Frame Analysis on the Effects of Small-and-Medial-Load Aerobic Exercise on Fatty Livers of Obese Patients

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Abstract

Obese patients can easily have fatty livers, so they take small-and-medial-load aerobic exercise to lose weight. This paper compares the internal and external health indicators before and after exercise, analyzes indicators of blood and liver function and degrees of fatty livers and compares the changes in the ketone body content. Through research, it is found that the actual blood biochemical indicators are significantly reduced, the liver functions of obese patients are significantly improved and the degrees of fatty livers are greatly lowered. The ketone body content is also decreased, but the change is not statistically significant in this research. Therefore, proper small-and-medial-load aerobic exercise can effectively reduce blood lipids and fat mass, thereby improving the condition of fatty liver.

Keywords: Small-And-Medial-Load aerobic exercise, Obese patients, Fatty liver, Frame analysis.

1. INTRODUCTION

The main cause of obesity is high-fat diet. With this diet, the body’s energy increases dramatically, but it cannot be completely absorbed by the body, so the remaining energy is converted into fat, leading to obesity. Obesity can easily lead to metabolic disorders and the insulin content cannot meet the needs of the human body, so the risks of high blood sugar, high blood pressure and high blood lipids sharply rise, posing threats to people’s health. According to years of clinical research, up to 60% of the obese patients have fatty livers, and this percentage is still growing. In the United States, fatty liver is clinically considered as one of the main conditions for obesity-related metabolism syndrome.

2. LITERATURE OVERVIEW

Research on aerobic exercise and fatty livers of obese patients are being continuously developed and improved. In recent years, this research has achieved great results, but there are still shortcomings. Xu, Chen and Shen (2011) mainly tested the effects of aerobic exercise on the obesity of teenagers. The results showed that after periodical aerobic exercise, the positive rate of fatty liver in male teenagers was decreased from 83.7% to 42.1%, that in female teenagers was decreased from 67.9% to 32.7% (Xv, 2011). In the following year, Jin and Chen (2012) studied the effects of diet and aerobic exercise together on obese patients and found that aerobic exercise had positive effects on multiple elements within the human body and can effectively reduce fat and the occurrence rates of high blood pressure, high blood lipids and high blood sugar, making it possible to cure the metabolic syndrome, and from this, they also concluded that small-and-medial-load aerobic exercise can effectively decrease the occurrences of fatty livers (Jin, 2012). Dong Shu, Liu Ping, Sun (2013) mainly studied the treatment of nonalcoholic fatty liver, but they mentioned in the paper that correct use of aerobic exercise could effectively reduce the occurrence of fatty liver and also emphasized the importance of “people first”. In addition, the three also studied the pathogeny and pathology of fatty liver and learned that a fatty liver had a lot to do with the internal maladjustment of the body. Obese patients have a high probability of suffering such illness, which can be cured only after they lose weight (Dong et al., 2013). Wang and Lu (2014) mainly studied the therapeutic effect of aerobic exercise on fatty livers of obese patients, and put forward the strategy of developing targeted aerobic exercise schemes according to the conditions of patients. They believed that the treatment effects would be better if it is combined with clinical medicine (Wang ang Lu, 2014). Feng Lei and Zhuang (2014) conducted experiments in the same year, which lasted for four weeks. After four weeks of aerobic exercise, the lipid content of obese patients was significantly reduced (Feng ang Zhuang, 2014).
3. THEORETICAL BASIS

This research takes frame analysis as its theoretical basis. In the 1970s, Goffman introduced the concept of framing into the kinematics, medicine, sociology and other fields. His paper titled "Frame Analysis" attracted the attention of many scholars. The framing theory, also known as the constructivism theory, mainly describes how exercise improves the physical conditions of the human body, which is a practical theory. By selecting and excluding certain known conditions, details and characteristics, it builds the interpretative structure of exercise and medicine and thus forms a frame. The frame theory used in this paper involves three aspects: the first is to study the relationship between sports and medicine from the perspective of kinematics; the second is to study the pathologies of the disease from the medical point of view so as to learn about the relationship with exercise; the third is to analyze how the patients and doctors should use exercise to mitigate the disease. This is the audience frame.

