



## *Summary of Published Scientific Studies Conducted Using Dr. Yang Yang's EBT Program*

*October 2011*

Dr. Yang Yang's EBT program is the product of his lifelong traditional training and teaching experience and research conducted over the course of his doctoral work in Kinesiology at the University of Illinois. The program was refined for participation by healthy older adults through the experience of several longitudinal pilot studies and a randomized controlled trial (RCT), and was successfully adopted for use in another RCT by persons with dementia.

Five papers have been published in the scientific peer reviewed literature that have used Dr. Yang Yang's EBT program. All of the papers are of controlled, longitudinal studies, and two were fully randomized controlled trials (RCTs). A sixth paper concerning qualitative methods of analysis of holistic mind/body/spirit benefits is currently under final review before publication. A seventh paper concerning the benefit of Taiji practice for caregivers of persons with dementia is also currently being written.

Following is an abstract summary of the six of these papers. The studies conclude that the EBT program is effective for health older adults for:

- Lower body strength
- Force control (a neuromuscular function)
- Improved functional balance
- Improved vestibular function (a mechanism of improved balance)
- Improved immune function (response to flu vaccine)
- complex, holistic benefits combining five dimensions of experience: physical, mental, emotional, social and spiritual

The study on persons with dementia was a multimodal intervention which included Taiji exercises, cognitive-behavioral therapies, and a support group. This study reports significant improvements in mental ability and self-esteem, but due to the study design it is not possible to discern which, or to what extent, the different intervention modalities contributed to these benefits.

Dr. Yang Yang's comments on additional significance of the findings are also included in each of the abstract summaries listed below. Complete texts of the studies are provided after the abstract summaries.

The CTS remains committed to conducting research on Taiji and Qigong. A RCT is currently being planned in partnership with the Mayo Clinic to evaluate the efficacy of this program for cardiovascular rehabilitation.

## **Study #1. Taiji Training Improves Knee Extensor Strength and Force Control in Older Adults**

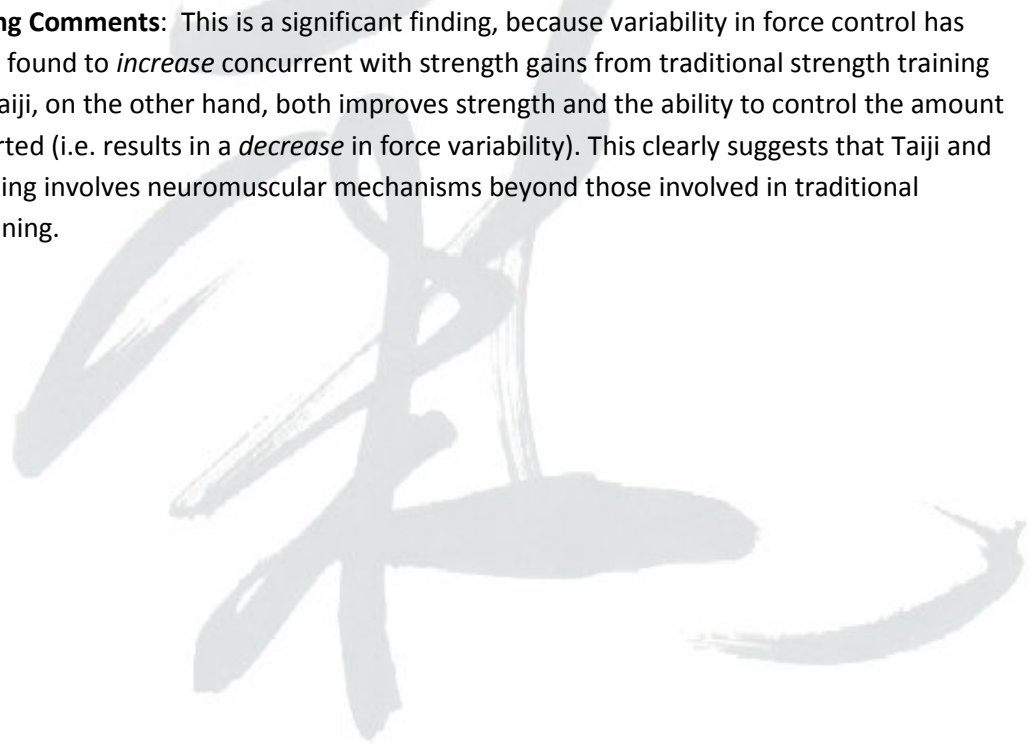
Evangelos A. Christou, Yang Yang and Karl S. Rosengren

