

EFFECTS OF TAI CHI BREATHING EXERCISE ON CARDIOVASCULAR OUTCOMES

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ABSTRACT

Purpose: The purpose of this study was to determine the effect of Tai Chi breathing exercise on blood pressure, heart rate, and respiratory rate. **Subjects:** The study participants were 30 healthy volunteer subjects ranging from 21-50 years of age. **Methods:** Subjects were randomly divided into two groups: control breathing (CB, n=15) and Tai Chi breathing (TCB, n=15). Cardiovascular outcomes including systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and respiratory rate (RR) were recorded before and after the breathing exercise. Each subject in the TCB group was instructed and given a demonstration of TCB exercise. Then they successfully performed TCB breathing exercise for fifteen minutes. The participants in the control group exhibited normal breathing for 15 minutes. Data were analyzed using paired T test. **Results**: The mean RR in CB group before and after breathing exercises was 17.53 ± 0.87 SE and 15.80 ± 1.25 SE, respectively. The mean RR in TCB group was 14.87 ± 1.28 SE and 12.00 ± 0.82, SE, respectively. TCB breathing exercise had significantly decreased RR (P-value = 0.025). However, there were no significant changes in blood pressure and heart rate following TCB breathing exercise. **Conclusions:** This pilot study indicates that 15 minutes of Tai Chi breathing exercise has no effect on BP and HR, but TCB significantly decreases RR. **Clinical relevance:** The literature reveals that an increase in RR is associated with an increase in stress and a decrease in respiratory efficiency and endurance. Therefore, results of the investigation may suggest that TCB could be used to decrease RR, to relieve stress and to increase respiratory efficiency. Future study is recommended to determine the long-term effect of TCB on cardiovascular and stress responses, especially for patients with respiratory problems and those patients in stress induced situations.

Keywords: Breathing exercise, Tai Chi, Blood pressure, Heart rate, and Respiration rate

INTRODUCTION

In physical therapy practice, breathing exercises have commonly been utilized to treat patients with respiratory problems. This ultimately results in a decrease in the cost of oxygen consumption, increase respiratory efficiency, and increase endurance during physical activity. Jones *et al*. [1] has demonstrated that diaphragm breathing (DB), pursed-lip breathing (PLB), and a combination of DB and PLB significantly lowered oxygen cost in patients with chronic obstructive pulmonary disease (COPD). A study from Schein *et al*. [2] has shown that slow, regular breathing guided by a device called BIM (Breath with Interactive Music) significantly lowers the high blood pressure by 10 to 15 mmHg. However, little information regarding the effects of traditional breathing exercises on cardiovascular response is available. Therefore, the objective of this study was to determine the effects of TCB breathing exercises on blood pressure, heart rate, and respiration rate.

METHODS

The participants in this study were 30 healthy volunteer subjects ranging from 21-50 years of age. All subjects were screened for medical problems that would prevent their participation. The subjects with the following conditions were excluded from the study: (1) respiratory problems, (2) cardiovascular problem, (3) neurological problem, (4) metabolic syndrome, (5) subjects who are currently on medication that affect heart rate, blood pressure and mental status, (6) subjects who are pregnant, or (7)

fail to answer questions in a consistent manner. All subjects signed an informed consent document and understood the procedure and the risks involved. Subjects were randomly divided into two groups: group 1 served as a control breathing (CB) and Tai Chi breathing group 2 (TCB). Standard protocol was performed and briefly all subjects were asked to rest for 5 minutes and then their systolic blood pressure, heart rate, respiratory rate were taken. Subjects in the CB group stood quietly with feet shoulder width apart and took spontaneous breaths for 15 minutes at their regular breathing pace. Subjects in the TCB group stood up with feet shoulder width apart and performed TCB with the hand movement for 15 minutes. Subjects inhaled while they moved their hands up to a flexed position and exhaled while they squatted and pushed their hands down and then returned to original position. Blood pressure, heart rate, and respiratory rate were taken again at the end of the breathing exercise. Data was analyzed using paired t-test (before and after breathing exercise) in each of the two groups. Statistical software (SPSS) was used to analyze the results. Data were expressed as mean ± SE. The 5 % level of significance was used to determine if the TCB breathing exercise has a significant effects on the cardiovascular outcomes (blood pressure, heart rate, and respiratory rate).

RESULTS AND DISCUSSION

Figure 1 represents the mean systolic blood pressure (SBP) in CB group and TCB group before and after breathing exercise. There was no significant change in SBP in both the CB and TCB groups following TCB breathing exercise ($P > 0.05$). Also, Figure 2 displays the mean diastolic blood pressure (DBP) in CB group before and after breathing exercise. Similarly, there was no significant change in DBP in both the CB and TCB groups ($P > 0.05$) following TCB breathing exercise. The results also indicated that there was no significant change in mean HR before and after breathing exercise ($P > 0.05$) for the TCB group and similar results obtained in the control group (Figure 3). However, the mean respiration rate (RR) was significantly reduced (Figure 4) following the TCB breathing exercise in both groups (P-value = 0.025).

