

Studies on the Health Benefits of Tai Chi

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When my teacher, Cheng Jin Cai, asked for volunteers to research the health benefits of Tai Chi, I welcomed the opportunity. I was drawn to Tai Chi nine years ago because my health was less than perfect.

I am a two time cancer survivor, have high blood pressure and have to keep an eye on cholesterol and blood sugar levels to keep them in check.

I knew Tai Chi made me feel stronger and more relaxed, but I was interested to learn what benefits had been documented in the medical literature.

The research team included King Lam, Barbara Lyle, Jennifer Wong, Tony Yeung, and myself. Together we reviewed over 200 English-language medical journal articles that reported the health benefits of Tai Chi.

We looked for measurable benefits like an increase in bone density or a decrease in blood pressure, not simply results that were reported by study participants as "improving self confidence" or "making me feel better."

While the Chinese have recognized the health benefits of Tai Chi Chuan for hundreds of years, the Western medical community has only recently, within the last twenty years or so, conducted scientific research to measure these benefits.

Hundreds of medical research papers have been published, but I touch on only a few of them here. (See Bibliography at end.)

Tai Chi exercise used to be labeled as "alternative." However, the wellness and rehabilitative aspects are beginning to be understood and the practice is becoming more mainstream, even being offered successfully as part of corporate wellness programs to reduce stress.

Yes, we were biased in our approach because we were looking only for benefits, but we found many!

Among the research findings, the practice of Tai Chi Chuan: improves cardiovascular function, lowers blood pressure and cholesterol, improves balance and reduces falls, improves symptoms and is safe for those with arthritis, and slows the rate of osteoporosis.

Tai Chi Chuan Improves Cardiovascular Function

Heart disease and stroke are the first and third leading causes of death for both men and women in the United States according to the Centers for Disease Control.

Over 910,000 Americans die of cardiovascular disease each year. The economic impact of these diseases is staggering, projected to be \$403 billion in 2006, including health care costs and lost productivity due to death or disability.

By improving cardiovascular function, Tai Chi Chuan could be of enormous function.

Aerobic exercise has long been prescribed as a deterrent to cardiovascular disease and studies have shown that Tai Chi Chuan is considered to aerobic, even though it is practiced in slow motion.

Aerobic exercise means activity that maintains an increased heart rate and causes the muscles to utilize oxygen to burn fats and glucose.

Your heart rate should be 50-75 percent of your maximum heart rate, which is calculated as 220 minus your age in years for an exercise to be considered aerobic of moderate intensity.

For example, a 50 year-old would have a maximum heart rate of 170. If that person exercises and maintains a heart rate between 85 and 128 beats per minute, he or she will be exercising aerobically.

A heart rate of 75-90 percent of your maximum would be considered high intensity aerobic exercise and over 90 percent would be anaerobic. For example, jogging for a long time at a moderate pace is aerobic, while sprinting over a short distance is not.

When you sprint, some muscle groups become anaerobic meaning that the muscles need more oxygen than the body can supply, so lactic acid builds up (the familiar "burn" you might feel in your legs) forcing the person to slow down or stop to recover. No one can maintain an anaerobic level of exertion for very long.

Aerobic capacity, also called peak oxygen use, is defined as the maximum volume of oxygen that can be consumed by your muscles during exercise. It varies from person to person.

For example, Olympic athletes can perform with greater endurance and intensity than the average person because of their higher aerobic capacity.

In the study "Heart Rate Responses and Oxygen Consumption During Tai Chi Chuan Practice," published in the American Journal of Chinese Medicine, researchers Lan, Chen, Lai, and Wong established that Tai Chi is an aerobic exercise of moderate intensity.

Fifteen men, ages 26 to 56, who had all practiced Yang style Tai Chi for at least three years, participated in the study.

Utilizing some special equipment, they measured heart rate and oxygen utilization of participants during Tai Chi practice. The heart rate was 58 percent of the maximum heart rate and the level of oxygen consumption was 55 percent of their aerobic capacity, which was consistent with that expected of aerobic exercise. Blood samples were also taken to measure lactic acid levels and were found to be low, which further confirmed that Tai Chi is aerobic.

