EFFECTS OF RESISTANCE EXERCISE ON PHYSICAL HEALTH IN MIDDLE-AGED AND ELDERLY WOMEN

EFEITOS DO EXERCÍCIO DE RESISTÊNCIA SOBRE A SAÚDE FÍSICA DE MULHERES DE MEIA-IDADE E IDOSAS

EFECTOS DEL EJERCICIO DE RESISTENCIA EN LA SALUD FÍSICA DE MUJERES DE MEDIANA Y AVANZADA EDAD

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ABSTRACT

Introduction: Several methods of sports training are applied to improve physical health in middle-aged and elderly women. Among the emerging ones is resistance exercise, despite little evidence about its effects in this population group. Objective: Explore the effects of resistance exercise on promoting muscle health and reducing cardiovascular risk in middle-aged and elderly women. Methods: A questionnaire on the level of muscle health and cardiovascular risk factors of 100 middle-aged and elderly women was conducted. A total of 20 middle-aged and elderly women were randomly selected as participants, and the experimental group performed resistance exercise training, while the control group performed simple exercise training. Results: In the muscle health indicators of the experimental group, BMI decreased by 0.3%, body fat decreased by 1.3%, waist-to-hip ratio decreased by 0.01, fat decreased by 1.7 kg, lean weight increased by 2.8 kg, and protein decreased by 0.9 kg. The changes in cardiovascular health indicators in the experimental group were greater than those in the control group. Conclusion: Resistance exercise can effectively improve muscle health in middle-aged and elderly women, reducing cardiovascular risk. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Resistance Training; Middle Aged; Aged; Physical Conditioning, Human.

RESUMO

Introdução: Diversos métodos de treinamento esportivo são aplicados para melhorar a saúde física de pessoas de meia-idade e idosas. Dentre os emergentes está o exercício de resistência, apesar de pouca evidência sobre seus efeitos neste grupo populacional. Objetivo: Explorar os efeitos do exercício de resistência na promoção da saúde muscular e na redução do risco cardiovascular em pessoas de meia-idade e idosas. Métodos: Foi realizado um questionário sobre o nível de saúde muscular e fatores de risco cardiovascular de 100 mulheres de meia-idade e idosas. Um total de 20 mulheres de meia-idade e idosas foram selecionadas aleatoriamente como participantes, e o grupo experimental realizou treinamento com exercícios resistidos, enquanto o grupo controle realizou treinamento com exercícios simples. Resultados: Nos indicadores de saúde muscular do grupo experimental, o IMC diminuiu 0,3%, a gordura corporal diminuiu 1,3%, a relação cintura/quadril diminuiu 0,01, a gordura diminuiu 1,7 kg, o peso magro aumentou 2,8 kg, e a proteína diminuiu 0,9 kg. As mudanças nos indicadores de saúde cardiovascular no grupo experimental foram maiores do que as do grupo de controle. Conclusão: O exercício de resistência pode efetivamente melhorar a saúde muscular em mulheres de meia-idade e idosas, reduzindo o risco cardiovascular. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Treinamento de Força; Pessoa de Meia-Idade; Idoso; Condicionamento Físico Humano.*

RESUMEN

Introducción: Se aplican varios métodos de entrenamiento deportivo para mejorar la salud física de las personas de mediana y avanzada edad. Entre los emergentes se encuentra el ejercicio de resistencia, a pesar de la poca evidencia sobre sus efectos en este grupo poblacional. Objetivo: Explorar los efectos del ejercicio de resistencia en la promoción de la salud muscular y la reducción del riesgo cardiovascular en personas de mediana edad y ancianas. Métodos: Se realizó un cuestionario sobre el nivel de salud muscular y los factores de riesgo cardiovascular de 100 mujeres de mediana edad y ancianas. Un total de 20 mujeres de mediana edad y ancianas fueron seleccionadas aleatoriamente como participantes, y el grupo experimental realizó entrenamiento con ejercicios de resistencia, mientras que el grupo de control realizó entrenamiento con ejercicios simples. Resultados: En los indicadores de salud muscular del grupo experimental, el IMC disminuyó un 0,3%, la grasa corporal disminuyó un 1,3%, la relación cintura-cadera disminuyó un 0,01, la grasa disminuyó 1,7 kg, el peso magro aumentó 2,8 kg y las proteínas disminuyeron 0,9 kg. Los cambios en los indicadores de salud cardiovascular del grupo experimental fueron mayores que los del grupo de control. Conclusión: El ejercicio de resistencia puede mejorar eficazmente la salud muscular en mujeres de mediana y avanzada edad, reduciendo el riesgo cardiovascular. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Entrenamiento de Fuerza; Persona de Mediana Edad; Anciano; Acondicionamiento Físico Humano.*

