“Tai Chi Quan” exercise used in improving the heart function of aged people

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In this study, we assessed the effect of “Tai Chi Quan” exercise on heart function of aged people. A total of 66 old people (mean age, 72.81 ± 7.27 years) was recruited for the study in November 2009. All subjects were asked to practice “Tai Chi Quan” for one hour, every day. This study had continued for 1 year. Some physiological indexes were measured in November 2009 (beginning point) and December 2010 (ending point), respectively. Results showed that “Tai Chi Quan” exercise could significantly increase cardiac output, stroke index and myocardial oxygen consumption index in aged practicers. It can be concluded that “Tai Chi Quan” exercise can improve heart function of aged people.

Key words: “Tai Chi Quan”, elderly, heart.

INTRODUCTION

Tai Chi, a martial art that involves slow controlled movement and the maintenance of various postures, may be an effective means of addressing balance problems. Recently, researchers have begun sophisticated scientific measurements of TCC movements. These measurements include, for example, electrocardiography, blood pressure, exercise capacity, and electromyography of selected muscles during TCC movements (Taylor, 2010; Barrios et al., 2010; Cattadori et al., 2009; Chanudet et al., 1996; Chanudet et al., 2007). The results from these measurements have provided both physiological and biomechanical evidences to help understand the mechanism of TCC’s positive effects (Chanudet et al., 2007; Kal et al., 1999).

Cardiovascular pathologies such as hypertension and cerebrovascular disease, and heart diseases such as coronary artery disease, arrhythmias, and heart failure, increase in incidence with increasing age. The aging process itself also affects the cardiovascular system. In old age, the heart may not pump as vigorously or as effectively as it once did. The older heart also becomes less responsive to adrenaline and cannot increase the strength or rate of its contractions during exercise to the same extent it could in youth.

In this study, we assessed the effect of “Tai Chi Quan” exercise on heart function of aged people.

SUBJECTS AND METHODS

Procedures

A total of 66 old people were recruited for the study in November 2009. The mean age of the subjects in the Tai Chi group was 72.81 ± 7.27 years. The subjects include 39 males and 27 female participants. These subjects never have “Tai Chi Quan” exercise history. In this study, all subjects were asked to practice “Tai Chi Quan” for one hour every day. This study continued for 1 year. Some physiological indexes were measured in November 2009 (beginning point) and December 2010 (ending point), respectively.

Physiological indexes

Pulse rate is measured by most blood pressure monitors. Cardiac output and stroke index was assessed by continuous-wave Doppler echocardiography at rest. Myocardial Oxygen Consumption Index was measured according to the literature (Kal et al., 1999). Myocardial oxygen consumption volume was measured according to the literature (Kal et al., 1999; Verma et al., 2010). Left ventricular function index was measured according to the literature (Amoore et al., 1992).
Table 1. Effect of “Tai Chi Quan” exercise on the pulse rate and cardiac output.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>November, 2009</th>
<th>December, 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse rate (beats/min)</td>
<td>76.82±3.93</td>
<td>72.65±2.98*</td>
</tr>
<tr>
<td>Cardiac output (L/min)</td>
<td>6.81±5.82</td>
<td>7.05±1.07</td>
</tr>
</tbody>
</table>

All values are expressed as means ± SD. *P < 0.05, vs. beginning point (November, 2009)

Table 2. Effect of “Tai Chi Quan” on stroke index and myocardial oxygen consumption index in aged practitioners.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>November, 2009</th>
<th>December, 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke index (ml/beat·m²)</td>
<td>56.21±6.72</td>
<td>57.23±6.84</td>
</tr>
<tr>
<td>Myocardial oxygen consumption index</td>
<td>2651.39±692.69</td>
<td>2583.98±592.17</td>
</tr>
</tbody>
</table>

All values are expressed as means ± SD. There are no statistical differences (P>0.05) in the stroke index and myocardial oxygen consumption index between groups.

Statistical analyses

All data are expressed as the mean ± SD. The statistical analyses were performed on an SAS program. The group comparisons were done using a variance analysis followed by Duncan’s multiple range test. Statistical significance was considered at P < 0.05.

RESULTS AND DISCUSSION

As a person ages, the heart undergoes subtle physiologic changes, even in the absence of disease. The muscles of the aged heart may relax less completely between beats; as a result, the pumping chambers (ventricles) become stiffer and may work less efficiently, especially if specific cardiac diseases are present. In old age, the heart also may not pump as vigorously or as effectively as it once did. The older heart also becomes less responsive to adrenaline and cannot increase the strength or rate of its contractions during exercise to the same extent it could in youth (Barrios et al., 2010; Chanudet et al., 2007, Mahmood et al., 2010).