4. RESEARCH DESIGN

4.1 Research subjects and period

This research selects obese patients with fatty livers (excluding those with severe fatty livers) admitted to hospital from 2015 to 2016 as the research subjects. Patients participating in the experiment have a body fat rate of 30% or more. Among the subjects, there are 25 men and 25 women. Before the experiment, they underwent detailed examination and it was learned that they had no other cardiovascular and cerebrovascular diseases and did not reject aerobic exercise and that their bodies could withstand small- and medial-load aerobic exercise. Before the experiment, these patients and their families all signed off the consent to the experiment. The basic information about the specific research subjects is shown in Figure 1. The research period is one month.

![Figure 1. Physical conditions of obese patients before exercise (Mean±SD)](image)

4.2 Research methods

4.2.1 Determination method for body shape indices

The body size indices of research subjects are measured by testing personnel before and after one month of small- and medial-load aerobic exercise. The indices should include height, weight, body fat, skinfold thickness and BWH measurements, and the measurement tools should include body composition analyzers, tape measures and skinfold calipers. In order to ensure the accuracy of measurement, the body composition analyzer should be of the Combi Wellness brand. During measurement, research subjects should stand in a natural and relaxed fashion, with their feet together. The waist circumference should be the circumference half a centimeter above the navel; and the hip line should be the circumference around the bulge of the gluteus maximus. Besides the BWH measurements, the thigh circumference should also be measured, from the bottom of the hip. The skinfold thickness should be measured at the upper arm and the scapular region. During the measurement of the upper arm, the acromion of the right upper arm should be selected and kneaded vertically. In the scapular region, the measurement should be carried out 1cm below the right scapula, with the skin kneaded at a 45 degree angle. Note that in the measurement of each dimension, the measurement should be horizontal to ensure the results are...
accurate, and the measurement should be carried out 3 or 4 times at the same position. At last, the average value
should be taken as the measurement result.

4.2.2 Determination methods for blood indices

The determination of these items requires the collection of blood specimens from the research subjects. The
collection time is the day before the exercise and the morning of the day before the exercise period is over.
Research subjects are required to keep their stomachs empty to ensure the accuracy of the measurement results.
3ml of blood should be drawn from the vein in the elbow to determine indicators like blood sugar, insulin and
blood lipid (Zhou, 2017). The blood lipids include TC, TG, HDL-C and LDL-C. Acetoacetic acid and
hydroxybutyric acid which account for 20% and 78% respectively are selected as indices. After the blood
specimens are collected, they should stand at room temperature for about 30 minutes. After centrifugation for 15
minutes, the serum separated should be tested.

4.2.3 Determination methods for liver

This paper uses the abdominal probe to examine the entire liver through color ultrasound diagnosis. In order to
ensure accurate examination results, this paper uses the commonly used Siemens SEQUIOA512 apparatus, with
the probe frequency set to 3.5 Hz. The examination time is consistent with the blood test time, but there is no
diet requirement for the research subjects. Testing personnel should be the same persons to reduce errors. Finally,
according to the clinical severity of fatty liver, this paper carries out analysis and comparison and obtains the
results.

4.3 Instructions for small-and-medial-load aerobic exercise

Based on the health conditions and acceptance level of the research subjects and the exercise load, the exercise
intensities are set and the targeted exercise programs are developed based thereon. Professional dietitians are
also engaged in providing targeted and rational diet plans for these research subjects to ensure that there are
sufficient nutrition and calories supplied to research subjects.

4.4 Data statistics

In this experiment, the statistical software SPSS17.0 is used to take the statistics of the data obtained before and
after the exercise of research subjects. The indices are analyzed by the chi-square test and the Spearman method.
The measuring indices are between Mean ± SD, with P<0.05 as the significant index and P <0.01 as the very
significant index.

