

Spotlight on Yoga

Hatha yoga exercise continues to emerge as an effective means of improving muscular strength, flexibility, balance and—perhaps most important—mental development and self-efficacy. Scientific evidence suggests that hypertension, insulin resistance, chronic pain, coronary disease and asthma all respond favorably to one or more forms of hatha yoga. To have the best chance of generating measurable benefits, a yoga program must incorporate three integral components: (1) hatha yoga poses within the participant's functional capacity; (2) a cognitive, contemplative component and (3) breath work.

Despite all the interest in and perceived benefits of yoga in the West, there remains a great need for more peer-reviewed and adequately controlled research trials investigating the impact of yoga on chronic disease, musculoskeletal function and behavioral outcomes. Although a considerable international body of research is now available—more than 3,000 published papers worldwide—much of it is statistically underpowered, lacking in adequate controls and/or void of comparisons with conventional health-enhancement models. The quantity and quality of hatha yoga research will surely escalate as structured course work in mindful exercise modalities is developed in Western graduate schools and students pursue study and investigational projects in this promising form of ancient exercise.

Presented here are brief reviews of five recently published papers on the benefits of and physiological responses to hatha yoga exercise. Readers are encouraged to browse one of the many MEDLINE search engines (e.g., PubMed, Medscape) to explore in greater depth the growing number of yoga research abstracts and reviews.

Lung Capacity and Yoga

Birkel, D. A., & Edgren, L. 2000. Hatha yoga: Improved vital capacity of college students. *Alternative Therapies in Health and Medicine*, 6 (6), 55-63.

Study. The vital capacity of the lungs (functional lung volume) is a critical component of good health. Vital capacity is an important concern for those with asthma, heart conditions or lung ailments; those who smoke; and those who have no known lung problems.

Researchers at Ball State University in Muncie, Indiana, studied the effects of yoga poses and breathing exercises on vital capacity. The investigators measured lung volume using the Spiropet spirometer (an instrument designed specifically for this purpose). Determinants were taken near the beginning and end of two 17-week semesters. No control group was used. A total of 287 college students (89 men and 198 women) enrolled in the yoga training program.

Subjects were taught yoga poses, breathing techniques and relaxation in 50-minute class meetings twice weekly for 15 weeks. Class adherence was very high (99.96%). The main outcome measure was vital capacity over time for asthmatics, smokers and subjects with no known lung disease. The large number of subjects—287—was a valid sample for a study of this type.

The study showed a statistically significant ($p < 0.001$) improvement in vital capacity across all categories over time. It is not known whether this positive improvement was the result of yoga poses, breathing techniques, relaxation or other aspects of exercise in the subjects' life. However, these findings were consistent with those of other

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research studies.

Comments. Increases in lung capacity and function are among the trademark benefits of yoga exercise as long as it is of sufficient quality and duration and involves a distinct yogic breathing component. Earlier studies have demonstrated yoga-induced increases in forced expiratory volume in one second (FEV-1), the factor that is perhaps the most functional index of lung function. This is an important benefit for those who have diminished lung volume and function from emphysema or a sedentary lifestyle.

Yoga and Heart Rate Variability

Raghuraj, P., et al. 1998. Effect of two selected yogic breathing techniques on heart rate variability. *Indian Journal of Physiological Pharmacology*, 42 (4), 467-72.

Study. Heart rate variability (HRV) is a functional measure of the proficiency of the parasympathetic nervous system. Greater variability is associated with relaxation and quiescence and a lower risk of major cardiovascular events, such as heart attack.

To measure HRV, two spectral components of an electrocardiogram are usually recorded: a *high-frequency* (0.15-0.50 hertz [Hz]) component, attributable to parasympathetic activity, and a *low-frequency* component (0.05-0.15 Hz), attributable to sympathetic activity.

Researchers at the Vivekananda Kendra Yoga Research Foundation in Bangalore, India, studied HRV during two yoga practices that had previously been found to have opposite effects: sympathetic stimulation (*kapalabhati*, or breathing at high frequency, i.e., 2 breaths per second for several seconds) and reduced sympathetic activity (*nadisuddhi*, or alternate-nostril

breathing). All 12 male volunteers (age range = 21-33 years) were assessed before and after each practice on separate days.