*The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 58:M763-M766 (2003)

### **Abstract**

The purpose of this study was to examine the effects of Taiji training on knee extensor strength and force control in older individuals. Twenty-six healthy older adults ( $71.9 \pm 1.8$  years) participated in the study. Sixteen of the older adults ( $70.2 \pm 1.8$  years) underwent Taiji training for 20 weeks (experimental group), whereas the other 10 ( $74.6 \pm 1.2$  years) served as the control group. For both groups, strength and force control of the knee extensors was assessed twice with an isokinetic dynamometer. Strength was assessed with a maximum voluntary isometric contraction (MVC). Force control was measured as the standard deviation (SD) and coefficient of variation (CV) of force during a constant isometric knee extension task at 2%, 30%, 60%, and 90% MVC. For the experimental group, MVC significantly increased ( $19.5 \pm 4.9\%$ ) and the CV of force decreased ( $18.9 \pm 3.3\%$ ) following Taiji training. Improvements in the CV of force were primarily due to decreases in the SD of force ( $R^2 = .86$ ) rather than increases in strength ( $R^2 = .12$ ). Furthermore, decreases in SD of force were independent of improvements in strength. For the control group, strength, SD, and CV of force were not different for the 2 tests. The overall findings suggest that Taiji training improves knee extensor strength and force control in older adults.

**Dr. Yang Yang Comments:** This is a significant finding, because variability in force control has always been found to *increase* concurrent with strength gains from traditional strength training exercises. Taiji, on the other hand, both improves strength and the ability to control the amount of force exerted (i.e. results in a *decrease* in force variability). This clearly suggests that Taiji and Qigong training involves neuromuscular mechanisms beyond those involved in traditional strength training.



**Study #2. Effect of combined Taiji and Qigong training on balance mechanisms: a randomized controlled trial of older adults.**

Yang Y, Verkuilen JV, Rosengren KS, Grubisich SA, Reed MR, Hsiao-Wecksler ET.  
*Med Sci Monit.* 2007 Dec;13(12):LE19-20.

**Abstract**

**BACKGROUND:** Taiji (T'ai Chi) has been shown to have generally positive effects on functional balance. However, few studies have investigated the mechanisms by which Taiji may improve balance. The goal of this study was to evaluate changes in sensory and biomechanical balance mechanisms as a consequence of a traditional Taiji exercise program for healthy older adults that intentionally emphasized both Taiji forms and Qigong meditation. **MATERIAL/METHODS:** This was a randomized controlled trial with blind testers. Forty-nine healthy older adults (mean age 80.4, SD. 8.6) were randomized to participate in Taiji-Qigong (TQ) training (N=33) or a wait-list control group (WC, N=16). TQ instruction was provided 1 hour/session, 3 sessions a week for six months. Somatosensory, visual, and vestibular ratios of the Sensory Organization Test, and quiet stance Base of Support (BoS) and feet opening angle measures were collected prior to instruction (T0), at two months (T2), and six months (T6). **RESULTS:** TQ group vestibular ratio scores (normalized to T0) were +22% and +47% greater than WC at T2 and T6, respectively. The TQ group exhibited an increase in quiet stance BoS over time but not feet opening angle, indicating that the increase in BoS was due to the adoption of wider stances. **CONCLUSIONS:** Improved use of vestibular input and wider stances are two mechanisms by which Taiji-Qigong training may improve healthy older adults' balance. Further study is needed to evaluate other balance mechanisms and the individual and combined effects of different aspects of traditional Taiji practice.

