Yoga and Exercise

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The contents of this bibliography do not provide medical advice and should not be so interpreted. Before beginning any exercise program, see your physician for clearance.

Abstract: Purpose: This clinical study was carried out with the aim of investigating whether Hatha Yoga (HY) training affects aerobic and anaerobic power in healthy young adults. Material and method: 33 sedentary, healthy, young adult subjects, aged 18 to 26 were divided into two groups according to age, sex and activity levels. 10 female and 7 male (mean 20.06 +/- 2.41 years, range 18-26 years) young adults were trained with Hatha Yoga (HYG). The aerobic exercise group (AEG) consisted of 9 female and 7 male (mean 19.75 +/- 1.81 years, range 18-26 years) young adults who performed aerobic type strength and stretch exercises of at least 60% maximal heart rate or higher. Both training programs were given by a supervisor, one hour per day, four days per week, for six weeks. Subjects in both groups were assessed by Cooper’s 12 minutes running test for cardiovascular endurance and vertical jump test for anaerobic power before and after training. Results: Aerobic and anaerobic power increased by 9.8%, 5.5% following HY and by 6.6%, 2.3% following aerobic training respectively. A significant increase was found in aerobic power and anaerobic power (p < 0.001) in HYG. There was a significant increase in aerobic power (p < 0.01) in AEG, while anaerobic power of subjects in AEG were consistently higher compared to that of before training, statistically the difference was not significant (p > 0.05). Although there was no substantial differences between the groups concerning cardiovascular endurance (p > 0.05), anaerobic power was significantly higher (p < 0.05) in the HYG. Conclusion: The results of this study suggest that HY training has positive effects on cardiovascular aerobic and anaerobic power. Therefore HY could be an exercise option for enhancing aerobic and anaerobic power in young adults.


“Various exercises, games, sports and even physio-therapy, occupational therapy and various techniques based on biofeedback system mainly work through the motor cortex making person to ‘DO’ an action as per his decision. On the other hand, most of the yoga techniques seem to work through the sensory cortex and the neuro-vegetative system and the person is advised to ‘FEEL’ and ‘OBSERVE’ various happenings and how these
happenings are taking place in the body. In games and sports most of the time the extremities are exercised while in yoga techniques the visceral organs and the vertebral column are worked upon at the periphery and subcortical levels at the centre.”


Abstract: CONTEXT: The vital capacity of the lungs is a critical component of good health. Vital capacity is an important concern for those with asthma, heart conditions, and lung ailments; those who smoke; and those who have no known lung problems. OBJECTIVE: To determine the effects of yoga postures and breathing exercises on vital capacity. DESIGN: Using the Spiropet spirometer, researchers measured vital capacity. Vital capacity determinants were taken near the beginning and end of two 17-week semesters. No control group was used. SETTING: Midwestern university yoga classes taken for college credit. PARTICIPANTS: A total of 287 college students, 89 men and 198 women. INTERVENTION: Subjects were taught yoga poses, breathing techniques, and relaxation in two 50-minute class meetings for 15 weeks. MAIN OUTCOME MEASURES: Vital capacity over time for smokers, asthmatics, and those with no known lung disease. RESULTS: The study showed a statistically significant (P < .001) improvement in vital capacity across all categories over time. CONCLUSIONS: It is not known whether these findings were the result of yoga poses, breathing techniques, relaxation, or other aspects of exercise in the subjects’ life. The subjects’ adherence to attending class was 99.96%. The large number of 287 subjects is considered to be a valid number for a study of this type. These findings are consistent with other research studies reporting the positive effect of yoga on the vital capacity of the lungs.

The following review of this study appears in an article by Ralph La Forge entitled “Spotlight on Yoga” in the May 2001 issue of *IDEA Health and Fitness Source* (http://www.findarticles.com/cf_0/m0BTW/5_19/74886169/p1/article.jhtml?term=yoga):

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 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.


