga group exhibited significantly improved post-study IBS symptoms and significantly improved disability, coping, and anxiety relative to waitlist controls.

Table 3: Studies examining yoga for irritable bowel syndrome.

Study	Pain	Design	Yoga	Participants Groups	Outcome Measures	Significant Findings
Taneja et al (2004)	Irritable bowel syndrome	RCT Std treatment controls for 8 wks	Twice daily (fixed series of postures	Yoga (9) Control (11) Age 20-50 y	Bowel symptoms, autonomic symptoms, parasympathetic reactivity, STAI	Both groups decrease in bowel movements and anxiety; enhanced stress responses in yoga group compared with controls.
Kuttner et al (2006)	Irritable bowel syndrome	RCT Wait-list controls	60-min instr.session + 4 wks home with videowith video	Yoga (14) Control (11) Age 11-18 y	Pain intensity, gastro symptoms, Functional Disability Inventory, PCQ, RCMAS, CDI-Short Form	Yoga improved disability, coping & anxiety compared with controls; Improved post-study gastro symptoms and coping for yoga group

In an RCT using yoga for IBS symptoms and functioning, Taneja and colleagues (2004) found improved parasympathetic reactivity in a group undergoing biweekly yoga classes for 8 weeks compared with standard treatment controls. One strength of the study was a description of the specific yoga asanas and pranayama used, allowing for replication and critique of the intervention. Both groups improved equally on decreasing bowel movements and anxiety, indicating limited additional benefits for yoga over standard intervention. The yoga group, however, showed significantly decreased autonomic system responses and increased parasympathetic reactivity when compared with controls at the end of the second month of yoga, indicating a decrease in stress responses. Limiting the study is a minimal sample size (n = 9 for the yoga group) and abbreviated health and functioning assessments. Possibly an increase in the study's power may have resulted in notable differences between the groups.

Discussion

Of the 15 studies reviewed, only one study on chronic pain failed to find significant improvement after a yoga intervention (Galantino et al., 2004). This trial tested a 6-week yoga practice for chronic low back pain and reported non-significant trends in the yoga group (Galantino et al., 2004). These null findings underscore the importance of an appropriate sample size (the yoga group included only 11 patients) and a sufficient length of treatment to induce change. A further limitation relevant to all yoga studies is the lack of a realistic placebo group. Given the scientific, practical, and ethical difficulty in developing a legitimate sham yoga group, studies generally use a standard treatment or waitlist control group. It is possible that improvements across studies are the result of patient expectations. Nevertheless, many studies used prior experience with yoga or meditation as exclusion criteria, thus reducing the likelihood of including patients who have strong positive feelings towards yoga.

Among the most important limitations of the existing work on chronic pain and yoga are the

1) inadequate sample size for most of the studies;

(2) overly broad age range (e.g., inclusion of adolescents and elderly patients in the same sample);

(3) lack of specification regarding the yoga

school utilized in most studies; and

(4) lack of a theoretical model to inform treatment implementation and assessment of outcomes.

As a great variation is found across the numerous traditions of yoga, this lack of standardization can confound interpretations of the overall efficacy of yoga on illness states. Without a clear description of the yoga tradition and the specific yoga poses used, further research designed to replicate the findings is difficult. We argue that future yoga research should include not only a clear indication of which specific tradition of yoga the intervention follows (i.e., Iyengar yoga, viniyoga) but also a detailed description of the poses incorporated into the program. This approach will afford greater understanding of which asanas are most beneficial for which conditions and will allow other interventions to replicate benefits. Another important dimension that has to be detailed better in studies of yoga efficacy for health conditions is that of teacher qualifications. Certain forms of yoga, such as Iyengar yoga, require extensive training and accreditation. Background information regarding the teachers' credentials is key to ensuring the validity and reliability of the yoga intervention.

Conclusion

Yoga research suggests that such training benefits pain patients when they follow a program of yoga. Although the improvements on physical symptoms are relatively consistent (e.g., pain intensity, strength, medication use), improvements on psychological functioning scores for pain groups are not as consistent. That said, this result could be a function of the kinds of poses utilized. Other studies looking specifically at psychological functioning and yoga (Woolery, Myers, Sternlieb, & Zeltzer, 2004) demonstrated significant improvements in their population, and the poses in these studies were intended for improved psychological functioning. Possibly, the poses designed specifically for physical and psychological functioning should be implemented if interventions intend to address the entire functioning of the patient.

Generally, yoga is considered a safe practice and one with few dangers to people with health conditions. This aspect has not been rigorously explored, however, and more work is needed in this area to ensure that yoga interventions are indeed safe for a variety of patients. Further large scale RCTs designed to address the safety and efficacy of yoga for health conditions are clearly required before definitive conclusions can be drawn regarding the use of yoga to improve pain and functioning. During the design stage, future studies should also be mindful of employing yoga traditions that involve substantial training in therapeutics. At the least, studies should provide details regarding the yoga tradition and background of teachers used.

At this stage, yoga represents a promising intervention. The practice is low-cost, easily accessible, and poses few, if any, hazards to people with health conditions. As the public is becoming increasingly interested in the use of CAM (Barnes, 2002), the popularity of yoga is likely to continue to grow. Further research is needed to inform health care practitioners regarding the safety and efficacy of yoga for their patients with pain.

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Iyengar Yoga as a Complementary Treatment of Generalized Anxiety Disorder: Pilot Study

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Abstract: This is a report of a pilot study of the benefits of Iyengar yoga practices designed specifically for patients with Generalized Anxiety Disorder GAD) and of its potential as a complementary treatment of GAD. The participants were nine patients with GAD, who showed a clinical picture of anxiety and depression coupled with general neurotic symptoms and somatic dysfunctions. They participated in 17 yoga classes. Comparing pre- and post-intervention assessments, significant reductions were shown for measures of anxiety, depression, hostility, disruption at work due to emotional symptoms, and difficulty at work due to physical issues. Other data suggest that the improvements tended to occur mainly in somatic and behavioral domains. The findings support the therapeutic potential of Iyengar yoga for GAD. Further research is needed to compare Iyengar yoga with other forms of physical activity and exercise and other complementary treatment methods.