In another study, "The Effect of Tai Chi on Cardio-Respiratory Function in Patients with Coronary Artery Bypass Surgery," published in Medicine & Science in Sports and Exercise, researchers Lan, Chen, Lai, and Wong Selected 20 patients who had undergone coronary artery bypass surgery. Nine of the men practiced Yang Style (108 Form) Tai Chi every morning for an hour, while the other eleven were instructed to walk three times a week for approximately an hour.

At the beginning of the study and again after one year, the participants took a stress exercise test on a stationary bicycle. Using special equipment, the researchers measured peak oxygen use (the maximum oxygen utilized before the subject must stop exercising due to fatigue, which is a good measure of cardio-respiratory fitness). After a year, the Tai Chi group showed a 10 percent improvement in cardio respiratory function while the control group's function declined slightly.

Tai Chi Chuan is not only restorative, but preventative as well. One study, "Two-Year Trends in Cardio-Respiratory Function Among Older Tai Chi Chuan Practitioners and Sedentary Subjects," by Lai, Lan, Wong and Teng and published in the Journal of American Geriatric Society, found that practicing Tai Chi regularly (five times per week) could delay the decline of cardio-respiratory function in older people.

Forty five men and women, who practiced Tai Chi regularly for a minimum of three years were matched for age and body size to a sedentary control group. The average age of participants in the study was 64 years old.

Peak oxygen utilization was assessed at the beginning and again two years later. While both groups showed some decline over the period, the Tai Chi group only declined 2.8 to 2.9 percent. The sedentary group declined 6.6 to 7.4 percent, confirming Tai Chi's capacity to preserve cardio-respiratory fitness.

Tai Chi Chuan Reduces Blood Pressure and Cholesterol

Two of the biggest factors for cardiovascular disease are high blood pressure and high cholesterol.

The Centers for Disease Control estimate that 29 percent of adults in the U.S. have high blood pressure. However, as you age, the likelihood of developing high blood pressure increases. A 12 to 13 point reduction in blood pressure can reduce heart attacks by 21 percent, strokes by 37 percent and all deaths from cardiovascular disease by 25 percent.

Blood pressure is a measure of the force of blood against the artery walls and is reported in two numbers: systolic and diastolic pressure. The point of greatest pressure-systolic-is when the heart contracts. At normal pressure, the heart would send a column of mercury (Hg) to a height of about 120 millimeters when it contracts. Diastolic, the second number, is the pressure when the heart is relaxed between beats. Normal blood pressure is defined as less than 120/80 mmHg.

According to the National Institutes of Health, the systolic reading gives a better diagnosis of high blood pressure (or hypertension) than diastolic because it tends to rise with age. After age 55 diastolic pressure tends to decline, although both numbers are used to diagnose hypertension. A reading over 140/90 mmHg is considered high, and prolonged high blood pressure can cause heart failure, kidney disease, and blindness.

It is commonly understood that one of the best prescriptions for reducing blood pressure is exercise. One study, "Health Benefits of Tai Chi Exercise: Improved Balance and Blood Pressure in Middle Aged Women," published in Health Promotion International by Thorton, Sykes and Tang, recruited 17 women between the ages of 33 and 55 for a twelve week Tai Chi exercise program. The women had not practiced Tai Chi or any other exercise for at least two years previously. The control group included 17 more women who were matched to the Tai Chi group for age and body size.

The Tai Chi group met 3 days per week. The routine included 29 minutes of warm up, 30 minutes of Yang Style Tai Chi and 10 minutes of cool down. After 12 weeks the Tai Chi group showed significant decreases in both systolic (9.71 mmHg) and diastolic (7.53 mmHg) blood pressure. The control group had no change I blood pressure.

