EFFECT OF AEROBIC EXERCISE ON NEUROMUSCULAR QUALITY IN THE ELDERLY

EFEITO DO EXERCÍCIO AERÓBICO SOBRE A QUALIDADE NEUROMUSCULAR EM IDOSOS

EFECTO DEL EJERCICIO AERÓBICO SOBRE LA CALIDAD NEUROMUSCULAR EN ANCIANOS

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ABSTRACT

Introduction: Physical activity has a good effect on improving the health of the elderly, especially in the treatment of chronic diseases of the respiratory, digestive, and cardiovascular systems. Many studies have proven that exercise, especially strength training, can delay and even reverse the decline in neuromuscular and motor function caused by aging, with a safe return to activities of daily living. The elderly generally choose an aerobic exercise for cardiovascular and endocrine benefits, but research on neuromuscular benefits has inconsistent results. Objective: Investigate the effects of aerobic exercise on neuromuscular quality in the elderly. Methods: Medical screening, background information questionnaire, and exercise habits were collected from 80 elderly people aged 65 to 80 years in two nursing homes in a given city. They were randomly divided into four groups without statistical difference. The male and female control groups maintained normal daily activities. In contrast, the male and female experimental groups practiced aerobic training exercises with progressively increasing intensity three times a week for 12 weeks. BMI, lean muscle mass and 6-minute walk test scores were collected. The software SPSS10 approaches t-test and data between groups compared by ANOVA ($P<0.05$). Results: The 6-minute walking distance of patients in the aerobic exercise group increased by an average of 20%. After aerobic exercise training, the 6-minute walking distance can increase by 10% to 18%. It shows that a certain intensity of aerobic exercise training can improve the submaximal exercise capacity of the patient, thus increasing the walking distance under the same exercise time. Conclusion: The aerobic exercise group is better than the control group at changing the body shape of the elderly by reducing fat and increasing lean body mass, while the control group has apparent effects on increasing muscle mass, strengthening muscle strength, and strengthening muscle function. ***Evidence Level II; Therapeutic Studies - Investigating the result.***

Keywords: Aerobic Exercise; Elderly; Endurance Training.

RESUMO

Introdução: A atividade física tem um bom efeito na melhoria da saúde dos idosos, especialmente no tratamento de doenças crônicas dos sistemas respiratório, digestivo e cardiovascular. Um grande número de estudos tem provado que o exercício, especialmente o treinamento de força, pode retardar e até reverter o declínio da função neuromuscular e motora causado pelo envelhecimento, com retorno seguro às atividades de vida diária. Os idosos geralmente escolhem o exercício aeróbico para benefícios cardiovasculares e endócrinos, porém pesquisas sobre benefícios neuromusculares possuem resultados inconsistentes. Objetivo: Investigar os efeitos do exercício aeróbico sobre a qualidade neuromuscular em idosos. Métodos: Passaram por triagem médica, questionário de informações básicas e hábitos de exercícios 80 idosos de 65 a 80 anos em duas casas de repouso em uma determinada cidade. Eles foram divididos em quatro grupos aleatoriamente sem diferença estatística. Os grupos de controle masculino e feminino permaneceram com suas atividades diárias normais enquanto os grupos experimentais masculino e feminino praticaram exercícios de treinamento aeróbico com intensidade de exercício físico progressivamente crescente, 3 vezes por semana durante 12 semanas. Foram coletados os índices de IMC, massa muscular magra e teste de caminhada de 6 minutos. O software SPSS10.0 foi utilizado para análise estatística com teste-t de student, os dados entre os grupos foram comparados pela ANOVA ($P<0,05$). Resultados: A distância de 6 minutos a pé dos pacientes no grupo de exercícios aeróbicos aumentou em média 20%. Após o treinamento de exercícios aeróbicos, a distância de 6 minutos a pé pode aumentar de 10% a 18%. Isso mostra que uma certa intensidade do treinamento de exercícios aeróbicos pode melhorar a capacidade submaximal de exercício do paciente, aumentando assim a distância de caminhada sob o mesmo tempo de exercício. Conclusão: O grupo de exercícios aeróbicos é melhor que o grupo de controle na mudança da forma corporal dos idosos, reduzindo a gordura e aumentando a massa corporal magra, enquanto o grupo de controle tem efeitos óbvios no aumento da massa muscular, no fortalecimento da força muscular, e no fortalecimento da função muscular. ***Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.***