In 2004, a systematic review was conducted of the evidence for the effectiveness of yoga for the treatment of anxiety and anxiety disorders (Kirkwood et al., 2005). Positive results were reported in eight studies. The authors of the review concluded that because of the diversity of anxiety conditions treated and the poor quality of most of the studies, it was not possible to say that yoga is effective in treating anxiety in general. They also suggested that further well conducted research is necessary, particularly if focused on specific anxiety disorders. In a previous study of Iyengar Yoga as a complementary treatment of major depressive disorder, we found that clinical measures of both depression and anxiety were significantly reduced from pre- to post-intervention (Shapiro et al., 2007). This is a report of the findings of a pilot study of Iyengar yoga as a complementary treatment of patients specifically diagnosed with Generalized Anxiety Disorder (GAD).

Methods

Participants:

The participants who volunteered for this study were patients of the UCLA Anxiety Disorders Clinic, A. Bystritsky, Director, with the primary diagnosis of GAD in the mild to moderate range. Those with other serious primary psychiatric conditions such as major depression, bipolar disorder, or psychosis were excluded. Also excluded was anyone with physical conditions that would limit their ability to participate fully in the yoga practices. Participants with prior yoga experience exceeding three months were also excluded.

Eleven patients volunteered of whom 2 decided not to participate for non-study reasons. The 9 participants included 7 women and 2 men; age, 32.9 yrs. (23-54) (mean, range); education, 18.3

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yrs. (14-28); marital status, 5 single, 3 married, 1 divorced; occupation, 4 students, 1 teacher, 1 writer, 1 editor, 1 analyst, 1 sales; medication, 7 of the 9 were on anti-anxiety or anti-depressant medications; duration of medication use, 44 mos. (0-132); 5 reported other health problems (chronic fatigue, fibromyalgia, colitis, migraine).

Procedure:

17 1-hour Iyengar Yoga classes (3/wk) were led by three highly experienced and certified Iyengar yoga teachers (Marla Apt., Paul Cabanis, Jim Benvenuto). Attendance was erratic, from 5 to 16 classes; most participants attended 8 or 9 classes (attendance: 5, 8, 8, 8, 9, 9, 9, 13, 16).

The yoga asanas and sequences were designed specifically for anxiety under the guidance of B.K.S. Iyengar. Each session included inverted postures, supported backbends, supine poses and supported forward bends. The teachers emphasized relaxing regions on the body that are prone to tension as a result of anxiety. The backbends focused on stretching the abdomen where there is often tightness associated with anxiety. In all poses, close attention was paid to the position of the head and neck so that the back of the neck was elongated and the facial muscles (where concentrated tension is associated with anxious thinking) were relaxed and allowed to spread. The participants in the study were taught how to relax the eyes, forehead and throat to help calm the mind. The participants were also taught simple pranayama (breathing) techniques that focused on soothing an overactive mind through attention to and lengthening of the exhalation.

Measures:

Assessments were done pre- and post-intervention including: diagnostic interview (MINI, pre-yoga only), Sheehan Disability Scale, Hamilton Anxiety (Ham-A) and Depression (Ham-D) Scales, UCLA4D Anxiety Scale, Cook Medley (CM) Hostility Scale, Spielberger Trait Anxiety (STAI) and Anger Expression (ANGIN, ANGOUT) Scales, Marlowe-Crowne (MC) Social Desirability Scale (defensiveness), Quick Inventory of Depressive Symptoms (QIDS), SF-36 Fitness Scale, Symptom Check List-90 (SCL). Before and after each yoga class, participants rated 20 moods, representing positive, negative, and energy/arousal related emotional states.

Results

Initial data: Ham-A 15.7 (9-23), Ham-D 12. 7 (9-19), UCLA 4D Anxiety Total 50.8 (28-69). These scales were intercorrelated: Ham-A – Ham-D .81, Ham-A – UCLA4D .67, Ham-D – UCLA4D .63. All three scales were positively correlated with CM, STAI, SCL, QIDS, and Sheehan Family disability (emotional problems affecting family) scores and with reported caffeine use and smoking, and negatively correlated with several SF-36 fitness scales (general health, mental health). In general, the pattern is one of anxiety and depression coupled with general neurotic symptoms and somatic dysfunctions.

From pre- to post-intervention, significant reductions were obtained in the means of Ham-A, 6.6 (amount of reduction) ($p < .02$) and Ham-D, 5.6 ($p < .005$), plus a reduction in CM (indirect hostility) (2.9, $p < .02$), improvement in a Sheehan scale (less disruption at work due to emotional symptoms) ($p < .05$) and in a SF-36 fitness scale ($p < .05$) (less difficulty at work due to physical issues).

In regard to the changes in specific items on the Ham scales, most changed in a healthier direction. The following showed significant effects ($ps < .05$): On the Ham-A, items 5, 7, 8,

and 14: less difficulty in concentrating, fewer somatic complaints (muscular, sensory), and less expressed anxiety symptoms during the Ham-A interview. On the Ham-D, items 10, 12, and 15: less psychic anxiety, fewer somatic (GI) complaints, less hypochondriasis.

As to pre-yoga data predicting improvement, these were assessed by correlating test scores at the beginning of the study with changes from pre- to post-yoga in the Ham scales. Taking all correlations greater than .50, these are the measures associated with improvement: With Ham-A: higher Ham-A total; SF-36 scales, less bodily pain, more physical health, more vitality; on the Sheehan, less social and work limitations. With Ham-D: the same SF-36 and Sheehan effects plus lower scores on ANGERIN.

As to the mood ratings, significant changes ($p < .05$) were obtained pre- to post-class on the average over all sessions attended by each participant in 19 out of 20 moods. Positive moods increased, negative moods decreased, and energy-related moods increased. The reduction in Ham-A from pre- to post-intervention was correlated with mean pre- and mean post-session mood ratings per subject. Taking correlations greater than .50, the following post-session moods were associated with improvement in anxiety on the Ham: less fatigued, less depressed, less frustrated, less tired. And before class, participants who rated themselves as less depressed, relaxed, and tired did better. In depression shown in the Ham-D scale for pre- to post-intervention was associated with the following post-session ratings: less blue, depressed, fatigued, frustrated, irritated, pessimistic, relaxed, and sad. In terms of pre-session ratings, the following were associated with improvement in the Ham-D: less angry, blue, depressed, frustrated, irritated, pessimistic, sad, sleep, and tired.