Following kapalabhati, low-frequency power and the ratio of low to high frequency increased significantly, whereas high-frequency power fell significantly. There were no significant changes following nadisuddhi. According to Raghuraj and colleagues, these results suggest that (1) kapalabhati modifies cardiac autonomic control (nervous system regulation of heart function) by increasing sympathetic activity and reducing vagal (primary parasympathetic nerve) activity and (2) HRV is a more useful psychophysiological measure than heart rate alone.

Comments. HRV is an up-and-coming measure of cardiovascular function in clinical cardiology. HRV cannot be discerned by heart rate palpation or wrist-worn cardiometers; it must be measured using very expensive electrocardiographic spectral analysis equipment, such as that found in university-based cardiovascular research institutions.

Yoga and Depression

Janakiramaiah, N., et al. 2000. Antidepressant efficacy of Sudarshan Kriya Yoga (SKY) in melancholia: A randomized comparison with electroconvulsive therapy (ECT) and imipramine. *Journal of Affective Disorders*, 57(1-3), 255-9.

Study. Sudarshan kriya yoga (SKY) is a procedure that involves rhythmic hyperventilation at different rates. SKY's ability to reduce depression was demonstrated in a prospective, open clinical trial conducted by researchers at the National Institute of Mental Health and Neuro Sciences in Bangalore, India. This study measured the antidepressant efficacy of SKY as a treatment for melancholia against the efficacy of two of the current standard treatments, electroconvulsive therapy (ECT) and imipramine (IMN), an antidepressant also known as tofranil. Consenting, untreated melancholic depressives ($n = 45$) were hospitalized and randomized equally into the three treatment

groups. They were assessed at recruitment and weekly thereafter for four weeks.

Total scores on the Beck Depression Inventory and the Hamilton Rating Scale for Depression (HRSD) dropped significantly on successive occasions in all three groups. From group to group, however, results did not differ significantly. At week three, the SKY group's scores were higher than the ECT group's but no different from the IMN group's. Rates of remission (defined as a total HRSD score of 7 or less) at the end of the trial were 93, 73 and 67 percent in the ECT, IMN and SKY groups, respectively. No clinically significant side effects were observed in any group. While acknowledging the limitations of the design (lack of double-blind conditions), the authors concluded that SKY, although inferior to ECT, can be a potential alternative to drugs like IMN as a first-line treatment for melancholia.

Comments. This is one of the first studies to investigate the effect of a meditation-based yoga practice on patients with clinically documented depression. Many patients with depression appear to be responsive to exercise therapy. In theory and as borne out, in part, by the results of this study, yoga may have at least as much to offer as some standard treatments, given its balanced inclusion of individualized asana-exercise, breath work and quiet cognitive aspects.

Yoga and Treadmill Exercise Recovery

Bera, T. K., Gore, M. M., & Oak, J. P. 1998. Recovery from stress in two different postures and in Shavasana—a yogic relaxation posture. *Indian Journal of Physiological Pharmacology*, 42 (4), 473-8.

Study. Researchers at the Scientific Research Department at Kaivalyadhama S.M.Y.M. Samiti in Lonavla, India, compared the efficacy of Shavasana (a yogic relaxation posture) and two other postures (resting in a chair and resting in the supine position) as methods of recovery from induced physiological stress (treadmill running).

Twenty-one males and six females (age

range = 21-30 years) were allowed to rest in one of the above postures after completing a treadmill workout. Recovery was assessed by measuring resting and exercise recovery heart rate and blood pressure. These factors were measured before and every two minutes after the treadmill running until they returned to their initial resting levels.

The results revealed that the effects of treadmill exercise stress were reversed in significantly ($p < 0.01$) shorter time with Shavasana than with either of the other two resting postures.

Comments. The Shavasana pose (sometimes spelled “Savasana” or called “corpse pose”) is often overlooked as an effective yoga pose. Seemingly easy, it is one of the most challenging poses in yoga. Shavasana is practiced in a relaxed supine position, feet apart, palms facing up to gently open the chest. The neck should be extended. (Placing a folded towel underneath the neck is recommended.) What primarily distinguishes Shavasana from the other two modes of relaxation used in this study is utilization of the breath. Abdominal yogic breathing is sequenced with normal breathing throughout Shavasana.