Descritores: *Exercício Aeróbico; Idosos; Treino Aeróbico.*

RESUMEN

Introducción: La actividad física tiene un buen efecto en la mejora de la salud de las personas mayores, especialmente en el tratamiento de las enfermedades crónicas del sistema respiratorio, digestivo y cardiovascular. Un gran número de estudios ha demostrado que el ejercicio, especialmente el entrenamiento de fuerza, puede retrasar e incluso

invertir el declive de la función neuromuscular y motora causado por el envejecimiento, con un retorno seguro a las actividades de la vida diaria. Las personas mayores suelen elegir el ejercicio aeróbico por sus beneficios cardiovasculares y endocrinos, pero la investigación sobre los beneficios neuromusculares tiene resultados poco consistentes. Objetivo: Investigar los efectos del ejercicio aeróbico en la calidad neuromuscular de las personas mayores. Métodos: Se realizó un cribado médico, un cuestionario de información básica y hábitos de ejercicio a 80 ancianos de entre 65 y 80 años en dos residencias de ancianos de una ciudad determinada. Se dividieron aleatoriamente en cuatro grupos sin diferencia estadística. Los grupos de control masculino y femenino permanecieron con sus actividades diarias normales mientras que los grupos experimentales masculino y femenino practicaron ejercicios de entrenamiento aeróbico con una intensidad de ejercicio progresivamente creciente, 3 veces por semana durante 12 semanas. Se recogieron los índices de IMC, masa muscular magra y prueba de marcha de 6 minutos. Se utilizó el software SPSS10.0 para el análisis estadístico con la prueba t de Student, los datos entre grupos se compararon mediante ANOVA (P<0,05). Resultados: La distancia recorrida en 6 minutos de los pacientes del grupo de ejercicio aeróbico aumentó en promedio un 20%. Tras el entrenamiento de ejercicios aeróbicos, la distancia de 6 minutos de marcha puede aumentar entre un 10% y un 18%. Esto demuestra que una determinada intensidad de entrenamiento de ejercicio aeróbico puede mejorar la capacidad de ejercicio submáxima del paciente, aumentando así la distancia de marcha con el mismo tiempo de ejercicio. Conclusión: El grupo de ejercicio aeróbico es mejor que el grupo de control en el cambio de la forma corporal de los ancianos, la reducción de la grasa y el aumento de la masa corporal magra, mientras que el grupo de control tiene efectos evidentes en el aumento de la masa muscular, el fortalecimiento de la fuerza muscular y el fortalecimiento de la función muscular. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Ejercicio Aeróbico; Ancianos; Entrenamiento Aeróbico.*

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INTRODUCTION

As the aging process accelerates, there are more and more elderly people, and there are more and more various senile diseases. In particular, many elderly people have osteoporosis, which makes muscle tissue and muscle strength gradually attenuate, forming elderly muscle attenuation syndrome. Among them, the decline in balance ability of the elderly is an important reason for restricted mobility and falls. Once a fall occurs, it is easy to cause hip and wrist fractures, resulting in a serious prognosis.[1] And many elderly people have cognitive dysfunction, which will also have varying degrees of impact on patients' independent ability of daily living. Exercise therapy is a treatment program centered on exercise intervention. It is currently widely used in patients with cerebrovascular diseases and has achieved relatively ideal results, but the therapeutic application in muscle attenuation is still rare.[2] Aerobic exercise has a good effect on improving the health of the elderly, especially in the treatment of chronic diseases of the respiratory, digestive, cardiovascular and other systems.[3-4] A large number of studies have proved that exercise, especially strength training, can delay or even reverse the neuromuscular and motor function decline caused by aging, and improve the effectiveness and safety of exercise. The elderly usually choose aerobic exercise to maintain or improve cardiovascular function, endurance and/or endocrine function, but the research of aerobic exercise on the neuromuscular function and exercise capacity of the elderly is rarely reported and the results are not consistent.[5-6]

METHOD

Experimental subjects

There are a total of 80 elderly people aged 65-80 in two nursing homes in a certain city. Questionnaire surveys were used to ask for basic information, medical history, and physical exercise habits. Eligibility criteria: voluntary participation in the study, no systematic physical exercise experience (exercise no more than 3 times a week, exercise no more than 30 minutes a day, and exercise for less than 1 year), basic healthy people without severe hypertension, cardiovascular and cerebrovascular diseases, and motor dysfunction.

The research object is the test data of the pre-test and post-test. The longitudinal comparison of the test data of each group before and after the exercise intervention and the horizontal comparison of the degree of change between the two groups were carried out respectively.