Conclusions

The findings indicate that Iyengar Yoga practices designed for anxiety yielded significant benefit for the participants, a small sample of patients with anxiety and depression and other neurotic symptoms and physical complaints. At the end of the intervention, five out of the nine participants would no longer be considered to have the level of anxiety (Ham-A score greater than 7) to be eligible to participate in the study. The remission rate (56%) compares favorably with drug and other conventional methods of treatment of GAD. Excluding the participant who attended only five sessions, the remission rate is 5 out of 8 or 62%.

The findings indicate that Iyengar Yoga practices designed for anxiety yielded significant benefits for the participants. The remission rate compares favourably with drug and other conventional methods of treatment.

As to attendance and adherence, unlike our previous research with patients with major depressive disorder, these participants were not as likely to drop out early in the study but they were erratic in their attendance. Only three out of the 17 participants attended more than nine out of the 17 sessions. The poor record of adherence is likely characteristic of this patient group, and we need to consider how to deal with it in future studies.

The clinical and test findings support the potential benefit of yoga as a complementary treatment of GAD. It is of interest that the specific improvements tended to fall into the "somatic" or physical and behavioral domains, not so much in terms of cognitive aspects of anxiety such as "worry." It also seems that those who were somewhat healthier, physically speaking, and those whose moods were more positive and less negative to begin with did better. Moreover, the participants whose moods improved the most from before to after classes were most likely to benefit from the program.

This was a preliminary study designed to examine the potential and feasibility of Iyengar yoga as a complementary treatment of GAD and to provide a basis for further systematic research. The findings provide evidence in support of its potential for a specific anxiety disorder. We need now to compare Iyengar yoga for GAD with other forms of physical activity and exercise and other complementary treatment methods.

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The influence of Iyengar Yoga on the quality of life of patients with Parkinson's disease

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Abstract: Parkinson's disease (PD) is a progressive neurodegenerative disorder of the central nervous system. The disease is primarily characterized by tremors, rigidity, bradykinesia (slowness in movement), poor balance and poor gait. This study was carried out to study the influence of Iyengar Yoga on the Quality of Life (QOL) of 27 PD patients as compared with a control group. The yoga group performed specific yogic postures under the guidance of experienced Iyengar Yoga teachers for 12 weeks. The (QOL) of the patients was evaluated before and after completion of 12 weeks using the Parkinson Disease Questionnaire (PDQ-39) and the Unified Parkinson's Disease Rating Scale (UPDRS). The total UPDRS score significantly ($P<0.0005$) decreased in the yoga group as compared with the controls. On studying the individual sub-groups of UPDRS, there was a significant (18.6%; $P< 0.03$) improvement in the mentation, mood and behaviour as well as the motor function (11%; $P<0.001$) in the pre-test and post test evaluation in the yoga group. However, control group indicated no significant change. The PDQ-39 showed significant improvements in all sub-sections in the yoga group. The post-test motor function significantly ($P<0.0001$) improved by 39.5% in the yoga group as compared with 5% in the controls. Activities of daily living, emotional wellbeing showed significant ($P<0.001$) improvements. This preliminary study thus demonstrates that practice of Iyengar Yoga significantly improves the quality of life of PD patients.

Parkinson's disease (PD) is a progressive neurodegenerative disorder of the central nervous system. The disease is primarily characterized by tremors, rigidity, bradykinesia (slowness in movement), poor balance and parkinsonan gait. The secondary symptoms of parkinson's disease include pain, dystonia, sleep disturbances, depression, micrographia (handwiritng becomes smaller), disarthria, difficulty in swallowing and lack of facial expressions.

Bradykinesia (slowness in movement) is a significant and the most disabling symptom as it interferes with routine daily activities like walking and sitting. Rest tremor is the most common presenting symptom of PD. It is least diabling but most embarassing and therefore psychologically distressing. Even a mild tremor can become distrubing as it creates difficult in performing simple tasks like cutting food, buttoning garments and handling utensils.

Intially the symptoms are mild but as the disease progresses, it needs medical intervention. The goal of medical treatment is not to treat the disease but treat the symptoms of the disease and help the patient manage functioning independatly.

One of the limitations of medical therapies are the side effects of the drugs used. Secondly, the benefits of medical therapy are not everlasting, as the medications lose their efficacy with time.

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Therefore attempts have been made to use alternative or complimentary forms of therapy to alleviate the symptoms of the disease. Many of these therapies have their origins in ancient traditional practices of different cultures. Such therapies include Ayruveda, Herbal and Traditional Chinese Medication, Acupuncture, Tai Chi and Yoga.

Yoga is an ancient Indian science and philosophy which dates back to 5000 years having been first been codified in the treatise Yoga darshana by Patanjali. The objective of yoga is to attain control and balance in the mind and body. The control in body and mind, in turn, can be acquired by performing different asanas (postures) and pranayama (modultation of the breath).

In the last century Yogacharya BKS Iyengar, through his teachings and books has brought about a resurgence of interest in this subject all over the world . His method of teaching emphasises on precisely bringing alignment to the body in different asanas. To achieve this goal, various props such as belts, chairs, ropes, blankets, bolsters and other wooden supports are used. His style of teaching yoga is now commonly referred to as Iyengar Yoga. The use of these props also makes it possible for people with physical ailments to perform the classical asanas, which otherwise would not have been possible. The therapeutic effects of Iyengar yoga to treat various medical conditions have been reported .

Yogacharya BKS Iyengar's method of teaching emphasis on precisely bringing alignmet to the body in different asana-s. To achieve this goal several props such as belts, chairs, ropes, blankets, bolsters and wooder supports are used.

There have been reports on the benefits of Iyengar Yoga in patients with PD in the mass media but there have been no controlled trials to substantiate these claims.