In the present study, we investigated the direct effects of Tai Chi breathing (TCB) exercise on blood pressure, heart rate and respiration rate in healthy subjects. Compared with spontaneous breathing, TCB significantly decreased respiration rate, but there were no significant changes in blood pressure and heart rate in any of the groups. A growing body of clinical research has shown that different form of breathing exercises are very effective to reduce dyspnea, short of breath, depression, anxiety, hypertension, angina, functional chest disorder, chronic obstructive pulmonary disease (COPD) and cardiac rehabilitation [3,4],5,6,7,8]. In physical therapy rehabilitation program, Diaphragm breathing (DB) and pursed lip breathing (PLB) exercise are commonly used to treat patients with respiratory problems [1].]. The common clinic symptoms of respiratory disorders are dyspnea and fatigue. Obstruction of the air ways, an increase in respiratory activities and lack of quality of breathing are the common mechanisms to cause fatigue and short of breath. A research reported by Breslin et al. [9] showed an increase in fatigue severity leads to an increased disorder in pulmonary performance, further reduce endurance for activity and resulting more fatigue. Pharmacologically, there is no effective cure for dyspnea and fatigue. Therefore, performing different forms of breathing exercises becomes more important to control the symptoms and to improve functional performance of life activities. A research made by Zakerimoghadam et al. [10] showed the change in respiratory pattern caused reduction of fatigue intensity in COPD patients. Patient with COPD used to have a fast, shallow, and insufficient breathing. PLB exercise improved patient to diaphragm respiration pattern which is a slow, deep and relaxing breathing pattern. PLB and DB are the methods of choice of slow and deep breathing exercise.

Tai chi is the most common form of excise in elderly population in China. It is the combination of martial arts and exercise. Tai Chi has four key components includes mental concentration, physical balance, muscle relaxation and relaxed breathing [11]. Many previous research studies have suggested that performing Tai chi has great beneficial effects on variety of health issues including improvement of flexibility, muscle strength, standing balance activities in elderly population, cardiopulmonary function, immune function [12,13,11].] as well as on a range of psychological well-being measures, including depression, anxiety and stress [11]. Some research studies have also shown that Tai Chi is an effective modality to treat different medical conditions including type 2 diabetes, stroke, osteoarthritis and rheumatoid arthritis [13,2,14,15]. We have previous reported that combined breathing (CBB, combination of CB and PLB) significantly decreased respiration rate and shallow breathing significantly increased respiration rate although none of these breathing exercise significantly affecting blood pressure and heart rate (16]. However there is no information available regarding the effect of Tai Chi breathing on blood pressure, heart rate and respiration rate. The main focus of the present study was to determine the effect of TCB on blood pressure, heart rate and respiration rate.

TCB is one of the four key elements of Tai Chi exercise. All previous research studies have examined the effect of Tai Chi with four components together on variety of medical conditions. To the best of our knowledge this is the first study assessing the effects of TCB on blood pressure, heart rate and respiration rate in healthy adults without respiratory problems. TCB integrated traditional deep, slow breathing with body movement. The advantage of using TCB is the movement of body and hands can facilitate the expansion of the chest and further strengthen the deep and slow breathing technique. The mental concentration and mind-body moment can further relax the body and relieve the stress. Several studies also reported that a slow and relaxed breathing exercise can be a choice of nonpharmacological invention of hypertension. Schein *et.al* [2] reported that slow, regular breathing guided by a device called BIM (Breath with Interactive Music) significantly lowers the high blood pressure by 10 to 15 mmHg. A recent view article made by Brandani *et al*. [17] showed that Yoga breathing exercise can decrease blood pressure by 4 to 21 mmHg. However, the results of the present study showed that there were no significant changes in HR and BP between pre and post measurements in any of the groups. The difference between previous studies [**17, 13**] and our study is that our study only included 15 minutes of breathing excise in healthy subject without pulmonary problems and hypertension. Further study is needed to determine the long term beneficial effects of TCB exercise on blood pressure, heart rate, and respiration rate in patient population. However, the positive result of TCB on respiration rate supports our hypothesis that TCB may be a good choice of performing a deep, slow breathing technique for stress and anxiety management. In conclusion: 15 minutes of TCB exercise significantly decrease the rate of respiration, suggesting TCB can be useful tool to reduce fatigue, dyspnea, anxiety, short of breath caused pulmonary disorders and also a good tool for stress management. The most important clinical application of the present study is that TCB can be easily adapted by those elderly adults who can't perform the whole set of Tai Chi exercise due to physical limitations and standing balance deficits.

