Effect of Exercise Therapy on Elasticity of the Blood Vessels

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Abstract. [Purpose] The purpose of this study was to determine how a compound exercise program affected the elasticity of the blood vessels of middle aged obese women. [Methods] The research subjects were 40–50 year old women who had excess body fat (30%). The experimental group performed warm-up and cool-down: walking at 3.5–4.0 km/h for 5 minutes and exercised using nine kinds of machinery. A analysis of covariance (ANCOVA) was used for statistical analysis. [Results] In the experimental group, LH PWV, RH PWV, HF PWV, RF PWV significantly increased compared to the control. [Conclusion] The compound exercise program designed for middle aged obese women had affected the elasticity of the blood vessels.

Key words: Compound exercise, Elasticity, Blood vessel

INTRODUCTION

Atherosclerosis is a condition in which the artery’s wall thickens because of the accumulation of cholesterol1, 2). The causes of cardiovascular system diseases in the middle aged are hereditary, gender, increasing age, obesity, smoking, hyperlipidemia, hypercholesterolemia, and lack of exercise; therefore, it is important to prevent and reduce the incidence of cardiovascular disease the middle-aged by improving the risk factors of the disease. A aerobic exercises such as walking, swimming, and cycling are well known as activities which have positive effects on cardiovascular disease risk factors. Participating in regular aerobic exercise improves risk factors such as obesity, hyperlipidemia, hypercholesterolemia vascular endothelial growth3), aortic elasticity4), and vessel diameter5–7).

Many researches have shown that the vascular function is related to arterial pulse wave velocity which changes with increasing age8, 9). However, recently, research has been conducted on how the elasticity of blood vessels change with exercise. A study reported that the elasticity of blood vessels was changed significantly following an aerobic dance program compared to the non-exercise group9). Continuous exercise and resistance exercise also improved the elasticity of blood vessel10). Participant in a moderate intensity exercise program showed a positive improvement in blood vessels elasticity11). Also, a yoga exercise delivered the same result as other physical activities12).

SUBJECTS AND METHODS

The subjects of this study were 40 middle-aged women. They were selected using a bioelectrical impedance method which showed a body fat rate of over 30%. The subjects had not participated in exercise or training for at least 6 months. They were randomly assigned to two groups; the experimental group, n=20, and the control, n=20 (Table 1).

<table>
<thead>
<tr>
<th>Group</th>
<th>Age(yrs)</th>
<th>Height(cm)</th>
<th>Weight(kg)</th>
<th>(%fat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>54.3 ± 4.38</td>
<td>153.2 ± 2.13</td>
<td>63.2 ± 3.3</td>
<td>37.9 ± 5.8</td>
</tr>
<tr>
<td>Control</td>
<td>55.5 ± 3.49</td>
<td>154.3 ± 2.33</td>
<td>62.2 ± 2.6</td>
<td>38.5 ± 2.9</td>
</tr>
</tbody>
</table>

*Values are mean ± SD.

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A longitudinal study showed that the arterial wall elasticity, which has a strong relationship with blood pressure, arteriosclerosis, and cerebrovascular disease seen in the exercise group17, 18). The flexibility of the arteries increases after long-term aerobic exercise, but not after short-term exercise19.

In this study, although 12 weeks of the compound exercise did not show a statistically significant difference in the elasticity of the blood vessels, the experimental group showed a significant difference between before and after exercise in the elasticity of the blood vessels (p<0.05).

Table 2 shows the results of the ANCOVA for the changes in the elasticity of the blood vessels. The experimental group showed a significant difference between before and after exercise in the elasticity of the blood vessels (p<0.05). Elasticity of the blood vessels can be measured using magnetic resonance imaging (MRI) and a computed tomography (CT), sectioning of the body. It can also be measured by putting a pressure sensor into the blood vessel, an invasive method. However, these methods observe structural change by putting a pressure sensor into the blood vessel, an invasive method. However, these methods observe structural change rather than the severity of arteriosclerosis and are costly and time-consuming.

It has been reported that the elasticity of the blood vessels, which induce associated with the functional change of endothelial cells, decreases with increasing age4). This change starts at the age of 30 to 40, and features endothelial cell degeneration2), calcium and fiber accumulation in the endothelial cells1), and increasing systolic blood pressure3). However, regular exercise can prevent decrease in the vascular elasticity4), and aerobic exercise has a positive effect on the blood vessel elasticity, increasing blood level, pressure, and activating the sympathetic nerve system3, 6). Many studies have reported that athletes have high vascular elasticity compared to sedentary subjects, and it is thought that the higher aerobic capacity is the higher the vascular elasticity of the arterial walls is5, 6, 8, 15, 16). A study showed that participating in aerobic exercise improved the elasticity of the carotid artery and aorta in middle aged women which explained the decrease in cardiovascular disease seen in the exercise group7, 10). The flexibility of the arteries increases after long-term aerobic exercise, but not after short-term exercise9).

In this study, although 12 weeks of the compound exercise did not show a statistically significant difference in the elasticity of the blood vessels, the experimental group showed an increase in the elasticity of blood vessels due to the compound exercise. A aerobic exercise increases blood flow, increasing the arterial pressure, expanding the blood vessel, and increasing collagen fibers. Also, regular exercise stimulates catecholamine which affects the blood vessel.

Table 2. Changes in the elasticity of the blood vessels

<table>
<thead>
<tr>
<th>Variable</th>
<th>LH PWV</th>
<th>RH PWV</th>
<th>LF PWV</th>
<th>RF PWV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre</td>
<td>post</td>
<td>pre</td>
<td>post</td>
</tr>
<tr>
<td>Experimental</td>
<td>210.6 ± 6.18</td>
<td>215.7 ± 3.74*</td>
<td>211.3 ± 5.26</td>
<td>219.2 ± 5.25*</td>
</tr>
<tr>
<td>Control</td>
<td>212.4 ± 5.13</td>
<td>213.1 ± 5.74</td>
<td>212.4 ± 4.31</td>
<td>213.2 ± 6.52</td>
</tr>
<tr>
<td>F</td>
<td>12.41</td>
<td>15.75</td>
<td>12.17</td>
<td>16.45</td>
</tr>
</tbody>
</table>

*Values are mean ± SD. Unit: m/s

7) Kokkinos PF, Papademetriou V: Exercise and hypertension. Coron Artery Dis, 2000, 11: 99–102. [Medline] [CrossRef]
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Comments