The objective of this study was to determine the efficacy of Iyengar Yoga in alleviating the most common symptoms of patients suffering from PD.

Patients and Methods:

Patients : PD patients attending outpatient clinics attached to different hospitals in Mumbai were given an orientation to the proposed study. Patients who volunteered to participate in this study were given a detailed patient information sheet. Written informed consent was obtained from those patients who met with the inclusion exclusion criteria of the study. Information on the personal details of the patient including age, gender, duration of disease and the medication being used was recorded.

Evaluation of the patients: The intensity of the PD was evaluated using the Unified Parkinson's Disease Rating scale (UPDRS) and the Parkinson's Disease Quality of life (PDQ – 39). All the four scales of UPDRS were evaluated. Strengths of the UPDRS include its wide utilization, its application across the clinical spectrum of PD, its nearly comprehensive coverage of motor symptoms, and its clinimetric properties, including reliability and validity Of the range of disease specific instruments that have been developed to assess these dimensions of outcome, the Parkinson's Disease Quality of life (PDQ – 39) is the most widely used instrument with the most extensive

Table 1: Comparision of pre-test and post test values in the yoga and control groups on the UPDRS scale.

Test	Pre-test	Post-test	P value
Mental State Mood and Behaviour			
Control	2.58	2.96	NS
Yoga	2.96	2.41	0.033
Activities of Daily Living			
Control	12.25	10.87	0.02
Yoga	10.81	9.37	0.008
Motor Examination			
Control	26.87	25	NS
Yoga	25.48	22.67	0.0018
Other complications			
Control	2.79	2.83	NS
Yoga	2	1.56	NS
Total Score			
Control	41.71	38.83	NS
Yoga	39.26	34.48	0.0005

supportive evidence of measurement properties such as reliability, validity and responsiveness. Therefore, these two instruments were used to evaluate the patients.

Each patient was evaluated at the time of enrollment of the programme (baseline) and after the completion of three months after 'yoga' intervention.

Selection of patients: A total of 60 patients enrolled for this programme. Of these, 30 were "randomly" assigned to the 'yoga' group and the remaining 30 served as controls.

Yoga therapy: Patients in the yoga therapy group were intially instructed daily for 5 days a week, consecutively for 2 weeks. Each yoga sesssion lasted 1 ¼ hour each. On completion of the 10 day period, the yoga classes were held once a week over a period of two and a half months. During this period patients were provided with an instruction sheet to help them practice yoga. Each patient maintained a weekly record sheet of yoga practice.

The yogic asanas that were taught during this period were Tadasana, Urdhva Hastasana, Urdhva Baddhungliyasana, shoulder and neck traction, Adho Mukha Svanasana, Supta Padangusthasana I and II, Bharadvajasana, Supta Baddha Konasana, Sarvangasana, Setu bandha Sarvangasana and Savasana.

Results

Of the 51 patients enrolled for the study, 27 patients were in the 'yoga therapy' group and 24 served as controls.

Table 2: Comparision of pre-test and post test values in the yoga and control groups on the PDQ scale.

Test	Pre-test Mean Value	Post Test Mean Value	P value
Mobility			
Control	38.27	36.02	NS
Experimental (n = 27)	37.96	23.22	0.000001
Activities of Daily Living			
Control	39.2	27.84	0.005
Experimental	32.56	20.83	0.0007
Emotional Well being			
Control	28.89	25.75	NS
Experimental	30.71	18.52	0.0007
Stigma			
Control	26.99	23.58	NS
Experimental	22.92	17.13	0.12
Social Support			
Control	6.63	7.2	NS
Experimental	9.87	4.32	0.03
Cognition			
Control	22.72	15.62	0.05
Experimental	21.94	14.81	0.005
Communication			
Control	35.98	29.92	NS
Experimental	31.17	19.75	0.004
Bodily Discomfort			
Control	29.54	28.79	NS
Experimental	33.33	23.15	0.02

No significant difference in the pre-test value of the control & experimental group

The mean age of the patients in the yoga group was 64.1 years and those in the control group was 63.7 years. There were 5 women (19.2%) and 22 men (84.6%) in the yoga group while there 4 women (18.2%) and 19 men (86.4%) in the control group. The patients were suffering from PD for a mean duration of 6.2 years while that for the control group was 5.9 years.

UPDRS evaluation

The comparison of the baseline measures of the UPDRS and the PDQ-39 scales were not statitistically different between the groups.

The mental state, mood and behavior reflective of the emotional state of the patients significantly ($P < 0.033$) improved in the yoga group. The activities of daily living should a significant improvement in both the control as well as the yoga group. However, the extent of improvement in the yoga group was more significant than the control group.

There was no change in the motor examination of the control group but showed a significant ($P< 0.0018$) chage in the yoga group. There was no change in the incidence of complications in both the groups.

PDQ Evaluation

The pre and post test values in the control and yoga group are listed in table 2.

Discussion

Attempts have been made in the last few years to improve the quality of life of patients suffering from PD as cure is as yet available for the same. Various forms of complimentary therapies have been evaluated such as acupuncture, tai chi, ayurveda.

We have attempted to study the efficacy of Iyengar Yoga in treating patients with PD. It was observed that in a span of three months, Iyengar Yoga was found to significantly improve the quality of life as judged by both the PDQ and UPDRS scales.

The unique advantages of Iyengar Yoga have been the precise set of instructions on how the patient can perform the asanas (yogic postures) as well as the use of props like chairs, bolsters, blankets. The props gave confidence to the patients to perform the yogic asanas which would have been beneficial to them as well as gave support so that they could stay in the asana for prolonged duration of time to attain its benefits.

The high level of statistical signifiance on both the UPDRS as well as the PDQ scales suggest that the beneficial effect is not merely a feeling of well being but could likely be some physiological effects. Further studies need to be carried out to determine whether any physiological changes are occuring by the practice of yogasanas.

Acknwledgemets

The authors express their gratitude to Yogacharya BKS Iyengar for personal guidance in this study; to Dr BS Singhal for his constant support and encouragement and all the patients who willing cooperated with the reseachers during the study.

