

Original Article

Treatment effect of the method of Tai Chi exercise in combination with inhalation of air negative oxygen ions on hyperlipidemia

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Abstract: Objective: To observe the improvement effect of the treatment method of Tai Chi exercise in combination with inhalation of the air negative oxygen ions on the blood lipid indicator of the patient suffering from the hyperlipidemia. Methods: 56 patients, who are diagnosed with hyperlipidemia, are the study objects and divided into an observation group and a control group by the random number method. Each group consists of 28 patients. The patients in the control group do Tai Chi exercise for about 60 min once a day; the patients in the observation group, in addition to Tai Chi exercise, are treated by inhalation of the air negative oxygen ions. Before the treatment and after 6 months' treatment, respectively test and compare body fat content, blood lipid, blood rheology and psychological adaptation as well as other indicators for these two groups of patients. Results: In comparison with the ordinary materials of the patients in two groups before the treatment, it shows no significant difference, $P>0.05$; after they are respectively treated for 6 months, it is found that the testing indicators of the patients in two groups are improved to some extent, but those of the observation group are better. Compared with the improvement effect of the control group, the difference has statistical significance, $P<0.05$. Conclusion: Tai Chi Exercise can improve the blood lipid indicator of the patient suffering from hyperlipidemia to some extent, however, the treatment method, in combination with inhalation of air negative oxygen ion, can obtain better effect than that of single Tai Chi exercise. Tip: the environment of the exercise plays an important intervention role in the treatment effect.

Keywords: Hyperlipidemia, Tai Chi exercise, negative oxygen ions, combination, treatment effect

Introduction

Hyperlipidemia means that one or more than one plasma lipids are higher than normal level due to abnormal fat metabolism or operation, for example, TC and TG is too high or HDL-C is too low. In the modern medicine, it is also called dyslipidemia [1, 2]. Hyperlipidemia is induced by the disorder of lipid metabolism and it is a risk factor of cardiovascular and cerebrovascular disease. It is closely related to hypertension, coronary heart disease, cerebrovascular diseases and obesity, while it can seriously threaten the physical and mental health of the patient [3, 4]. Negative oxygen ion therapy is a medical technology that has gradually emerged in recent years. It achieves the therapy purpose through the negative oxygen ion regulating physiological function [5]. It has proved that negative oxygen ion could regulate the blood circula-

tion system of the human body, however, there is less empirical study data about its treatment effect on the hyperlipidemia. In the study, the hyperlipidemia patients are treated by Tai Chi exercise in combination with the negative oxygen ion therapy. After 6 months' treatment, it is found that their blood lipid levels are improved significantly in comparison with those prior to the treatment. Meanwhile, the improvement effect on the patients with the combination treatment is obviously better than that of Tai Chi exercise group and the clinical effect is satisfactory. Now, it is reported as follows.

Data and methods

Study data

From Oct. 2011 to Oct. 2012, 56 hyperlipidemia patients were selected, who were treated

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Table 1. Comparison of body fat content, blood lipid and blood rheology for patients in the two groups before and after treatment ($\bar{x} \pm s$, n=30)

Indicators	Control group		Observation group	
	Before treatment	After treatment	Before treatment	After treatment
Fat percent (%)	32.58±2.36	29.44±2.25 ^a	32.71±2.34	27.44±2.28 ^{b,c}
TC (mmol/L)	5.64±0.31	5.11±0.29 ^a	5.76±0.33	4.25±0.32 ^{b,c}
TG (mmol/L)	2.12±0.22	1.91±0.21 ^a	2.14±0.24	1.59±0.22 ^{b,c}
LDL-C (mmol/L)	3.15±0.30	2.87±0.28 ^a	3.16±0.26	2.40±0.25 ^{b,c}
HDL-C (mmol/L)	1.12±0.13	1.30±0.16 ^a	1.11±0.12	1.51±0.19 ^{b,c}
Whole blood high shear viscosity (mpa.s)	5.34±0.53	5.07±0.48 ^a	5.36±0.59	4.52±0.56 ^{b,c}
Whole blood low shear viscosity (mpa.s)	8.63±0.92	8.14±0.86 ^a	8.64±1.01	7.72±0.94 ^{b,c}
Plasma viscosity (mpa.s)	1.91±0.12	1.83±0.11 ^a	1.93±0.14	1.65±0.13 ^{b,c}
Erythrocyte sedimentation indicator (mm/L)	16.36±5.71	15.92±5.45 ^a	16.52±6.11	13.73±5.43 ^{b,c}