5. RESEARCH RESULTS AND ANALYSIS

5.1 Research results

5.1.1 Changes in body shape indices

After one month of small-and-medial-load aerobic exercise, the body weight, body fat rate, BWH measurements,
thigh circumference and skin fold data of research subjects were significantly lower than those before the
exercise, in which the body fat rate and the skin fold change were very obvious and the waist saw the largest
decline. Details are shown in Table 1.

<table>
<thead>
<tr>
<th>sex</th>
<th>index</th>
<th>before exercise</th>
<th>postexercise</th>
<th>amplitude of variation</th>
<th>change rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 men and 2 women</td>
<td>weight/kg</td>
<td>97.11±22.71</td>
<td>89.67±20.54</td>
<td>7.44±3.15</td>
<td>-7.57</td>
</tr>
<tr>
<td></td>
<td>85.06±17.57</td>
<td>79.20±16.77</td>
<td>5.85±1.29</td>
<td>5.21±3.21</td>
<td>-6.98</td>
</tr>
<tr>
<td>Body Fat/%</td>
<td>29.59±8.87</td>
<td>32.30±5.89</td>
<td>7.30±6.13</td>
<td>-17.37</td>
<td></td>
</tr>
<tr>
<td></td>
<td>47.34±8.92</td>
<td>42.12±7.93</td>
<td>5.21±3.21</td>
<td>-10.92</td>
<td></td>
</tr>
<tr>
<td>BWH(average)/cm</td>
<td>106.12±13.92</td>
<td>100.71±10.20</td>
<td>5.41±1.93</td>
<td>-5.53</td>
<td></td>
</tr>
</tbody>
</table>
According to the above analysis of the research subjects, it can be seen that, after the aerobic exercise, various body indices of the research subjects were obviously changed. Overall, after a period of aerobic exercise, the scapular skin folds changed the most and the skin folds of the upper arm and the body fat rate also changed quite significantly. The specific trend is shown in Figure 2.

![Figure 2. Overall change rate chart](image)

### 5.1.2 Changes in blood indices

After a month of aerobic exercise, the blood indices of the research subjects were significantly improved.

![Figure 3. Blood index change (average)](image)

### 5.1.3 Changes in liver function indices

After a month of aerobic exercise, it can be found that the AST and ALT data of the subjects were significantly changed.
decreased. The ALT of male patients were effectively decreased to the normal range, and the difference is very obvious and also statistically significant. The ASL content of female patients was high and did not reach the normal range, and the change was not statistically significant, but it still can prove that small-and-medial-load aerobic exercise can effectively improve the liver functions of obese patients also intuitive description of small-and-medial-load aerobic exercise can effectively improve (Wu, 2011). After further data analysis, it is found that the severity of fatty livers of the subjects was mitigated, and the number of fatty liver patients was also down and more and more subjects tended to have normal livers, indicating that small-and-medial-load aerobic exercise has positive effects on the fatty livers of obese patients. See Table 2 for details.

<table>
<thead>
<tr>
<th>Degree of fatty liver</th>
<th>Before exercise</th>
<th>Postexercise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>male</td>
<td>Female</td>
</tr>
<tr>
<td>severe</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>moderate</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>mild</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>The liver has a dense echo</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>No abnormal liver</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

5.1.4 Relationship between the severity of fatty liver and the influencing factors

Regarding the correlations between a fatty liver and the obesity degree and time and body fat rate of a subject, through statistical analysis, it can be found that the fatty livers of the subjects are mainly positively correlated with obesity degree, obesity duration, serum and body fat rate and are not correlated with acetoacetic acid and hydroxybutyric acid (Li et al., 2015) as the correlation is not statistically significant. Specific data are shown in Figure 4.