Effects of an Iyengar Yoga Program on Postural Stability and Gait in Elderly Women: A Pilot Study

*J Song, **M Garfinkel, J S Yun, B Heilman, E Zoltick, R Newton*

Abstract: Falls are a serious health risk in the elderly. It is estimated that nearly 30% of the individuals over the age of 65 experience a fall. This pilot study was carried out to determine postural stability and gait on elderly females after a 9 week classical Iiyengar yoga programme. 26 participants underwent a special Iyengar Yoga programme prepared for the elderly. They were assessed for postural sway, limits of reach and balance, plantar pressure and footfall parameters at baseline and after 9 weeks. subjects were taller at the follow-up visit. The circular area of postural sway in comfortable stance increased significantly at follow-up, but no significant difference was noted in the Rhomberg position. Subjects walked faster with longer stride lengths but were slower to complete the stair tests. Subjects were able to stand longer during right leg stance at follow-up, although there was no significant difference in the multi-directional reach tests. A barefoot plantar pressure assessment demonstrated significant differences; increased loading under the first metatarsal head along with a reduction of pressure beneath metatarsal head 3 during gait. Statistically significant differences were found between visits. Additional studies, including dynamic postural stability and clinical significance of the yoga intervention in fall prevention, are needed.

Falls are a serious health risk in elderly females. Thirty percent of individuals over the age of 65, the fastest growing segment of the U.S. population, fall every year and approximately 90% of the 240,000 annual hip fractures occur in women 65 years and older.[1] By promoting stretching and strength training, and improving overall awareness during posture and locomotion, a classical Iyengar yoga program is postulated to improve health and wellness in older adults. DiBenedetto et al. reported increased peak hip extension and stride length following an 8-week Iyengar Hatha yoga program in 19 elderly females.[2] The purpose of this pilot study was to examine the effects of a 9-week classical Iyengar yoga program on postural stability and gait on elderly females.

Methods

Employing a single group pre-post test comparison, healthy women aged 60-75 years were evaluated at baseline and following nine weeks (two 90-minute sessions per week) of a structured Iyengar yoga program. Dr. Marian Garfinkel and yoga master BKS Iyengar devised a specific Iyengar yoga exercise program, which consisted of simple non-strenuous poses specifically tailored for the elderly who have had little to no yoga experience. Participants were also instructed to practice particular exercises at home three times per week. This study was approved by the Temple University Institutional Review Board and consent was obtained from each participant prior to enrollment.

Postural sway was quantified with a force plate (Kistler™ Model 9261A) embedded in the floor

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while the subject stood in her comfortable stance and in a Rhomberg position (feet together with eyes closed). Data was captured for a 60 second trial at 240 Hz. The last 40 seconds of data were analyzed to eliminate transient effects, and circular and elliptical areas were fit to the center of pressure excursion.[3] Limits of reach and balance were measured. [4] In addition, plantar pressure and footfall parameters were quantified with EMED-X and GaitMatII™, respectively, during comfortable walking. The difference between baseline and follow-up was assessed using a repeated-measures analysis of variance.

Results

Of 26 participants, 24 completed the study; mean age was 66.8 years (range, 59-76) and mean Body Mass Index was 26.7 kg/m2 (range, 22.1-42.5) at the start of the study. On average, subjects were present for 16.3 instructional yoga sessions (range, 13-18). As summarized in Table 1, subjects were taller at the follow-up visit. The circular area of postural sway in comfortable

Table: Comparision of variables at baseline and after 9 weeks.

Parameters	Baseline	9Wks	P value
Height (cm)	159.54	160.73	0.0006
Weight (kg)	67.99	67.97	0.9260
Hip Flexion, Knee Extended (°)	71.21	77.85	0.0001
Ankle Dorsiflexion, Knee Extended (°)	-7.59	-2.64	0.0001
1st metatarsophalangeal joint dorsiflexion (°)	51.41	54.46	0.0363
Postural Sway			
Circular Area of sway- Comfortable (mm2)	377.89	520.46	0.0379
Circular Area of sway - Rhomberg (mm2)	1105.08	1064.73	0.7035
MDRT			
Forward Reach (cm)	27.36	30.00	0.1111
Back Reach (cm)	16.75	19.35	0.1750
Left Reach (cm)	15.99	17.88	0.0973
Right Reach (cm)	18.29	16.90	0.3670
Left stand (sec)	18.50	19.33	0.6010
Right stand (sec)	18.72	23.09	0.0441
Tandem (sec)	25.34	28.62	0.1800
GaitMat Footfall parameters			
Gait Speed (m/s)	1.04	1.09	0.0300
Stride Length- Left (m)	1.11	1.16	0.0012
Stride Length- Right (m)	1.12	1.16	0.0020
EMED - Dynamic Plantar Pressure			
Center of Pressure Excursion Index (%)	16.11	16.88	0.3731
Peak Pressure (N/cm2)	65.85	64.89	0.6490
Peak Pressure-Metatarsal head 1	19.3	22.8	0.0192
Peak Pressure- Metatarsal head 3	11.56	10.79	0.0191
Pressure Time Integral- Hallux	7.18	6.8	0.0519

stance increased significantly at follow-up, but no significant difference was noted in the Rhomberg position. Subjects walked faster with longer stride

lengths but were slower to complete the stair tests. Subjects were able to stand longer during right leg stance at follow-up, although there was no significant difference in the multi-directional reach tests. A barefoot plantar pressure assessment demonstrated significant differences; increased loading under the first metatarsal head along with a reduction of pressure beneath metatarsal head 3 during gait. Results of the dynamic plantar pressure and the first metatarsophalangeal joint range of motion suggest improved foot biomechanics.

Discussion

Statistically significant differences were found between visits; subjects walked faster with longer stride lengths in agreement with the findings of DiBenedetto et al.[2] Subjects also showed improved lower extremity joint range of motion and changes in dynamic plantar pressures. Although the study was limited to 9 weeks, results suggest these interventions can have measurable differences in postural stability, lower extremity joint range of motion, and gait. Additional studies, including dynamic postural stability and clinical significance of the yoga intervention in fall prevention, are needed.