"The Beneficial Effect of Tai Chi Chuan on Blood Pressure and Lipid Profile and Anxiety Status in a Randomized Control Trial," by Tsai, et al, and published in the Journal of Alternative and Complementary Medicine, targeted people who had high-normal or Stage I Hypertension. High-normal is defined as 130/85 – 139/89 mmHg and Stage I Hypertension is 140/90 – 159/99

mmHg. Since those recruited to the study had recently been diagnosed, none were taking medication to control their blood pressure.

76 people (both men and women), ages 35 to 65, completed the study. Half were randomly assigned to the Tai Chi group and the other half were in the control group. The Tai Chi group practiced Yang Style Tai Chi (108 form) three times a week for 50 minutes (including warm up and cool down) for twelve weeks. The control group continued to be sedentary.

At the conclusion of the study, the Tai Chi group showed significant decreases in both systolic (a drop of 15.6 from 142.4 to 126.8 mmHg) and diastolic (a drop of 8.8 from 87.4 to 78.6 mmHg) blood pressure. However, the control group's blood pressure actually increased (+6.4 to 154.6 mmHg systolic and +3.4 to 89.6 mmHg diastolic).

Tai Chi practice helped to return high blood pressure to normal levels.

High cholesterol is another risk factor for heart disease. The Centers for Disease Control have found that 25 percent of U.S. adults have high cholesterol, but only 63 percent are aware of it. A 10 percent decrease in cholesterol may reduce coronary heart disease by as much as 30 percent.

Cholesterol is a waxy substance found in all cells in your body and is carried in small packages called lipoproteins. Low density lipoprotein (LDL – the bad cholesterol) can lead to plaque build up on the walls of your arteries. High density lipoprotein (HDL – the "good" cholesterol) carries cholesterol from other parts of your body to your liver, which eliminates it from your body.

The National Institutes of Health recommends that total cholesterol should be less than 200 mg/dL (milligrams per deciliter). HDL greater than 60 mg/dL is considered protective against heart disease, but between 40 to 59 mg/dL is still considered okay. However, higher is better.

Optimally LDL should be less than 100 mg/dL, but less than 129 mg/dL is considered good. The lower the better.

In this same study by Tsai, et al, discussed above for blood pressure, the Tai Chi groups total cholesterol decreased 15.2 mg/dL from 205.2 to 190.0 mg/dL, the HDL Cholesterol increased 4.7 mg/dL to 55.9 mg/dL and the LDL decreased from 130 to 110 mg/dL.

In the control group, total cholesterol and LDL rose slightly while HDL declined, exactly the opposite of the Tai Chi group and not what one would want.

Tai Chi Chuan Improves Balance and Reduces Falls

One of the most exciting findings for older adults is the improvement of balance and coordination provided by Tai Chi.

According to the Centers for Disease Control, over one third of those over age 65 in the United States fall each year, which leads to spending an estimated \$19 billion to treat fall related injuries. Twenty five percent of the 338,000 annual hip fracture patients require nursing home care for a year and those affected will need to use a walker or a cane after that, so the cost in quality of life is great as well.

"Reducing Frailty and Falls in Older Persons: An Investigation of Tai Chi and Computer Balance Training..." by Wolf, Xu and others, published in the Journal of the American Geriatric Society evaluated Tai Chi versus balance training.

200 people over the age of 70 participated in the study. The participants were divided into three groups – those receiving Tai Chi training, those receiving computerized balance training (a computer operated platform on which participants tried to maintain their balance), and those receiving health education. The study ran 15 weeks. After adjusting for fall risk factors, the practice of Tai Chi was found to reduce the risk of multiple falls by 47.5 percent.

Those who received the balance training and the health education did not have significantly lower rates of falling.

One of the researchers, Dr. Tingsen Xu, is a veteran Tai Chi player and has adapted Tai Chi forms for older adults, even training former President and Mrs. Carter. Dr Xu has devoted his efforts to spreading the good news about Tai Chi for older adults.