Abstract: It is unclear whether the age-associated reduction in baroreflex sensitivity is modifiable by exercise training. The effects of aerobic exercise training and yoga, a non-aerobic control intervention, on the baroreflex of elderly persons was determined. Baroreflex sensitivity was quantified by the $a$-index, at high frequency (HF; 0.15–0.35 Hz, reflecting parasympathetic activity) and mid-frequency (MF; 0.05–0.15 Hz, reflecting sympathetic activity as well), derived from spectral and cross-spectral analysis of spontaneous fluctuations in heart rate and blood pressure. Twenty-six (10 women) sedentary, healthy, normotensive elderly (mean 68 years, range 62–81 years) subjects were studied. Fourteen (4 women) of the sedentary elderly subjects completed 6 weeks of aerobic training, while the other 12 (6 women) subjects completed 6 weeks of yoga. Heart rate decreased following yoga (69 +- 8 vs. 61 +- 7 min$^{-1}$, $P<0.05$) but not aerobic training (66 +- 8 vs. 63 +- 9 min$^{-1}$, $P=0.29$). VO$_2$ max increased by 11% following yoga ($P<0.01$) and by 24% following aerobic training. Following yoga, $a_{HF}$ (8.0 +- 3.6 vs. 11.5 +- 5.2 ms mmHG$^{-1}$, $P<0.01$) but not $a_{MF}$ (6.5 +- 3.0 vs. 7.6 +- 2.8 ms mmHG$^{-1}$, $P=0.29$) increased. Short-duration aerobic training does not modify the $a$-index at $a_{MF}$ or $a_{HF}$ in healthy normotensive elderly subjects. $a_{HF}$ but not $a_{MF}$ increased following yoga, suggesting that these parameters are measuring distinct aspects of the baroreflex that are separately modifiable.


Abstract: Purpose: To quantify the hemodynamic and metabolic demand of Ashtanga Vinyasa Yoga (aka power yoga), and compare the heart rate/oxygen consumption relationship of yoga to a maximal treadmill GXT, thirteen yoga practitioners (age 36.7 ±
6.5 yrs, body mass 62.1±13.2 kg, height 166.1 ± 9.4 cm, max VO2 46.6±4.5 mL/kg-min) with yoga experience of 3-36 months, participated in the study. Methods: Open circuit spirometry was continuously employed during both a maximal Bruce protocol GXT and while subjects mimicked a fifteen-minute video displayed yoga sequence. The video included six yoga positions repeated in several sequences with verbal cueing. All participants were familiarized with the yoga sequence prior to testing. Results: The following mean data were obtained during the yoga trial: VO2: 23.4±2.2mL/kg-min (~50% max VO2), HR: 143±14 b/min (~77% max HR), Lactate: 4.16±1.3 mMol/L, RER: .89±.04, caloric expenditure 7.15±1.3 kcal/min. The correlation of HR versus VO2 was r=.90 and r=.05 for the Bruce protocol and yoga, respectively. Conclusion: Despite the lack of relationship between HR and VO2, and the mild blood lactate level, Ashtanga Vinyasa Yoga can provide a moderate cardiovascular stimulus through a combination of anaerobic and aerobic energy requirements. The anaerobic exercise and isometric muscle actions involved in Vinyasa Yoga, may in part be responsible for the disproportionate HR/VO2 response and thus preclude the use of HR to estimate exercise intensity. The 6.7 MET energy cost of Vinyasa Yoga is similar to the moderate exercise intensity required by aerobic dance and walking.


The Yoga training followed the recommendations of a National Plan for Physical Education of the Government of India’s Ministry of Education, and after administering several tests of physical fitness before and after a three-week program of Yoga training found the scores of such tests to increase. Measurements for both male and female participants included extent flexibility and dynamic flexibility.


Abstract: Two hundred and fifty school boys from Lonavla were randomly selected and tested with Kraus-Weber tests for their minimum muscular fitness. The results revealed that 20.8 per cent boys failed in the tests. Multiple failures were 4.8 percent while flexibility failures alone were 11.6 percent. Boys at the age of 15 years failed more in flexibility test. Boys at the age of 10 years had the maximum percentage of failures to the extent of 38.5. Inclusion of Yogasanas in the programme of physical activities of the school is suggested for the improvement of the status of the failures.


Khalsa, Shakta Kaur. When yoga is, we are. *Yoga International*, Apr/May 2002, p. 17.

On what differentiates Yoga from exercise.


“Mind-body exercise couples muscular activity with an internally directed focus so that the participant produces a temporary self-contemplative mental state. This internal focus is in contrast to conventional body-centered aerobic and muscular fitness exercise in which there is little or no mindful component. Research on mind-body exercise programs such as yoga and tai chi reveal they have significant mental and physical value.”

See section entitled “Yoga Compared to Conventional Exercise.”

**Lee, Cyndi.** Answers the question: “I do a variety of exercise, including yoga and weight training. I’ve heard that you are not supposed to train the same part of your body every day because you are supposed to let the muscles rest. Does that mean I can’t do the same yoga sequence daily?” *Yoga Journal.* Article available online: http://www.yogajournal.com/practice/717_1.cfm.