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A compilation of abstracts of research papers published on the therapeutic aspects of Iyengar Yoga

A Yoga Intervention for Young Adults with Elevated Symptoms of Depression

-- A Woolery, H. Myers, B. Sternlieb, L Zelzter

Context: Yoga teachers and students often report that yoga has an uplifting effect on their moods, but scientific research on yoga and depression is limited.

Objective: To examins the effects of a short term Iyengar Yoga course on mood in mildly depressed young adults.

Design: Young adults pre-screened for mild levels of depression were randomly assigned to a yoga course or wait-list control group.

Setting: College campus recreation centre.

Participants: Twenty eight volunteers ages between 18 to 29. At itake, all participants were experiencing mild levels of depression, but had received no current psychiatric diagnosis or treatments. None had significant yoga experience.

Intervention: Subjects in the yoga group attended two 1-hour Iyengar Yoga classes each week for 5 consecutive weeks. The classes emphasized yoga postures thought to alleviate depression, particularly back bends, standing poses and inversions.

Main outcome measures:Beck Depression Inventory. State Trait Anxiety Inventory, Profile of Mood States, morning cortisol levels.

Results: Subjects hwo participated in the ygoa course demonstratedsignificant decreases in self reported symptoms of depression and trait anxiety. These effects emerged by the middle of the yoga course and were maintained by the end. Changes also were observed in the acute mood, with subjects reporting decreased levels of negative mood and fatigue following yoga classes. Finally there was a trent for higher morning cortisol levels in the yoga group by the end of the yoga course, compared to controls. These finding provide suggestive evidence of the utility of yogasanas in improving mood and support the need for further studies with larger samples and more complex study designs to more fully evaluate the effects of yoga on mood disturbances.

The paper has been published in Alt Therap Health Med (2004) 10:60-63

Rapid stress reduction and anxiolysis among distressed women as a consequence of a three-month intensive yoga program

-- *Andreas Michalsen, P. Grossman, A Acil, J Langhorst, R Ludtke, T Esch, G Stefano, G Dabos*

Background: Emotional distress is an increasing public health problem and Hatha yoga has been claimed to induce stress reduction and empowerment in practicing subjects. We aimed to evaluate potential effectsof Iyengar Hatha yoga on perceived stress and associated psychological outcomes in mentally distressed women.

Materials and Methods: A controlled prospective non-randomized study was conducted in 24 self-referred female subjects (mean age 37.9±7.3 years) who perceived themselves as emotionally distressed. Subjects were offered participation in one of two subsequential 3-months yoga programs. Group 1 (n=16) participated in the fi rst class, group 2 (n=8) served as a waiting list control. During the yoga course, subjects attendedtwo-weekly 90-min Iyengar yoga classes. Outcome was assessed on entry and after 3 months by Cohen Perceived Stress Scale, State-Trait Anxiety Inventory, Profi le of Mood States, CESD-Depression Scale, Bf-S/Bf-S' Well-Being Scales, Freiburg Complaint List and ratings of physical well-being. Salivary cortisol levels were measured before and after an evening yoga class in a second sample.

Results: Compared to waiting-list, women who participated in the yoga-training demonstrated pronounced and significant improvements in perceived stress ($P<0.02$), State and Trait Anxiety ($P<0.02$ and $P<0.01$, respectively), well-being ($P<0.01$), vigor ($P<0.02$), fatigue ($P<0.02$) and depression ($P<0.05$). Physical well-being also increased ($P<0.01$), and those subjects suffering from headache or back pain reported marked pain relief. Salivary cortisol decreased signifi cantly after participation in a yoga class ($P<0.05$).

Conclusion: Women suffering from mental distress participating in a 3-month Iyengar yoga class show significant improvements on measures of stress and psychological outcomes. Further investigation of yoga with respect to prevention and treatment of stress-related disease and of underlying mechanism is warranted.

The paper has been published in Med Sci Monitor (2005) 11:CR555-561

Feasibility and acceptibility of restorative yoga for treatment of hot flushes: A pilot trial

-- Cohen BE, Kanaya AM, Macer JL, Shen H, Chang AA, Grady D.

Objective: To determine the feasibility and acceptability of a restorative yoga intervention for the treatment of hot flushes in postmenopausal women.

Methods: A pilot trial in 14 postmenopausal women experiencing >/=4 moderate to severe hot flushes per day or >/=30 moderate to severe hot flushes per week. The intervention consisted of eight restorative yoga poses taught in a 3-h introductory session and 8 weekly 90-min sessions. Feasibility was measured by recruitment rates, subject retention and adherence. Acceptability was assessed by subject interview and questionnaires. Efficacy measures included change in frequency and severity of hot flushes as recorded on a 7-day diary.

Results: Recruitment was accomplished as planned. The majority of study subjects (93%) completed the trial. Of those who completed the trial, 92% attended seven or more of the eight yoga sessions. The majority of the subjects were satisfied with the study and 75% continued to practice yoga 3 months after the study. Mean number of hot flushes per week decreased by 30.8% (95% CI 15.6-45.9%) and mean hot flush score decreased 34.2% (95% CI 16.0-52.5%) from baseline to week 8. No adverse events were observed.
Conclusions: This pilot trial demonstrates that it is feasible to teach restorative yoga to middle-aged women without prior yoga experience. The high rates of subject retention and satisfaction suggest that yoga is an acceptable intervention in this population. Our results indicate that a larger, randomized controlled trial to explore the efficacy of restorative yoga for treatment of menopausal symptoms would be safe and feasible.

The paper has been published in Mauritas (2004) E-Pubmed

Randomized controlled trial of yoga and exercise in multiple sclerosis

-- B.S. Oken, S. Kishiyama, D. Zajdel, D. Bourdette, J. Carlsen, M. Haas, DCC. Hugos, D.F. Kraemer, J. Lawrence, BS;

Objective: To determine the effect of yoga and of aerobic exercise on cognitive function, fatigue, mood, and quality of life in multiple sclerosis (MS).