Experiment grouping

Groups are grouped according to the principle of voluntary participation and knowing the whole process of the experiment. There are two nursing homes. The elderly who participated in the experiment in nursing home A were the aerobic exercise group, and the elderly who participated in the experiment in nursing home B were the control group: male aerobic exercise group (MAT), female aerobic exercise group (FAT), and male control group (MSA), female control group (FSA). The age and gender distribution of the members of each group is relatively even, and all the experimental subjects accept the pre-experiment test, except for the subjects who failed to participate in the exercise intervention and did not participate in the post-experiment test.[7]

6min-walk test

Mark a straight line distance of 30m on the flat corridor, and place a chair at each end as a sign. The patient moves back and forth between the chairs, the speed is determined by himself, the examiner next to him will report the time every 2 minutes, and record the patient's possible discomfort (shortness of breath, chest tightness, chest pain), but no communication with the patient. There shall be no hints or encouragement. If the patient cannot persist, the test can be suspended or aborted. the walking distance will be calculated after 6min. Test will be carried out again after resting for 10 minutes. The longer distance between the two tests is regarded as the test result.

Experimental method

The initial assessment of muscle strength and athletic ability was completed within one week before the start of aerobic exercise training, and the second test within one week after the end of exercise training.

Aerobic training methods

The patients in the aerobic exercise group received treadmill walking training 3 times a week (every other day) for 12 weeks. Each exercise

training includes 5 minutes of warm-up and 5 minutes of relaxation exercises at 40% of the maximum heart rate. The intensity of exercise training is determined by the maximum heart rate during the submaximal exercise test, and the exercise intensity and time are gradually increased during the 12-week aerobic training period. In the first 3 weeks of training, exercise intensity at 50% maximum heart rate for 20 minutes each time. Then increase the maximum heart rate by 5% every two weeks and extend the exercise time by 5 minutes, until the exercise intensity reaches 75% of the maximum heart rate in the 12th week, and the exercise time reaches 45 minutes.

Statistical analysis

Statistical analysis was performed using SPSS10.0 statistical software. The data are expressed as mean ± standard deviation. Firstly, the independent sample t test was used to compare whether the general data and main observation indexes of the two groups were different at the first test; the measurement data between the groups were compared by ANOVA. $P<0.05$ means the difference is significant.

RESULTS

Comparison within the group before and after the experimental intervention

Body shape indicators

1. The percentage of body fat has dropped significantly.

According to Figure 1, it is not difficult to find that the physical percentage of the subjects before and after the experimental intervention has significantly decreased, which proves that both exercise methods have a good effect on the percentage of body fat. But there are obvious differences between the two, the aerobic exercise group is better than the resistance exercise group. It can be seen from Figure 1 that there is a significant difference in the value of Body Mass Index (BMI) between men and women in the aerobic exercise group. During the experimental intervention period, the degree of participation in aerobic exercise is very good. At the same time, the effect is very good, making the experimental data very effective. It can be seen that the BMI aerobic exercise for the elderly has a very obvious gaining effect, and it is suitable for both men and women.

2. Muscle mass increased significantly

The muscle mass of the two groups of subjects has increased significantly. Both aerobic exercise and resistance training can increase muscle mass. Therefore, the increase in muscle mass is not very obvious. Aerobic exercise is the most effective for cardiopulmonary function and lower limb strength, while the increase in muscle mass is minimal. (Figure 2)

3. Improved walking ability

In the ordinary life of the elderly, the ability to walk is an important indicator of whether the elderly care for themselves. In this experiment, a 6-meter pace test of response speed quality was used to observe whether the walking ability of the elderly improved before and after the experiment. There are significant differences in the changes in the aerobic exercise group. At the beginning, they did not dare to walk too fast. After the experiment, they had strong walking. This experiment has achieved initial results. It successfully strengthened the walking ability of the subjects and strengthened the strength of the lower limbs. (Figure 3)

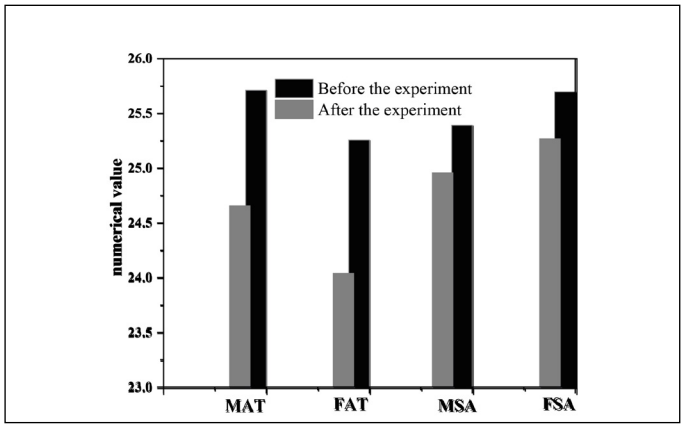

Figure 1. BMI value.

Comparison between groups after experiment

After the test, the data of the aerobic group and the control group were compared and analyzed. We found that the difference in physique percentage, muscle mass, grip strength, and vestibular step ability of the men and women in the control group was higher than that of the men and women in the aerobic group. However, the degree of difference between the BM work value and the 6-meter walking speed aerobic group was higher than that of the control group. There is no difference between the data before and after selecting the response. The data after the test are shown in Table 1.