**Dr. Yang Yang comments:** While many studies that have evaluated the effect of Taiji on older adults' balance have used sedentary populations or populations with impaired balance, the subjects in this study were healthy older adults. Indeed, several of the balance measures attempted were found insensitive because both the control and study groups scored near the ceiling on those measures *before* the study began. It is generally considerably harder to show statistically significant differences within and between control and study groups of healthy populations as compared to sedentary or impaired populations, and I believe the large effect size in vestibular improvement in healthy older adults in this study is testament to the power of this exercise—healthy older adults can still improve!

I also point out in the discussion section of this paper what I believe to be another very important mechanisms for improved balance—greater core strength. Core strength is very much at the heart of physical mechanism of Taiji movement, and it is of course the core that stabilizes the torso in an upright position.

**Study #3. The Effect of Taiji (T'ai Chi)/Qigong (Ch'i Kung) on Balance in Older Adults.**

Yang Y, Verkuilen JV, Rosengren KS, Grubisich SA, Reed MR, Hsiao-Wecksler ET.

*Med Sci Monit.* 2007 Dec;13(12):LE19-20.

**Abstract**

**BACKGROUND:** The author's objectives were to determine the effect of a 6 month Taiji and Qigong (TQ) intervention on healthy older adults' functional balance, and to explore mechanisms for improvements in balance afforded by TQ training. **METHODS:** Sixty-eight healthy older adults (mean age 79.5, std. dev. = 8.3) were randomly and selectively assigned to participate in TQ training or to a wait control (WC) group. TQ training consisted of 1 hour/session x 3 sessions/week x 6 months. Measurements were performed at baseline (T0), two months, (T2), and at the conclusion of the six month intervention (T6). Primary outcome measures included functional balance measures, sensory organization test (SOT) from computerized dynamic posturography, and chair stands (a measure of lower body strength). Secondary outcome measures included stance width in normal comfortable stance and Fall Efficacy Scale (FES) and Activities-Specific Balance Confidence (ABC) scale efficacy instruments. **RESULTS:** Significant TQ training effects were observed after 2 months in lower body strength (+12%,  $p = 0.021$ ), single leg stance with eyes open (+83%,  $p = 0.002$ ), and stance width (+22%,  $p = 0.046$ ). TQ effects for SOT vestibular function approached significance at two months and were significant at six months (+51%,  $p = 0.03$ ). No TQ effect was observed for visual SOT scores or gait speed measures. Pre-intervention scores for both TQ and WC groups were near the ceiling for SOT somatosensory, Berg Balance Scale, and efficacy instruments, thus these measures were ineffective for evaluating the healthy subject population. **CONCLUSIONS:** A short (2 month) intervention of moderate training frequency using traditional Taiji and Qigong curriculum (i.e., including standing and sitting meditation) is effective in improving healthy older adults' functional balance. Increased lower body strength, improved use of vestibular input, and wider stances are three mechanisms by which TQ training may improve postural control. Further study is needed to evaluate other balance mechanisms and the individual and combined effects of different aspects of traditional Taiji practice.

**Dr. Yang Yang comments:** This intervention is the same as Study #2 above, but group assignment was not purely randomized—19 of the 68 participants based their involvement on being allowed to choose group participation. Though not an RCT, the larger sample size does afford greater statistical power.

It is interesting and important to note that the improvements in functional balance and strength were observed after only *two months* of training. However, the choreography of the seven movement Taiji form was not learned until the end of the *fourth* month. Therefore, improvements in lower body strength and balance do not appear to be a function of the length of form choreography, and the static qigong component of the intervention (standing and sitting meditation) must contribute significantly to the rapid realization of benefits.

**Study #4. Effects of a Taiji and Qigong Intervention on the Antibody Response to Influenza Vaccine in Older Adults**

Yang Yang,\* , Jay Verkuilen, Karl S. Rosengren,,Rachel A. Mariani,  
Michael Reed, Scott A. Grubisich and Jeffrey A.Woods  
*Am J Chin Med. 2007;35(4):597-607*