“Dance and all forms of sport, even jogging, are about attending to the moment, making it vital. It is about being present, balancing effort with surrender, and in doing so, being fully at home in our body, and therefore being whole.

“But in today’s cybernetic environment, which requires only the mind, the eye and the hand, and has no use for the body, we are often not ‘at home’ in our body.

“Even for those people to go to the gym to work out, the principles that apply are those of precision engineering and technological regimentation. Gym-goers move along an assembly line of ‘stations,’ or Nautilus machines, each of which exercises a different muscle group.

“‘The body is conceived of as an interlocking assemblage of machinelike components, and the desired effect, in which glutes, lats, pecs and abs stand out in sharp relief, resembles the product of a punch press,’ as the author Mark Dery puts it so eloquently in his 1996 book, *Escape Velocity: Cybertulture At The End Of The Century.*

“I’m glad therefore to note the resurgence of the ancient art, yoga, which is fast growing in popularity even in hard-bodied temples like the fitness gyms, as our cover story reports.

“When we were discussing the story concept earlier last week, a colleague remarked: ‘But yoga takes up so much time! You need only 15 minutes on a treadmill.’

“Her remark is so telling of our age, when time is carved into blocks, and every block must be filled with some activity or another, or we are not seen as productive. Even leisure is measured in blocks of time, in a grid that is like a television channel’s, and there mustn’t be any blanks or ‘dead’ airtime.
“Some of us, who believe ourselves indispensable, slice our blocks so thinly that they are like the split-second cuts of MTV videos, and not content to do just one thing, we ‘multi-task.’

“Yoga, like taiqi, or like any true sport before it was ‘techno-colonised,’ is precisely about dead airtime.

“It’s about stopping the frenzy, to do one thing at a time, so as to do it well. It’s about being present to the ‘full bloom of the moment,’ in Walt Whitman’s words, relaxed yet fully alert to the surroundings . . .”


Abstract: This study reports the effects of yoga training on cardiovascular response to exercise and the time course of recovery after the exercise. Cardiovascular response to exercise was determined by Harvard step test using a platform of 45 cm height. The subjects were asked to step up and down the platform at a rate of 30/min for a total duration of 5 min or until fatigue, whichever was earlier. Heart rate (HR) and blood pressure response to exercise were measured in supine position before exercise and at 1, 2, 3, 4, 5, 7 and 10 minutes after the exercise. Rate-pressure product $[\text{RPP} = (\text{HR} \times \text{SP})/100]$ and double product $(\text{Do P} = \text{HR} \times \text{MP})$, which are indices of work done by the heart were also calculated. Exercise produced a significant increase in HR, systolic pressure, RPP & DoP and a significant decrease in diastolic pressure. After two months of yoga training, exercise-induced changes in these parameters were significantly reduced. It is concluded that after yoga training a given level of exercise leads to a milder cardiovascular response, suggesting better exercise tolerance.


On the difference between doing asana as Yoga and doing asana as exercise.

Nespor, Karel. Yoga and health. Article available online: http://www.geocities.com/health_yoga_poetry/phys.html. Dr. Nespor’s email address: nespor@plbohnice.cz.

Compares Yoga to sports exercise.

Nischalananda Saraswati, Swami. Difference between asanas and physical exercise. Article available online: http://www.yes2yoga.com/article5.asp.

Abstract: The effect of pranayama, a controlled breathing practice, on exercise tests was studied in athletes in two phases; sub-maximal and maximal exercise tests. At the end point of phase I (one year) both the groups (control and experimental) achieved significantly higher work rate and reduction in oxygen consumption per unit work. There was a significant reduction in blood lactate and an increase in P/L ratio in the experimental group, at rest. At the end of phase II (two years), the oxygen consumption per unit work was found to be significantly reduced and the work rate significantly increased in the experimental group. Blood lactate decreased significantly at rest in the experimental group only. Pyruvate and pyruvate-lactate ratio increased significantly in both the groups after exercise and at rest in the experimental group. The results in both phases showed that the subjects who practiced pranayama could achieve higher work rates with reduced oxygen consumption per unit work and without increase in blood lactate levels. The blood lactate levels were significantly low at rest.