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INTRODUCTION

The aging phenomenon has become a very serious problem in the world. More and more scholars have begun to pay attention to the health problems of the middle-aged and elderly people, and are looking for appropriate exercise methods to improve the physical health of the middle-aged and elderly people.[1] The decline of muscle strength, physical fitness and the high incidence of cardiovascular diseases in middle-aged and elderly people have become very common problems in this group. The decline of muscle strength can cause the decline of activity of middle-aged and elderly people, increase the risk of falls and injuries of middle-aged and elderly people, and cause the poor quality of life of middle-aged and elderly people.[2] Cardiovascular diseases can also directly affect the health quality of middle-aged and elderly people, and increase the risk of death of middle-aged and elderly people. Exercise intervention can help the middle-aged and old people improve their health quality, effectively alleviate the problems such as the decline of their body quality, low muscle quality and weak cardiovascular system.[3] Middle-aged and elderly people are characterized by low physical fitness, decreased muscle strength, and scientific and reasonable arrangements need to be made according to the needs and characteristics of the people. For the exercise mode of middle-aged and elderly people, we should not exercise blindly, but adopt scientific, effective and healthy training methods.[4] By querying a large number of documents, we can learn that for middle-aged and elderly people with poor activity ability and small range of movement, their muscle mass is relatively small, their physical functional quality is relatively low, and they are prone to injuries, falls and fractures during exercise. Therefore, the resistance exercise training method with moderate exercise intensity is adopted, which is more friendly to middle-aged and elderly people.[5] Muscle plays a key role in the health quality of middle-aged and elderly people. The control ability of muscle contraction and relaxation can directly affect the degree of exercise of middle-aged and elderly people. Better muscle control ability can also help the cardiovascular system in a balanced and healthy state.[6] Therefore, carrying out resistance exercise training for the muscle health of middle-aged and elderly people can help the middle-aged and elderly people improve their muscle health quality to a certain extent, Further reduce cardiovascular risk factors and ultimately improve quality of life.[7] This paper designed an intervention experiment of resistance exercise for middle-aged and elderly people. Through a certain period of exercise training, it explored that resistance exercise can improve the muscle health of middle-aged and elderly people, reduce cardiovascular risk, and lay a theoretical foundation for helping middle-aged and elderly people to maintain health and improve the quality of life.[8]

METHOD

In this experiment, middle-aged and elderly women aged 40 to 70 years in a city were selected as the respondents. The study and all the participants were reviewed and approved by Ethics Committee of Xinjiang University (NO.XJUST-F082). Data on muscle health and cardiovascular risk factors were collected from 100 respondents through questionnaires. Among them, the muscle health data includes the height (cm), weight (kg), lean weight (kg), upper arm circumference (cm), thigh circumference (cm), vertical jump touch height (cm) and standing long jump (cm) of the respondents. The cardiovascular risk factors include hypertension, overweight and obesity, genetics and other aspects.

20 experimental subjects were randomly selected from middle-aged and elderly women aged 40 to 70 years old, and divided into experimental group and control group, with 10 in each group. The subjects were trained through resistance exercise experiment intervention, and their muscle health indicators and cardiovascular health indicators were tested before and after the experiment. Muscle health indicators include BMI, body fat (%), waist to hip ratio, fat (kg), lean body weight (kg) and protein (kg), and cardiovascular health indicators include cardiac output, stroke output, cardiac index, internal diameter (mm) and resistance index RI.

The experimental group received resistance exercise training, while the control group received simple exercise training. The training cycle of the two groups was 14 weeks, four times a week, and the training time was the morning of 1, 2, 4, and 5 every week, and each training time was 50 minutes. The resistance exercise training method uses elastic band exercise. Each exercise activity includes warm-up, resistance and relaxation. The warm-up time is 10 minutes, the resistance exercise time is 20 minutes, the relaxation time is 10 minutes, and the rest time is 10 minutes. The simple exercise training method is fast walking, with warm-up time of 10 minutes, fast walking practice time of 20 minutes, relaxation time of 10 minutes and rest time of 10 minutes.

The survey data and experimental data of this experiment are statistically processed using Excel software to ensure the accuracy and scientificity of the data.

RESULTS

Effect of resistance exercise on muscle health of middle-aged and elderly people

In view of the current situation of muscle health of middle-aged and elderly people, this experiment counted the muscle health of 100 middle-aged and elderly women, and the specific data is shown in Table 1.

The experimental group tested the muscle health indicators before and after the 14-week resistance exercise training, and the specific data are shown in Table 2. Through data comparison, it can be seen that the test data of BMI, body fat, waist to hip ratio, fat and protein have decreased, and the test data of lean weight has improved to some extent.