5.2 Analysis and discussion

5.2.1 Effects of small-and-medial-load aerobic exercise on the blood elements of obese patients

Obese patients have fatty livers mainly because they have excessive fat in their bodies. This disease can easily lead to lipid metabolism disorders — the TC level increases significantly while the HDL-C level significantly decreases, further leading to other complications and posing great health threats to the human body. Small-and-medial-load aerobic exercise can promote the secretion of some hormones in the human body, which effectively enhances the CAMP level in the body and activates HSL and ultimately increases the lipolysis rate. Usually, 20 minutes after the exercise, the activity of the lipase oxidizing and decomposing the fat would gradually increase; 40 minutes later, the activity would be maintained at a certain level, so the exercise period should be very long to achieve weight loss and reduce the severity of fatty liver. Therefore, in this study, the
small-and-medial-load aerobic exercise period is designed to be one month. A month later, the contents of TC and TG of the subjects decreased significantly, but the HDL-C level was significantly increased, indicating that small-and-medial-load aerobic exercise can effectively balance the increase or decrease in blood elements, thereby improving the lipid disorders, which is of positive significance to the prevention of some complications. In addition, the dietary habit and exercise habit of obese patients can easily lead to increase of blood sugar, and may cause insulin resistance in the long run. After a month of experiments, the patients’ insulin contents tended to be normal.

5.2.2 Effects of small-and-medial-load aerobic exercise on fatty livers of obese patients

There are many reasons for a fatty liver, but the basic one is the functional disorder of the fat metabolism of the liver, leading to the accumulation of fat in the liver. By pathology, it can be classified into alcoholic and non-alcoholic fatty livers. In this study, none of the 44 subjects had a history of drinking, so the fatty liver category is non-alcoholic, which also shows that the main cause of this disease is obesity. Currently in clinical medicine, it is believed that the obesity-induced fatty liver is mainly caused by the imbalance between the TG and VLDL synthesized by liver cells. Obese patients have too much fat. Under in the effect of HSL, FFA gradually enters the liver (Yang and Lu, 2014), leading to a significant increase in the TG content in the liver and making it a fatty liver. The stem cells of the fatty liver are not severely damaged. As long as the patient can keep a healthy diet and take proper exercise, the liver can be recovered. After one month of aerobic exercise, the contents of liver function indices decreased obviously. Both the ALT of male patients and AST of female patients showed a decreasing trend, indicating that small-and-medial-load aerobic exercise has good effects on fatty livers. According to statistics, the prevalence rate of fatty livers in male patients is 81.8% and that in female patients is 77.3%, showing an obvious downward trend. In addition, aerobic exercise can improve a fatty liver not because it improves the liver’s ability to oxidize and decompose fat, but because it reduces the degree of obesity, thereby effectively reducing the fat stored in the human body and reducing the blood sugar and blood lipids. In this way, the fat entering the liver cells is also decreased significantly, and thus the degree of fatty liver is effectively mitigated (Li and Sun, 2014).

5.2.3 Relationships between fatty liver and influencing factors

According to the research results, the longer obesity time the patient has, the more severe the fatty liver will be. Long-term small-and-medial-load aerobic exercise can effectively increase the resting metabolic rate of the obese patients, consume their energy, decrease the TG content in the serum and gradually reduce the fat in their bodies, indicating that it has positive effects in mitigating the severity of fatty livers. In addition, IR is the cause and process of a fatty liver, and aerobic exercise can effectively improve IR, thus reducing the secretion of insulin in the body and inhibiting the sugar conversion rate. In this way, the oxidation and decomposition of fat are enhanced and the severity of fatty liver is mitigated (Xie and Zhang, 2010).

6. CONCLUSION

Small-and-medial-load aerobic exercise is an effective way to lose weight. It can not only effectively improve body fat metabolism disorders of obese patients, but also effectively improve their liver functions and recover the element metabolism in their livers to normal, thereby mitigating the severity of their fatty livers. Through this experiment, it can be seen that small-and-medial-load aerobic exercise can effectively improve the influencing factors to fatty liver, and thus it has positive effects on the treatment and prevention of fatty livers.

REFERENCES