**Abstract**

Previous studies have suggested that Taiji practice may improve immune function. This study was intended to examine whether 5 months of moderate Taiji and Qigong (TQ) practice could improve the immune response to influenza vaccine in older adults. Fifty older adults (mean age  $77.2 \pm 1.3$  years) participated in this study (TQ N = 27; wait-list control [CON] N = 23). Baseline pre-vaccine blood samples were collected. All subjects then received the 2003–2004 influenza vaccine during the first week of the intervention. Post-vaccine blood samples were collected 3, 6 and 20 weeks post-intervention for analysis of anti-influenza hemagglutination inhibition (HI) titers. We found a significant ( $p < 0.05$ ) increase in the magnitude and duration of the antibody response to influenza vaccine in TQ participants when compared to CON. The vaccination resulted in a 173, 130, and 109% increase in HI titer at 3, 6, and 20 weeks post-vaccine, respectively, in the TQ group compared to 58, 54, and 10% in CON. There was a significant between group difference at 3 and 20 weeks post-vaccine and at 20 weeks the TQ group had significantly higher titers compared to the pre-vaccine time point, whereas the CON group did not. A higher percentage of TQ subjects also responded to the influenza A strains with a protective ( $> 40\text{HI}$ ) antibody response (37% TQ vs. 20% CON for the H1N1 strain and 56% TQ vs. 45% CON for the H3N2 strain), but the differences between groups were not statistically significant. Traditional TQ practice improves the antibody response to influenza vaccine in older adults, but further study is needed to determine whether the enhanced response is sufficient to provide definitive protection from influenza infection.**Dr.**

**Dr. Yang Yang comments:** As with Study #3 above, it is important to note that the improvements were quickly realized—in this case at the *three week* measure period in the between group comparison. Again, because much more time is required to learn even a short seven movement Taiji form, the rapid benefit must be in part due to the static meditation component of practice.

It was also interesting to learn that most older adults do not achieve what is considered a “protective response” to the flu vaccine.

**Study #5. The Effects of a Multimodal Intervention on Outcomes of Persons with Early Stage Dementia**

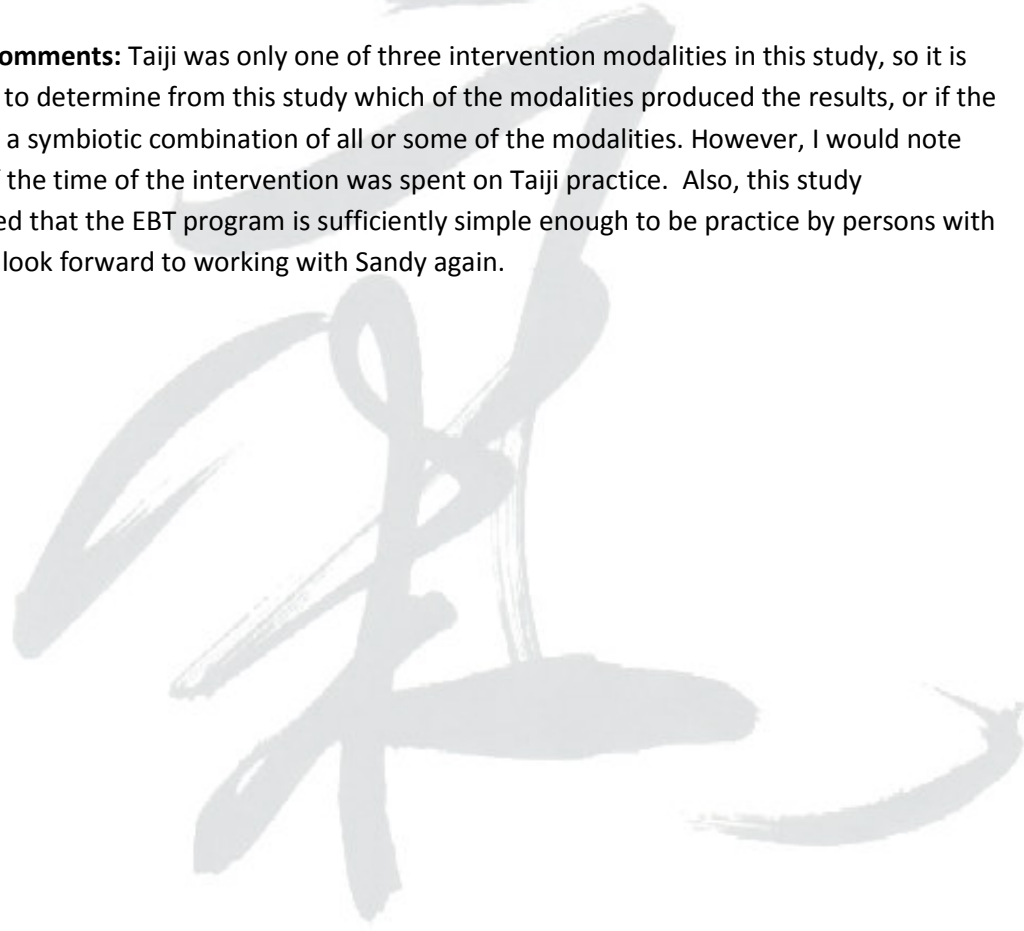
Burgener SC, Yang Y, Gilbert R, Marsh-Yant S.