Methods: Subjects with clinically definite MS and Expanded Disability Status Score less than or equal to 6.0 were randomly assigned to one of three groups lasting 6 months: weekly Iyengar yoga class along with home practice, weekly exercise class using a stationary bicycle along with home exercise, or a waiting-list control group. Outcome assessments performed at baseline and at the end of the 6-month period included a battery of cognitive measures focused on attention, physiologic measures of alertness, Profile of Mood States, State-Trait Anxiety Inventory, Multi-Dimensional Fatigue Inventory (MFI), and Short Form (SF)-36 health-related quality of life.

Results: Sixty-nine subjects were recruited and randomized. Twelve subjects did not finish the 6-month intervention. There were no adverse events related to the intervention. There were no effects from either of the active interventions on either of the primary outcome measures of attention or alertness. Both active interventions produced improvement in secondary measures of fatigue compared to the control group: Energy and Fatigue (Vitality) on the SF-36 and general fatigue on the MFI. There were no clear changes in mood related to yoga or exercise.

Conclusion: Subjects with MS participating in either a 6-month yoga class or exercise class showed significant improvement in measures of fatigue compared to a waiting-list control group. There was no relative improvement of cognitive function in either of the intervention groups.

The paper has been published in Neurology (2004) 62:2058-2064

Yoga-Based Intervention for Carpal Tunnel Syndrome:
A Randomized Trial

-- M Garfinkel, A Singhal, WA Katz, DA Allan, R Reshetar, R Schumacher

Context:Carpal tunnel syndrome is a common complication of repetitive activities and causes significant morbidity.

Objective: To determine the effectiveness of a yoga-based regimen for relieving symptoms of carpal tunnel syndrome.

Design: Randomized, single-blind, controlled trial.

Setting: A geriatric center and an industrial site in 1994-1995.

Patients: Forty-two employed or retired individuals with carpal tunnel syndrome (median age, 52 years; range, 24-77 years).

Intervention: Subjects assigned to the yoga group received a yoga-based intervention consisting of 11 yoga postures designed for strengthening, stretching, and balancing each joint in the upper body along with relaxation given twice weekly for 8 weeks. Patients in the control group were offered a wrist splint to supplement their current treatment.

Main Outcome Measures: Changes from baseline to 8 weeks in grip strength, pain intensity, sleep disturbance, Phalen sign, and Tinel sign, and in median nerve motor and sensory conduction time.

Results: Subjects in the yoga groups had significant improvement in grip strength (increased from 162 to 187 mm Hg; P = .009) and pain reduction (decreased from 5.0 to 2.9 mm; P = .02), but changes in grip strength and pain were not significant for control subjects. The yoga group had significantly more improvement in Phalen sign (12 improved vs 2 in control group; P = .008), but no significant differences were found in sleep disturbance, Tinel sign, and median nerve motor and sensory conduction time.

Conclusions: In this preliminary study, a yoga-based regimen was more effective than wrist splinting or no treatment in relieving some symptoms and signs of carpal tunnel syndrome.

The paper has been published in JAMA (1998) 280:1601-1603

Iyengar Yoga for Treating Symptoms of Osteoarthritis of the Knees: A Pilot Study

--S Kolansinski, M Garfinkel, A Singhal, AG Tsai, W Matz, A V Dyke, R Schumacher

Objectives: The American College of Rheumatology (ACR) Guidelines for the medical management of osteoarthritis (OA) emphasize the use of nonpharmacologic interventions including exercise. Implementation of an exercise program can be difficult for patients, and little is known about the benefits of alternative therapies such as yoga. The aim of this pilot study was to assess the feasibility of using yoga in the tradition of B.K.S.Iyengar to treat the symptoms of osteoarthritis of the knee.

Design: Participants were instructed in modified Iyengar yoga postures during 90-minute classes once weekly for 8 weeks.

Subjects: Participants met ACR criteria for osteoarthritis of the knee and completed a medical history and physical examination, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Arthritis Impact Measurement Scale 2 (AIMS2), Patient Global Assessment (GA) by Visual Analog Scale (VAS), Physician GA by VAS, and 50-foot Walk Time before and following an 8-week course of yoga instruction. Eleven (11) subjects enrolled, nine completed at least one session and seven (six of whom were obese) had data from pre- and post-course time points available for analysis.

Results: Statistically significant reductions in WOMAC Pain, WOMAC Physical Function, and AIMS2 Affect were observed when participants' status were compared to their pre-course status. WOMAC Stiffness, AIMS2 Symptoms, Social and Role, Physician GA, and Patient GA measured trends in improvement of symptoms. No adverse events from treatment were reported.

Conclusions: This pilot study suggests that yoga may provide a feasible treatment option for previously yoga-naive, obese patients !50 years of age and offers potential reductions in pain and disability caused by knee OA. Future studies should compare yoga to other nonpharmacologic interventions for knee OA, such as patient education or quadriceps-strengthening exercises .

The paper has been published in J Altern Comp Med (2005) 11:689-693

Effect of a gentle Iyengar yoga program on gait in the elderly: an exploratory study.

-- DiBenedetto M, Innes KE, Taylor AG, Rodeheaver PF, Boxer JA, Wright HJ, Kerrigan DC.

Objective: To determine if a tailored yoga program could improve age-related changes in hip extension, stride length, and associated indices of gait function in healthy elders, changes that have been linked to increased risk for falls, dependency, and mortality in geriatric populations.

Design: Single group pre-post test exploratory study. A 3-dimensional quantitative gait evaluation, including kinematic and kinetic measurements, was performed pre- and postintervention. Changes over time (baseline to postintervention) in primary and secondary outcome variables were assessed using repeated-measures analysis of variance.

Setting: Yoga exercises were performed in an academic medical center (group classes) and in the subjects' homes (yoga home-practice assignments). Pre- and postassessments were performed in a gait laboratory.
Participants: Twenty-three healthy adults (age range, 62-83 y) who were naive to yoga were recruited; 19 participants completed the program.