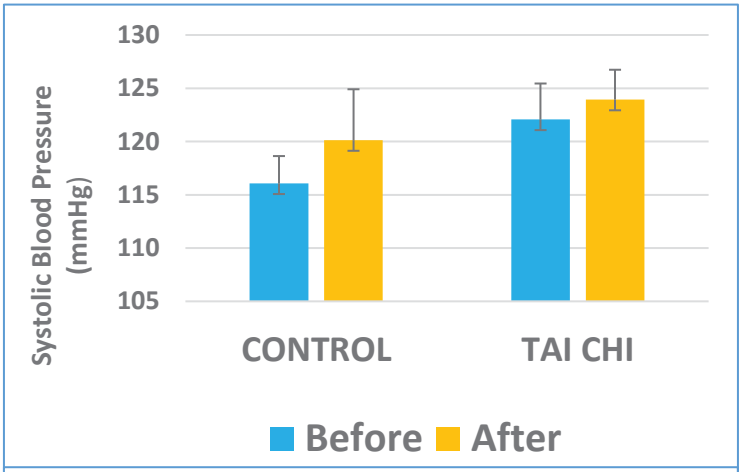

Figure 1: The effect of Tai Chi breathing exercise on systolic blood pressure (for more details see methods section).

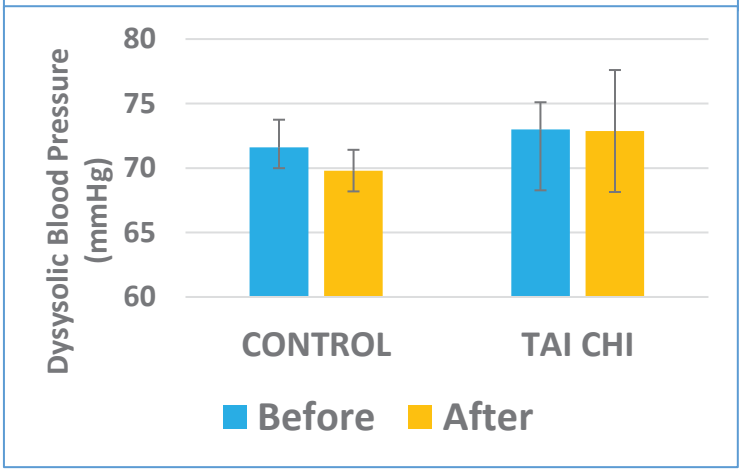

Figure 2: The effect of Tai Chi breathing exercise on diastolic blood pressure (for more details see methods section).

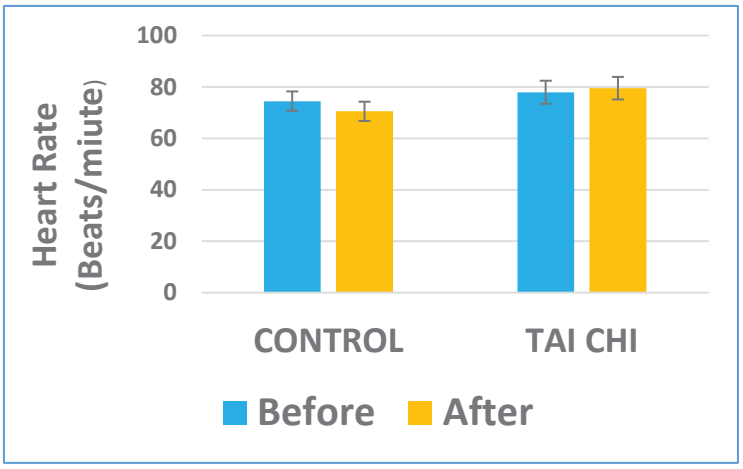

Figure 3: The effect of Tai Chi breathing exercise on heart rate (for more details see methods section)

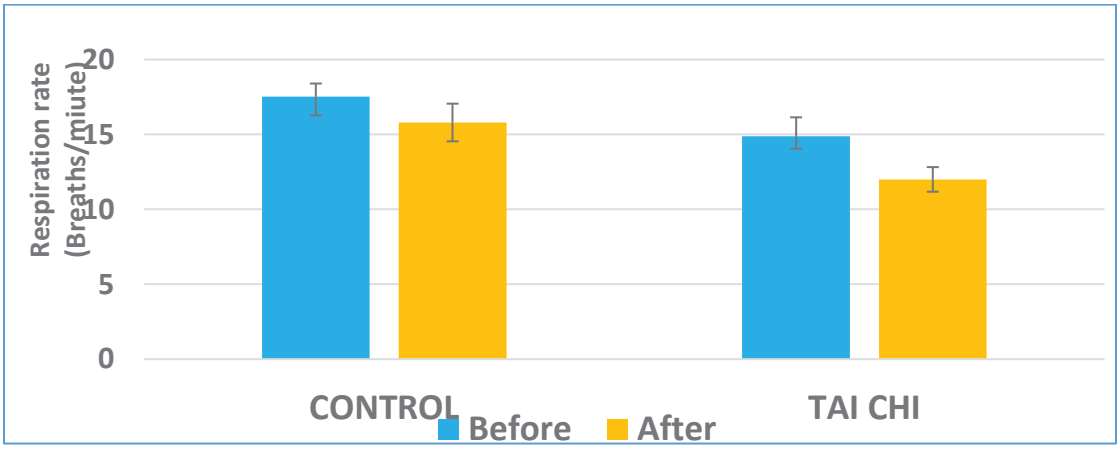

Figure 4: The effect of Tai Chi breathing exercise on respiration rate (for more details see methods section)

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