*Am J Alzheimers Dis Other Demen.* 2008 May 4. [Epub ahead of print]

**Abstract**

Theories supporting the existence of a use-dependent neuroplasticity in the older brain were used to guide this pilot study. A repeated-measures randomized design was used to test the effectiveness of a multimodal (Taiji exercises, cognitive-behavioral therapies, support group) intervention on cognitive functioning, physical functioning, and behavioral outcomes in persons with dementia. The treatment group (n = 24 persons with dementia) participated in a 40-week intervention, with outcomes assessed at 20 and 40 weeks to assess optimal treatment length. Control group subjects (n = 19 persons with dementia) received attention-control educational programs. At 20 weeks, differences between groups were found for mental ability and self-esteem, with gains in balance being evident. Also, stability in depression and physical health were evident at 20 and 40 weeks for treatment group subjects. Continued improvement in outcomes was not observed at 40 weeks. However, findings support further testing of the intervention along with potential for achieving positive outcomes in early-stage dementia.

**Yang Yang comments:** Taiji was only one of three intervention modalities in this study, so it is not possible to determine from this study which of the modalities produced the results, or if the results were a symbiotic combination of all or some of the modalities. However, I would note that most of the time of the intervention was spent on Taiji practice. Also, this study demonstrated that the EBT program is sufficiently simple enough to be practice by persons with dementia. I look forward to working with Sandy again.



**Study #6. Subjective Experiences of Older Adults Practicing Taiji and Qigong**

Yang, Y., DeCelle, S., Reed, M., Rosengren, K., Schlagal, R., and Greene, J.  
2011: *Journal of Aging Research*, vol. 2011, Article ID 650210, 11 pages.

**Abstract**

This article presents a qualitative study following a 6-month Taiji (T'ai Chi)/Qigong (Ch'i Kung) intervention for older adults. The researchers conducted in-depth interviews of eight selected participants who elected to continue practicing Taiji after the intervention ended, in order to explore their subjective experiences of Taiji's effects and their motivations for continuing to practice. We created a Layers Model to capture the significance and meaning of the multidimensionality of their reported experiences. Participants not only reported simple benefits along five dimensions of experience (physical, mental, emotional, social and spiritual) but also described complex multidimensional experiences. Overall findings indicate that participants derived a very wide variety of perceived benefits, the most meaningful being a felt sense of body-mind-spirit integration. Our results support the important role of qualitative studies in researching the effects of Taiji and Qigong.

**Dr. Yang Yang comments:** I believe that qualitative methods of analysis will play an important role in future Taiji and Qigong studies, as there are many benefits of practice that may not be measured by standardized, quantitative health assessments.

In this study we conceived a Lotus diagram model to visually represent the five dimensions of experiences in layers of increasing complexity: simple, complex, immersion (where the relevance of TQ permeates many aspects of life), and integration (where TQ is perceived as a transforming experience yielding positive lifestyle changes).

Here are two examples of participants' quotes exhibiting integration of Taiji into life experiences:

*"I am going to live the rest of my life differently."*

*"I think this is just grand! To learn something when you are in your late 70s that you can use for however long you happen to live: I mean what greater gift could you expect? You don't think about 70-year-olds really learning new things they can carry on – this is so unexpected. This has made me feel much younger, much younger, let's say 10 years. . . . Someone who hasn't done this has no comprehension about how much better it has made me feel."*