Intervention: An 8-week Iyengar Hatha yoga program specifically tailored to elderly persons and designed to improve lower-body strength and flexibility. Participants attended two 90-minute yoga classes per week, and were asked to complete at least 20 minutes of directed home practice on alternate days. MAIN OUTCOME **Measures**: Peak hip extension, average anterior pelvic tilt, and stride length at comfortable walking speed.

Results: Peak hip extension and stride length significantly increased ($F_{1,18}=15.44$, $P<.001$; $F_{1,18}=5.57$, $P=.03$, respectively). We also observed a trend toward reduced average pelvic tilt ($F_{1,18}=4.10$, $P=.06$); adjusting for the modifying influence of frequency of home yoga practice strengthened the significance of this association (adjusted $F_{1,17}=14.30$, $P=.001$). Both the frequency and duration of yoga home practice showed a strong, linear, dose-response relationship to changes in hip extension and average pelvic tilt.
Conclusions: Findings of this exploratory study suggest that yoga practice may improve hip extension, increase stride length, and decrease anterior pelvic tilt in healthy elders, and that yoga programs tailored to elderly adults may offer a cost-effective means of preventing or reducing age-related changes in these indices of gait function.

The paper has been published in Arch Phy Med Rehabil (2005) 86:1830-1837

Randomized Control 6-month Trial of Yoga in Healthy Seniors
Effects on Cognition and Quality of Life

-- B.S. Oken, D. Zajdel, S. Kishiyama, K Flegal, C Dehen, M Haas, D.F. Kraemer, J. Lawrence, J. Leyva

Context: There are potential benefits of mind-body techniques on cognitive fijnction because the techniques involve an active attentional or mindfulness component, but this has not been fully explored.

Objective: To determine the effect of yoga on cognitive function, fatigue, mood, and quality of life in seniors.

Design: Randomized, controlled trial comparing yoga, exercise,and wait-list control groups.

Participants: One hundred thirty-five generally healthy men and women aged 65-85 years.

Intervention: Participants were randomized to 6 months of Hatha yoga class, walking exercise class, or wait-list control. Subjects assigned to classes also were asked to practice at home.

Main Outcome Measures: Outcome assessments performed at baseline and after the 6-month period included a battery of cognitive measures focused on attention and alertness, the primary outcome measures being performance on the Stroop Test and a quantitative electroencephalogram (EEG) measure of alertness; SF-36 health-related quality of life; Profile of Mood States; Multi-Dimensional Fatigue Inventory; and physical measures related to the interventions.

Results: One hundred thirty-five subjects were recruited and randomized. Seventeen subjects did not finish the 6- month intervention. There were no effects from either of the active interventions on any of the cognitive and alertness outcome measures. The yoga intervention produced improvements in physical measures (eg, timed 1-legged standing, forward flexibility) as well as a number of quality-of-life measures related to sense of well-being and energy and fatigue compared to controls.

Conclusions: There were no relative improvements of cognitive function among healthy seniors in the yoga or exercise group compared to the wait-list control group. Those in the yoga group showed significant improvement in quality-of-life and physical measures compared to exercise and wait-list control groups.

The paper has been published in Alt Therap Health Med (2006) 12:40-47

Restorative Yoga for Women with Ovarian or Breast Cancer:
Findings from a Pilot Study

-- SC Danhauer, JA TroozeDF Farmer, CR Campbell, RP McQuellon, R Barrett, BE Miller

Yoga has demonstrated benefit in healthy individuals and those with various health conditions. There are, however, few systematic studies to support the development of yoga interventions for cancer patients. Restorative yoga (RY) is a gentle type of yoga that has been described as ''active relaxation.'' The specific aims of this pilot study were to determine the feasibility of implementing an RY intervention as a supportive therapy for women diagnosed with ovarian or breast cancer and to measure changes in self-reported fatigue, psychological distress and well-being, and quality of life. Fifty-one women with ovarian (n= 5 37) or breast cancer (n= 5 14) with a mean age of 58.9 years enrolled in this study; the majority (61%) were actively undergoing cancer treatment at the time of enrollment. All study participants participated in 10 weekly 75-minute RY classes that combined physical postures, breathing, and deep relaxation. Study participants completed questionnaires at baseline, immediately postintervention, and 2 months postintervention. Significant improvements were seen for depression, negative affect, state anxiety, mental health, and overall quality of life. Fatigue decreased between baseline and postintervention follow-up. Health-related quality of life improved between baseline and the 2-month follow-up. Qualitative feedback from participants was predominantly positive; relaxation and shared group experience were two common themes.

The paper has been published in J Society of Integrative Oncology (2008) 6:47-48

Adherence to yoga and exercise interventions
in a 6-month clinical trial

-- kE Flegal, S Kishiyama, D Zajdel, M Haas and BS Oken

Background:To determine factors that predict adherence to a mind-body intervention in a randomized trial.

Design: We analyzed adherence data from a 3-arm trial involving 135 generally healthy seniors 65–85 years of age randomized to a 6-month intervention consisting of: an Iyengar yoga class with home practice, an exercise class with home practice, or a wait-list control group. Outcome measures included cognitive function, mood, fatigue, anxiety, health-related quality of life, and physical measures. Adherence to the intervention was obtained by class attendance and bi-weekly home practice logs.

Results: The drop-out rate was 13%. Among the completers of the two active interventions, average yoga class attendance was 77% and home practice occurred 64% of all days. Average exercise class attendance was 69% and home exercise occurred 54% of all days. There were no clear effects of adherence on the significant study outcomes (quality of life and physical measures). Class attendance was significantly correlated with baseline measures of depression, fatigue, and physical components of health-related quality of life. Significant differences in baseline measures were also found between study completers and drop outs in the active interventions. Adherence was not related to age, gender, or education level.

Conclusions: Healthy seniors have good attendance at classes with a physically active intervention. Home practice takes place over half of the time. Decreased adherence to a potentially beneficial intervention has the potential to decrease the effect of the intervention in a clinical trial because subjects who might sustain the greatest benefit will receive a lower dose of the intervention and subjects with higher adherence rates may be functioning closer to maximum ability before the intervention. Strategies to maximize adherence among subjects at greater risk for low adherence will be important for future trials, especially complementary treatments requiring greater effort than simple pill-taking.

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