The control group tested the muscle health indicators before and after the 14-week simple exercise training. The specific data are shown in Table 3. Through data comparison, it can be seen that the BMI, body fat, waist to hip ratio, fat and protein data of the experimental subjects in the control group have decreased to a certain extent, while the lean weight data has increased.

Table 1. Investigation status of muscle health in middle-aged and elderly women.

Option	40-50 years old	50-60 years old	60-70 years old
Height (cm)	164.004±5.187	160.104±5.297	159.215±4.665
Body weight (kg)	59.097±6.849	62.748±7.471	62.335±10.275
Lean weight (kg)	40.597±4.380	42.478±6.883	41.969±7.131
Upper arm circumference (cm)	26.937±3.058	28.760±2.734	26.835±2.937
Thigh circumference (cm)	49.629±3.565	51.105±4.190	50.525±5.229
Vertical jump touch height (cm)	23.323±5.459	20.451±5.603	14.393±5.387
Standing long jump (cm)	131.305±27.633	120.004±28.512	84.895±21.440

Table 2. Effects of resistance exercise on muscle health of middle-aged and elderly people.

Option	Before intervention in the experimental group	After intervention in the experimental group
BMI	24.418±2.283	24.172±2.433
Body fat (%)	32.626±3.677	31.375±3.591
Waist to hip ratio	0.911±0.424	0.901±0.466
Fat (kg)	19.852±3.626	18.143±3.651
Lean weight (kg)	40.821±2.829	43.664±6.998
Protein (kg)	8.445±0.589	8.358±0.622

Table 3. The influence of muscle health in middle-aged and elderly people in the control group.

Option	Before intervention in control group	After intervention in the control group
BMI	23.520±2.134	23.314±2.130
Body fat (%)	32.934±2.750	31.721±2.584
Waist to hip ratio	0.901±0.345	0.881±0.344
Fat (kg)	19.951±3.209	18.548±3.073
Lean weight (kg)	40.608±3.663	41.899±3.759
Protein (kg)	8.404±0.748	8.100±0.799

Effect of resistance exercise on cardiovascular risk factors in middle-aged and elderly people

Cardiovascular disease is very harmful to middle-aged and elderly people, and its influencing factors can be shown in 10 aspects through the questionnaire, as shown in Figure 1. It can be seen from Figure 1 that hypertension is the most influential aspect of cardiovascular risk factors, accounting for 28.24%, hyperlipidemia 27.43%, overweight and obesity 14.75%. Other influencing factors are smoking, drinking, unreasonable diet, insufficient physical activity, bad psychosocial factors, genetics and other aspects according to the degree of risk.

The cardiovascular health indicators of the experimental group were tested at rest and after exercise. The specific data are shown in Table 4.

The cardiovascular health indicators of the control group were tested at rest and after exercise. The specific data are shown in Table 5.

DISCUSSION

Analysis of the impact of resistance exercise on muscle health of middle-aged and elderly people

The BMI, body fat, waist to hip ratio and fat data of the subjects in the experimental group decreased, and the lean weight data increased, indicating that the muscle health quality of the subjects was improved. The reason for the decrease of protein data may be that the subjects increased the amount of exercise, but did not supplement enough nutrients, resulting in the decrease of protein. The change rule of muscle health index test data in the control group is consistent with that in the experimental group. BMI, body fat, waist to hip ratio, fat and protein data have decreased to a certain extent, and lean weight data have increased. It can be seen from this that a certain amount of physical exercise has a positive effect on the muscle health of the middle-aged and elderly people. Through physical exercise, the muscle control ability of the middle-aged and elderly people can be improved, thus helping the middle-aged and elderly people to maintain a healthy state and improve the quality of life. In the experimental group, BMI decreased by about 0.3, body fat decreased by about 1.3 (%), waist to hip ratio decreased by about 0.01, fat decreased by about 1.7 (kg), lean weight increased by about 2.8 (kg), and protein decreased by about 0.9 (kg); In the control group, BMI decreased by about 0.2, body fat decreased by about 1.2 (%), waist to hip ratio decreased by about 0.02, fat decreased by about 1.4 (kg), lean weight increased by about 1.2 (kg), and protein decreased by about 0.3 (kg). Comparing the change degree of the two groups of data, it can be seen that the data of BMI, body fat, fat, lean weight and protein in the experimental group have a greater range of change, which indicates that the resistance exercise training proposed in this experiment has a greater impact on the muscle health of the middle-aged and elderly people, and the improvement effect is better, which is more conducive to the improvement of the physical quality of the middle-aged and elderly people.