A more recent study, "Tai Chi and fall Reductions in Older Adults: A Randomized Controlled Trial," by Li, et al, published in the Journals of Gerontology, holds even greater evidence of the fall reducing qualities of Tai Chi. 256 people ages 70 to 92 participated in the study that ran for 6 months. The Tai Chi group practiced Yang Style (24 – Form) three times per week and the control group practiced stretching and deep breathing three times a week while seated in a chair. The reason for conducting the stretching while seated was to provide the same class-like environment without providing the leg strength and balance training benefits of Tai Chi.

The study found that Tai Chi reduced the risk of multiple falls by 55 percent as compared to the control group. The most evident reduction began after the first three months of training and was maintained for at least six months after the Tai Chi training stopped. Strengthening the lower body and improving balance can dramatically reduce the risk of falling.

Tai Chi Chuan Improves Symptoms and is safe for Those with Arthritis

An estimated 43 million Americans suffer from the pain of arthritis and other rheumatic diseases, according to the Centers for Disease Control. Over 50 percent of adults over the age of 75 have doctor-diagnosed arthritis. Total annual costs exceed \$86.2 billion. Arthritis and other rheumatic conditions are the leading cause of disability in the U.S.

A primary consideration regarding exercise for those with arthritis is: will the exercise worsen arthritic symptoms?

In "Effects of Tai Chi Exercise on Pain, Balance, Muscle Strength, and Perceived Difficulties in Physical Functioning in Older Women with Osteoarthritis: A Randomized Clinical Trial," Published in the Journal of Rheumatology, Song, Lee, Lam, and Bae analyzed whether or not the practice of Tai Chi was safe for people with arthritis.

In other words, did it exacerbate already inflamed joints? 43 older osteoarthritis patients were divided into a control group and a Tai Chi group. The Tai Chi group practiced a form of Sun Style Tai Chi (12 Form) that was specially designed for those with arthritis for twelve weeks. At the beginning and the end of the study, the participants were assessed for their physical fitness, self reported pain level, knee muscle strength and flexibility.

The Tai Chi group reported less pain and stiffness in their joints and researchers documented improvements in balance and abdominal muscle strength. The control group reported no change to mild deterioration of their joint symptoms. There was no difference in flexibility or knee muscle strength between the two groups.

A similar study, "Evaluating the Safety and Potential Use of a Weight Bearing Exercise, Tai Chi Chuan, for Rheumatoid Arthritis Patients," by Kirssteins, Dietz, and Hwang, published in the American Journal of Physical Medicine and Rehabilitation, found the joints of rheumatoid arthritis sufferers were not further inflamed by Tai Chi practice. Joint tenderness, swelling, hand grip strength and the time to walk 50 feet did not deteriorate after 10 weeks of Tai Chi practice, so they concluded that the exercise was safe.

The Centers for Disease Control reports that "among adults with knee osteoarthritis, engaging in moderate physical activity at least three times per week can reduce the risk of arthritis related disability by 47 percent."

In the study, "Taiji Training Improves Knee Extensor Strength and Force Control in Older Adults," published in the Journals of Gerontology – Series A: Biological Sciences and Medical Sciences, researchers Christou, Yang and Rosengren examined Tai Chi training on knee extensor strength and force control.

An example of knee extensor or quadriceps strength is found when you sit down or stand up. Force control is a measure of how well you control the force of a muscle, which affects the accuracy of your movement. Older people often lose leg strength and have trouble standing up and moving accurately forward away from the chair. They may "jerk" to stand up, resulting in a loss of balance.

26 men over the age of 70 were divided into the Tai Chi group and the control group. Extensor strength and force control were assessed in both groups at the beginning and the end of the study. The Tai Chi group performed Chen Style Tai Chi (12 Form) three times a week for 20 weeks. Compared to the sedentary control group, the Tai Chi group became stronger and improved force control, meaning that they improved their ability to move more accurately.

The authors of the study contend that while both Tai Chi and conventional weight lifting can improve knee extensor strength, only Tai Chi involves considerable muscle coordination of the lower body in order to move in all directions, thus causing force control to become much more coordinated.