DISCUSSION

The validity and reliability of the 6min walking distance for the assessment of the physical condition and athletic ability of the elderly have been confirmed. The 6-min walk distance of patients in the aerobic exercise group increased by an average of 20%. After aerobic exercise training,

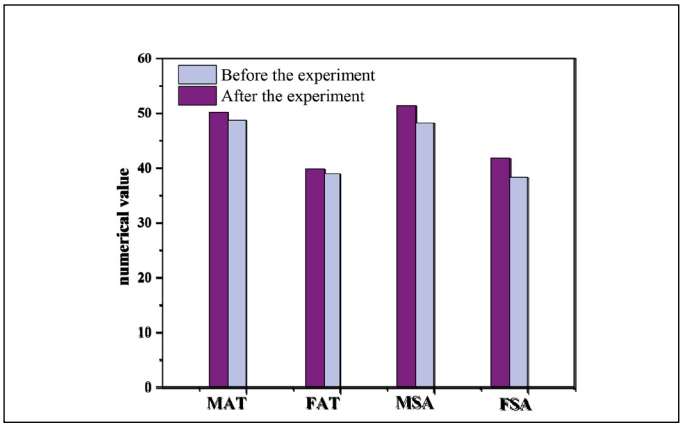

Figure 2. Muscle mass.

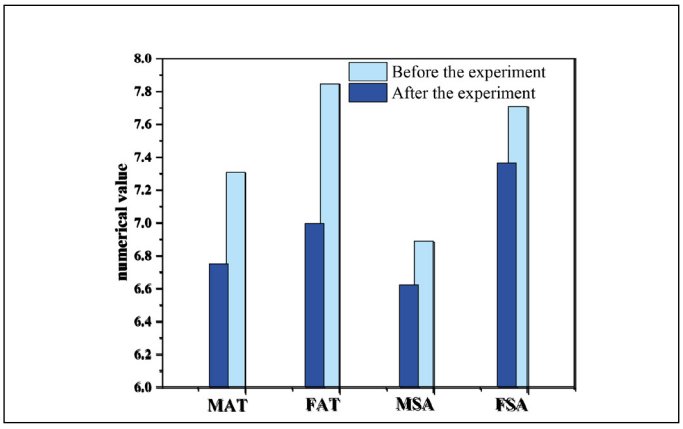

Figure 3. 6m walking speed.

Table 1. Comparison of various indicators between the two groups after the experiment ($\overline{x} \pm s$).

Index	Male aerobic group	Female aerobic group
BMI	23.4±2.1	23.1±1.1
Muscle(kg)	50.1±4.6	38.5±2.6
6m walking speed (s)	6.0±1.5	6.1±2.2

the 6min walking distance can increase by 10%-18%. It shows that a certain intensity of aerobic exercise training can improve the patient's submaximal exercise capacity, thereby increasing the walking distance under the same exercise time.[8] In the past, the focus of the research on the effect of exercise was mainly on the role of strength training. It is believed that exercise training can maintain muscle strength and improve the nerve and motor function of the elderly. However, for the elderly, the use of strength training exercise methods will be restricted by relevant knowledge, equipment and other conditions. Aerobic exercise training, such as fast walking, mountain climbing, and biking, is often chosen as a daily exercise method for the elderly because of its simple exercise methods and convenient intensity control. It is generally believed that aerobic training is used to improve the cardiopulmonary function of patients, improve glucose and lipid metabolism and enhance exercise endurance.[9]

This study also shows that the maximum muscle strength of the knee flexors and extensors has also been significantly improved after 12 weeks of exercise training. Compared with the initial test, the 1RM of the flexors and extensors increased by 20% and 22%, and the absolute value increased by about 4kg. The strength of the knee flexors and extensors is of great significance for preventing falls in the elderly and maintaining normal ADL ability. All elderly patients who participated in this study did not have good exercise habits, so the muscle strength and exercise ability of the lower limbs were poor at the initial assessment. Although the decline in exercise capacity is mainly caused by aging, the lack of good exercise habits is also an important factor and may aggravate the decline in exercise function due to aging.[10] Therefore, the results of this study also support aerobic training for elderly patients to set exercise intensity based on the results of submaximal exercise test, delay the decline of exercise function caused by aging, and even improve exercise function.

CONCLUSION

This study shows that 12-week gradual moderate and high-intensity aerobic training can increase the patient's exercise capacity, which is manifested by increased knee flexor and extensor muscle strength and an increase in the 6-minute walk distance, thereby maintaining, delaying or even improving the diminishment of motor function caused by aging. In summary, aerobic exercise can improve the effect of intervention on attenuation syndrome in the elderly, promote the recovery of balance ability, and improve cognitive function. It is worthy of clinical application.

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