Note: comparison of the control group before and after treatment, ^aP<0.05; comparison of the observation group before and after treatment, ^bP<0.05; comparison of the control group and the observation group after treatment, ^cP<0.05.

in Henan Province Second Charity Hospital and the affiliated hospital of our college. These patients did not suffer mental illness and any movement dysfunction disease that could give adverse effect on the aerobic exercise. The above said patients were divided into an observation group and a control group by the random number method. Each group consists of 28 patients. 16 male and 12 female patients are divided into the observation group and their ages are 31-64 years old and the average age (49.2±8.2); TC level is (6.42±0.38) mmol/L and TG level is (1.96±0.24) mmol/L. 18 male and 10 female patients are divided into the control group and their ages are 32-62 years old and the average age (48.5±6.7); TC level is (6.44±0.37) mmol/L and TG level is (1.99±0.26) mmol/L. Upon the statistics comparison of the ordinary data and the blood lipid level for the two groups of patients, it is found that their difference shows no statistical significance (P>0.05) and it is comparable.

Treatment method

The patients in the control group are treated with Tai Chi exercise, that is, Chen Style Tai Chi is used as a guide. First, under the guidance of professionals, the patients are trained with a simple Tai Chi for 45 min once a day and such exercise lasts for about 1 week. After the patients master the essentials of Tai Chi exercise, organize the patients to train for 45 min twice a day, that is, in the morning and in the evening. The intensity of training maintains moderate level, namely, the patients keep 110-130/min heart rate in the exercise process and they are trained for 6 months.

The patients in observation group are treated with inhalation of air negative oxygen ions in addition to Tai Chi exercise. It adopts MIS-05-03 indoor negative ion generator made in China. Start the generator to generate air negative oxygen ions one hour before Tai Chi exercise. Meanwhile, it adopts DLY-4G type air ion instrument made in China to determine concentration of air negative ions generated by the negative ion generator at 30-45 cm distance from the air outlet of the negative ion generator. It requires that concentration of air negative ions is $1 \times 10^4 / \text{cm}^3$. In the Tai Chi exercise process, always operate the negative oxygen ion generator and require the patients to keep 30-50 cm distance from the air outlet of the negative ion generator.

Testing indicators and methods

Before treatment and after 6 months' treatment, respectively test the following indicators for two groups of patients: 1. Fat percentage of the human body is directly tested by JS7-G65 body composition analyzer by a means of the machine set program (Beijing Zhongxi Yuanda Science and Technology Co., Ltd.). 2. The patients in the two groups stop exercise and treatment 2 days before this testing of blood lipid and they do not eat high fat food in supper 1 day before this testing. In the next morning, extract venous blood for testing under the condition of limosis. Adopt Olympus 2700 full-automatic biochemical analyzer made in Japan to respectively test blood lipid indicators of the subjects. The blood lipid test indicators include: TC, TG, LDL-C and HDL-C; adopt LBY-type N6C

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Table 2. Comparison of improvement on food, sleep and mood indicators for two groups of patients after treatment ($\bar{x} \pm s$, n=30)

Indicator	Control group					Observation group				
	Total patients	Im-proved	No change	Worse	Improvement rate(%)	Total patients	Im-proved	No change	Worse	Improvement rate(%)
Appetite Change	30	19	8	3	63.33	30	28	2	0	93.33*
Sleep change	30	21	7	2	70.00	30	28	2	0	93.33*
Mood change	30	17	9	4	56.67	30	29	1	0	96.67**

Note: comparison of the improvement rate between the observation group and the control group after the treatment, *P<0.05; **P<0.01.

full automatic rapid blood rheology tester test the whole blood viscosity, plasma viscosity and erythrocyte sedimentation indicator. 3. After 6 months' exercise therapy, evaluate psychology of patients in two group through a questionnaire.

Statistical analysis

Data from this study is expressed by ($\bar{x} \pm s$) and processed by SPSS13.0 version statistics software package. As for comparison of the measurement data, adopt t for testing; for comparison of counting data, use χ^2 for testing. P<0.05 means that the difference has statistics significance.