Tai Chi Chuan Slows the Rate of Osteoporosis

Osteoporosis is a health threat for 44 million Americans, of whom 68 percent are women, according to the National Institutes of Health. It is responsible for 1.5 million fractures annually. Decreases in bone mass of post-menopausal women may be as much as 2 percent per year (cited in "Osteoporosis: Current Modes of Prevention and Treatment" by Lane and Nydick, published in the Journal of the American Academy of Orthopedic Surgeons).

The NIH also has reported that weight bearing exercise can build bone density and stave off the effects of osteoporosis because it forces you to work against gravity. It is important to understand that bone is continuously being rebuilt. Old bone is being reabsorbed and new bone is deposited.

Osteoporosis occurs when old bone is reabsorbed faster than new bone can be deposited which results in a thinner bone with a lower bone density, which increases the risk of fracture. Bone loss is greatest in the first three to six years after menopause for women, however, men who smoke, take certain medications or who don't exercise are also at risk of bone loss.

Risk of bone fractures can be predicted by a bone mineral density test, which is a special x-ray, usually done of the hip and lower spine. Bone mineral density at these locations correlates with the ability of these bones and others in the body to bear weight.

The University of Hong Kong undertook a study to measure the differences in bone loss between post menopausal women who practiced Tai Chi Chuan and those who did not. The result was a publication called, "A Randomized Prospective Study of the Effects of Tai Chi Chuan Exercise on Bone Mineral Density on Postmenopausal Women" by Chen, et al, published in the Archives of Physical Medicine and Rehabilitation.

One hundred and thirty two postmenopausal women (ages 50.5 to 57.5) were recruited for the study and were randomized, half and half, into the Tai Chi group and the control group. None were on hormone replacement therapy or other drugs that could affect their bone density.

The Tai Chi group practiced Tai Chi for 45 minutes a day, five days a week for 12 months while the control group remained sedentary. Bone mineral density was measured in the lower spine, the hip and the lower leg (tibia) at the beginning of the study and at the end.

While both groups experienced some bone loss, bone loss was 2.6 to 3.6 times slower in the Tai Chi group. There four fractures during the study and three of them were in the control group. These results indicate that Tai Chi might be beneficial in slowing down the rate of osteoporosis. Coupled with the benefits of improving balance, fractures from osteoporosis could be expected to dramatically decline with regular Tai Chi practice.

Conclusion

With all the benefits Tai Chi Chuan has to offer, it has been described as "The Perfect Exercise." Many of the students at the International Chen Style Tai Chi Development Center in Houston, where I study, will attest to the health benefits that they have attained by practicing Tai Chi.

Our teacher, Cheng Jin Cai, often tells us about his childhood illnesses and at one point doctors thought that he might die. He credits Chen Style Tai Chi Chuan with his full and complete recovery.

These anecdotal benefits are now backed by scientific research, however more research needs to be done. In the studies highlighted above, Tai Chi practice was often compared to no exercise at all. Scientists readily point out that research must continue to test other populations and compare Tai Chi to other exercises to really confirm the benefits.

So if you live in an area where you have the chance to participate in a research study, please do so. It will benefit the Tai Chi community.

I find these research results exciting. Tai Chi not only improves strength, flexibility and balance, but also contributes to improvements in cardiovascular disease, osteoporosis, arthritis and balance disorders. Compared to other exercises, Tai Chi is meditative in nature and leaves the practitioner relaxed and stress free. Because it is mentally challenging, people are less likely to abandon this form of exercise. (Most studies reported a high compliance rate among the Tai Chi practitioners.)

More importantly, the cost of health care in the United States is skyrocketing. Many companies are grappling with health insurance costs and are looking for ways to promote health and stress reduction for their employees. As the research articles highlighted above suggest, much could be done to reduce these costs if Tai Chi were offered in the workplace and the community, and if people were educated in its benefits.

In my case, while Tai Chi is not a cure-all, I can claim that Tai Chi has reduced my recovery time after surgery and is helping to keep my blood pressure under control. I like the idea of battling my "invisible enemies" and improving my health through the practice of Tai Chi.

Bibliography

Available on request