Cardiac output is the amount of blood ejected by the left ventricle in one minute. The left ventricle seems to get the lion’s share of attention perhaps because the body’s blood flow and pulse are provided by the left ventricle. Generally speaking, heart rate and cardiac output have a direct relationship (Cattadori et al., 2009). As heart rate increases, so does cardiac output. As mentioned earlier, as energy demands grow (oxygen demands), cardiac output increases in kind (Taylor, 2010; Mikail, 2010).

The effect of “Tai Chi Quan” exercise on the pulse rate and cardiac output is shown in Table 1. As shown in Table 1, the pulse rate (73.65±4.98, beats/min) in aged practitioners was significantly (P<0.05) decreased as compared to the beginning point (76.82±6.93 beats/min). The cardiac output (7.05±1.07, L/min) in aged practitioners was increased as compared to the beginning point (6.81±5.82 L/min). However, no statistical differences were detected between beginning and ending points.

Stroke volume is the amount of blood the left ventricle ejects in one beat, measured in milliliters per beat (ml/beat). The stroke volume can be indexed to a patient’s body size by dividing by the body surface area to yield the stroke index (Khang et al., 2010). Myocardial oxygen consumption rate is an index of postischemic recovery. Oxygen plays a critical role in the pathophysiology of myocardial injury during both ischemia and subsequent reperfusion (I/R) (Aijaz et al., 2009).

Table 2 represents the effect of “Tai Chi Quan” on stroke index and myocardial oxygen consumption index in aged practitioners. The stroke index (57.23±6.84 ml/beat·m²) was found to be increased in the aged practitioners compared to the beginning point (56.21±6.72 ml/beat·m²). The myocardial oxygen consumption index (57.23±6.84) was found to be increased in the aged practitioners compared to the beginning point (56.21±6.72). However, no statistical differences in the two indexes were detected between beginning and ending points. “Tai Chi Quan” exercise is not only useful in detecting myocardial function but also provides important information on practitioners’ exercise capacity and prognosis.

The pressure-volume framework provides an excellent tool with which to study and describe the complex relationship between cardiac mechanics, energetics, and efficiencies (Suga, 1979; Westerhof, 2000; Knaapen et al., 2007). Channer et al. (1996) studied tai chi use in the period following myocardial infarction and found that regular tai chi exercise in the post-MI period is associated with falls in blood pressure. They suggested that tai chi may be a useful alternative to formal aerobics as part of a cardiac rehabilitation program. Lai et al. (1995) concluded, from a prospective study of tai chi
Table 3. Effect of “Tai Chi Quan” on myocardial oxygen consumption volume and left ventricular function index in aged practitioners.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>November, 2009</th>
<th>December, 2010</th>
</tr>
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<tbody>
<tr>
<td>Myocardial oxygen consumption volume</td>
<td>44.08±8.31</td>
<td>41.03±5.81</td>
</tr>
<tr>
<td>Left ventricular function index</td>
<td>74.28±11.54</td>
<td>78.59±11.09</td>
</tr>
</tbody>
</table>

All values are expressed as means ± SD. There are no statistical difference (P>0.05) in the myocardial oxygen consumption volume and left ventricular function index between groups.

practitioners, that tai chi may delay the decline of cardio respiratory function in older individuals. They also stated that tai chi is a suitable aerobic exercise for older adults.

Myocardial oxygen consumption volume in the aged practitioners after one year of exercise is presented in Table 3. “Tai Chi Quan” exercise produced a decrease in the myocardial oxygen consumption volume (41.03±5.81 vs. 44.08±8.31). In addition, “Tai Chi Quan” exercise produced an increase in left ventricular function index (78.59±11.09 vs. 74.28±11.54) in the aged practitioners. After one year of “Tai Chi Quan” exercise, though there was a decrease in the myocardial oxygen consumption volume and an increase in left ventricular function index, the difference was not statistically significant (P>0.05) compared to the experimental beginning point.

The present study is the first to provide evidence that there is an association between impaired heart function and aging in humans. “Tai Chi Quan” exercise may improve heart function by increasing cardiac output, stroke index and myocardial oxygen consumption index in aged practitioners.

ACKNOWLEDGEMENT

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REFERENCES