Results

After 6 months' treatment, it is found that the relevant testing indicators of the patients in two groups are improved to some extent in comparison with those prior to treatment, P<0.05. Meanwhile, improvement of the observation group is better. Compared with the improvement effect of the control group, P<0.05 or P<0.01 and the difference has statistical significance (Tables 1, 2).

Discussion

At present, the hyperlipidemia patients are intervened by the drugs in clinic, however, the side effect of drug treatment is easy to damage the body organ. One of the important topics in clinical study is to improve hyperlipidemia treatment measures [6-8]. Nowadays, a large number of clinical studies show that aerobic exercise not only can increase energy consumption, but also can enhance the body metabolism and improve the activity of some body enzymes (Especially lipoprotein lipase), thus enhance muscle uptake, utilize more free fatty acid (FA), accelerate the metabolism of TC, TG and LDL

and help to reduce the lipid level. Improvement of the blood lipid level is helpful for that of hemorrheology level [9-12]. Tai Chi exercise, adopted in the study, is one of the aerobic exercises. The whole set of postures combines movement with static state and have moderate strength, thus it is suitable for the people at different ages to learn and train [13]. The results of this study show that after the patients of the control group do Tai Chi exercise for 6 months, it is found that their body fat and blood lipid indicators are improved significantly compared with those before treatment, P<0.05. It can further prove that Tai Chi, an aerobic exercise, has curative effect on the treatment of hyperlipidemia patients to some extent.

Negative oxygen ion is called as "air vitamin" in the medical field. Relevant study shows that the high concentration negative oxygen ions enter into the lung through the respiratory tract and then into the blood circulation and the tissues and organs of the human body through the membrane exchange, therefore, it directly stimulates the nerve reflex and body fluid to act on each system of the body and plays a physiological regulation role [14, 15]. After the negative oxygen ions enter into the blood, through the release of charge, it will directly affect composition and distribution of the charged particles (such as protein in blood cells) in the blood so as to promote normalization of abnormal blood morphological composition and physical and chemical characteristics, increase the blood oxygen content and enhance absorption and utilization of the blood oxygen of the body [16-18]. Additionally, negative oxygen ions can promote the oxidation and reduction reaction of the body, especially it can play a role in the regulation of the body fat, protein, carbohydrate, water and electrolyte metabolism through strengthening oxidation process of liver, brain, kidney and activating many enzymes in the body [19, 20]. Moreover, inhalation of nega-

tive oxygen ions can regulate the function of the cerebral cortex, help to eliminate the sense of fatigue and improve quality and intensity of training. It can be said that it plays an important role in further accelerating the metabolism of lipids, reducing blood pressure and blood lipid level [21, 22]. For example, the places, for example, rural area, coast, waterfall and after-rain park with rich vegetation, are full of high negative oxygen ion content. The negative oxygen ion provides more oxygen supply to the human body and is helpful for oxygen delivery, absorption and utilization, while it can promote metabolism, thus people feel that they are full of energy. On the contrary, the places, in which the population is concentrated, air flow is not good or the pollution is heavy (Populated station, venue or city etc.), has relatively low negative ion concentration. It is easy for people to feel depressed, even tired. Thus, air negative oxygen ion content level not only affects physical and mental health of the people, but also restricts the fitness effect of the people who do exercise.

By comparison of the improvement of relevant indicators for two groups of patients after exercise and treatment in **Tables 1, 2**, it can be seen that after 6 months' Tai Chi exercise in combination with negative oxygen ion treatment, as for the treatment effect, under the intervention of air negative oxygen ion, it is helpful for improving the indicators of the patients, for example, fat content, blood lipid and blood rheology. Compared with the control group and that before the treatment, it improves significantly, $P < 0.05$. At the same time, it can obviously improve the food, sleep and mood indicators of the patients. Compared with the control group, $P < 0.05$ or $P < 0.01$. The results confirm that the observation group, in which the patients do Tai Chi exercise in addition to the intervention of the negative oxygen ion, is better than the control group in which the patients only do Tai Chi exercise. It also proves that the training environment with high air negative oxygen ion content is helpful to improve Tai Chi exercise therapy of patients with hyperlipidemia; it reminds of hyperlipidemia patients that although it is important to select the appropriate exercise item, it shall also pay attention to the intervention effects of the environmental factor in rehabilitation treatment process.

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