Effects of an Intensive Yoga Program

Schmidt, T., et al. 1997. Changes in cardiovascular risk factors and hormones during a comprehensive, residential three-month kriya yoga training program and vegetarian nutrition. *Acta Physiologica Scandinavica*, 640 (Suppl.), 158-62.

Study. Researchers at Hannover Medical University in Hannover, Germany, investigated some of the effects of a comprehensive, residential three-month kriya yoga training program on cardiovascular risk factors in 106 healthy adults (58 men and 48 women ages 18-64 years, mean age = 29.6 years). Kriya yoga is an advanced tantric meditation process combining physical and mental techniques; sessions last four hours or longer.

The yoga program, which took place at the Scandinavian Yoga and Meditation School in Ha, Sweden, consisted of three

parts: During the *first month*, subjects practiced traditional yoga (daily hatha yoga exercises, breathing techniques, deep relaxation and meditation). In the *second month*, they learned kriya yoga. In the *final month*, they practiced kriya yoga daily, along with other yoga techniques and advanced meditations. Practical work in the school's kitchen, garden, fields and woods constituted an essential part of the training. Throughout the program, participants adhered to a low-fat (23% fat) vegetarian diet with no alcohol or caffeine. Pre- and postlaboratory assessments included blood lipids and lipoproteins, complete blood counts, fibrinogen (a plasma protein that contributes to the formation of blood clots), urinary and serum hormone levels, stress reactivity and blood pressure. The subjects were compared to control groups living their normal lives in Hannover; subjects and controls were matched for age, gender and respective initial risk factor levels.

The subjects lost an average of 5.7 kilograms and reduced their body mass index (BMI) by 1.88. Men experienced significant reductions in total serum cholesterol (from 181 to 166 milligrams per deciliter [mg/dl]), LDL cholesterol (from 117 to 102 mg/dl) and LDL-to-HDL ratio (from 2.7 to 2.2) ($p < 0.001$ in each category). Reductions in these categories were not significant for women, whose initial levels were lower than the men's. HDL cholesterol did not change significantly in men or women. In the 15 participants whose HDL was initially < 35 mg/dl, however, HDL did increase significantly (from 30 to 40 mg/dl, $p < 0.001$).

Compared to the matched controls, male and female yoga participants had, after three months, significantly reduced their fibrinogen levels (decreasing the risk of blood clots) ($p = 0.04$). Blood pressure and heart rate dropped significantly during the course, with blood pressure improvements being more pronounced (decreasing from 150/82 to 123/69) in those with initial systolic blood pressure levels ≥ 140 millimeters of mercury (both $p < 0.0001$). Serum testosterone levels and urinary excretions

of adrenaline, noradrenaline, dopamine and aldosterone all fell significantly in the study group compared to the control group. Schmidt and his fellow researchers concluded that commitment to intensive yoga therapy can significantly reduce cardiovascular risk factors, especially in individuals with increased risk factor levels, such as elevated BMI, cholesterol, blood pressure and fibrinogen.

Comments. The results of this study were not entirely unexpected considering the intensive and residential nature of the intervention. Nonetheless, reductions in total cholesterol, LDL cholesterol and blood pressure were substantial. Such clinical results rival those attained by many drugs prescribed for lowering lipid and blood pressure levels. The *challenge* for fitness and health promotion professionals as lifestyle-change agents is knowing how to implement effective strategies to foster *lifelong* behavior change. Finally, it is noteworthy that, as was the case in this program, yoga therapy is often far more comprehensive than mere exercise poses.

Final Comment

One of the principal challenges of many of the styles and forms of hatha yoga is to become proficient at handling increasingly greater amounts of "resistance" (more complex postures and breathing patterns) while maintaining a steady and comfortable equilibrium of mind and body. This effort to maintain an equilibrium ultimately becomes the stimulus for improving self-efficacy and forms much of the framework for the many benefits of hatha yoga.

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