Abstract: Surya Namaskar (SN) [is] a group of yogic exercise [consisting] of twelve postures . . . The present study was undertaken to observe . . . the energy cost and different cardiorespiratory changes during the practice of SN. Twenty-one male volunteers from the Indian army practiced selected yogic exercises for six days a week for three months duration. The yogic practice schedule consisted of Hatha YOGIC asanas (28 min), pranayama (10.5 min), and meditation (5 min). In the yogic practice schedule [subjects] first practiced Kapal Bhathi (breathing maneuvers) for 2 min, then yogamudra (yogic postural exercise) for 2 min; after that they took rest until oxygen consumption and heart rate (HR) came to resting value. Subjects subsequently performed SN for 3 min 40 seconds on average. After three months of training, subjects performed the entire yogic practice schedule in the laboratory, and experiments were carried out. Their pulmonary ventilation, carbon dioxide output, oxygen consumption, HR, and other cardiorespiratory parameters were measured during the actual practice of SN. Oxygen consumption was highest in the eighth posture (1.22+/−0.073 1 min(-1)) and lowest in the first posture (0.35+/−0.02 1 min(-1)). Total energy cost throughout the practice of SN was 13.91 kcal and at an average of 3.79 kcal/min. During its practice, the highest HR was 101+/−13.5 bpm. As an aerobic exercise SN seemed to be ideal, as it involves both static stretching and the slow dynamic component of exercise with optimal stress on the cardiorespiratory system.

Thomas, Andrew. Yoga and cardiovascular function. The Journal of The International Association of Yoga Therapists, 1993, no. 4, pp. 39-41. (Contrasts effects on the heart of heavy exercise vs. asanas.)


Abstract: Ten healthy, untrained volunteers (nine females and one male), ranging in age from 18-27 years, were studied to determine the effects of hatha yoga practice on the health-related aspects of physical fitness, including muscular strength and endurance, flexibility, cardiorespiratory fitness, body composition, and pulmonary function. Subjects were required to attend a minimum of two yoga classes per week for a total of 8 weeks. Each yoga session consisted of 10 minutes of pranayamas (breath-control exercises), 15 minutes of dynamic warm-up exercises, 50 minutes of asanas (yoga postures), and 10 minutes of supine relaxation in savasana (corpse pose). The subjects were evaluated before and after the 8-week training program. Isokinetic muscular strength for elbow extension, elbow flexion, and knee extension increased by 31%, 19%, and 28% (p<0.05), respectively, whereas isometric muscular endurance for knee flexion increased 57% (p<0.01). Ankle flexibility, shoulder elevation, trunk extension, and trunk flexion increased by 13% (p<0.01), 155% (p<0.001), 188% (p<0.001), and 14% (p<0.05), respectively. Absolute and relative maximal oxygen uptake increased by 7% and 6%, respectively (p<0.01). These findings indicate that regular hatha yoga practice can elicit improvements in the health-related aspects of physical fitness. Copyright © 2001 CHF, Inc.

Of Related Interest


Abstract: Moderate training of an endurance nature, but also other exercise activities, not only has a preventive effect on various illnesses and pre-illness states such as the metabolic syndrome and cancer, but is also effective in treating patients in the rehabilitation phase after illness, e.g., cardiovascular or cancer. Our investigation demonstrates that even low level physical activity has a very good preventive effect too, which is enhanced when it is accompanied by mental activity and psychological well-being. In total, we investigated 13,000 people on the basis of socio-economic panel polls with respect to life contentment, health status and leisure-time activities. Life contentment is positively linked to contentment with labor, which seems to be an essential aspect with regard to the increasing number of unemployed people in Europe. The second important factor is health-promoting activities during leisure time. Exercise, especially, has a significant influence on life satisfaction as a feeling of physical fitness feeling is regarded
as synonymous with good health. The results underline the psycho-neuroimmunological network, which stabilizes our health and shows that different activities in older adults have a significant effect on the aging process and age-related illnesses. Besides the various activities that are important in this arena, namely muscle and mental mobility (“brawn and brain”), a third component must be taken into consideration: life contentment in the form of a successful retrospective view and a positive outlook, embedded in a psychosocial family environment (“brood”) and integrated in a stress-free biotope, where life does make sense. Alternative and complementary strategies should be considered in light of these three aspects when we think about additional anti-inflammatory strategies in preventing diseases or treating them and their relapses.


“Adults who suffer from chronic health problems such as high blood pressure or heart disease can lower their short-term risk of death by exercising for at least 30 minutes a week, results of a study suggest.”


“Exercise offers a host of mental benefits that scientists are just beginning to uncover.

“...The psychological benefits of exercise by some accounts are as significant and meaningful as the physiological says Jack Raglin, associate professor of kinesiology at Indiana University.

“Recent studies indicate the benefits of exercise include everything from decreased anxiety, increased energy and self-confidence to improved memory, reaction time and reasoning skills.”