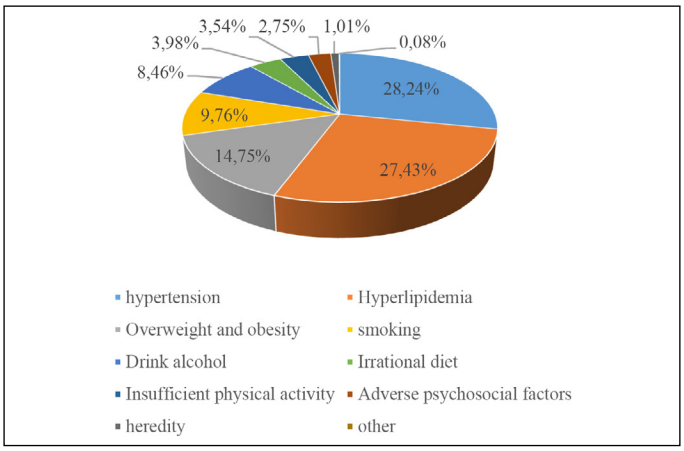

Figure 1. Survey of cardiovascular risk factors in middle-aged and elderly women.

Table 4. Effect of resistance exercise on cardiovascular health of middle-aged and elderly people.

Option	Before exercise in the experimental group	After exercise in the experimental group
Cardiac output (CO) L/min	3.940±1.000	6.285±0.645
Stroke output (SV) ml	61.680±9.527	70.384±7.640
Heart rate (HR) times/min	63.043±2.104	100.028±6.734
Ejection fraction (EF)%	66.861±7.589	71.489±6.065
Cardiac index (CI) L/min · m^2	2.532±0.552	3.980±0.486
Inner diameter (mm)	5.598±0.326	5.564±0.259
Peak systolic flow velocity Vs (cm/s)	104.954±19.802	104.328±19.192
End diastolic flow velocity Vd (cm/s)	40.624±6.325	40.815±4.815
Resistance index RI	0.609±0.036	0.606±0.050

Table 5. The influence of cardiovascular health in the control group.

Option	Before exercise in the control group	After exercise in the control group
Cardiac output (CO) L/min	3.432±0.818	5.552±1.012
Stroke output (SV) ml	51.035±9.577	59.853±6.652
Heart rate (HR) times/min	68.075±7.216	107.041±3.958
Ejection fraction (EF)%	61.441±7.294	64.481±3.761
Cardiac index (CI) L/min · m^2	2.197±0.513	3.484±0.699
Inner diameter (mm)	5.558±0.336	5.367±0.319
Peak systolic flow velocity Vs (cm/s)	87.628±12.646	104.457±22.543
End diastolic flow velocity Vd (cm/s)	36.519±5.976	34.046±4.479
Resistance index RI	0.589±0.039	0.697±0.060

Analysis of the impact of resistance exercise on cardiovascular risk factors in middle-aged and elderly people

In the experimental group, the cardiac output of cardiovascular health indicators increased by about 2.1 L/min, the stroke output increased by about 8.7 ml, the heart rate increased by about 37 times/min, the ejection fraction increased by about 4.6%, and the cardiac index increased by about 1.4 L/min · m^2. The inner diameter decreased by about 0.03 (mm), the peak systolic velocity decreased by about 0.63 (cm/s), the end diastolic velocity increased by about 0.2 (cm/s), and the resistance index decreased by about 0.003. In the control group, the cardiac output of cardiovascular health indicators increased by about 2.1 L/min, the stroke output increased by about 8.8 ml, the heart rate increased by about 39 times/min, the ejection fraction increased by

about 3.0%, and the heart increased by about 1.3 L/min · m^2. The inner diameter decreased by about 0.2 (mm), the peak systolic velocity decreased by about 0.6 (cm/s), the end diastolic velocity increased by about 2.5 (cm/s), and the resistance index increased by about 0.11. By comparing the changes of the data of the two groups, it can be seen that the stroke output, heart rate, internal diameter, end-diastolic flow rate and resistance index of the experimental group are lower than those of the control group, and the ejection fraction, cardiac index and peak systolic flow rate of the experimental group are higher than those of the control group. Through the comparison of the above data, it can be seen that the changes of cardiovascular health indicators in the experimental group after resistance exercise training are better than those in the control group. Therefore, compared with simple exercise training, the resistance exercise training proposed in this experiment is more beneficial to the cardiovascular health of the middle-aged and elderly people, can reduce the cardiovascular risk factors of the middle-aged and elderly people, help the middle-aged and elderly people improve their cardiopulmonary capacity, and thus reduce the incidence of disease.

CONCLUSION

Muscle health and cardiovascular health are the main health problems that perplex the middle-aged and elderly people. This paper proposes an anti-resistance exercise method based on elastic band training, and carries out experimental intervention on the muscle and cardiovascular capacity of the middle-aged and elderly people. From the experimental results, it can be seen that the improvement effect of muscle health and cardiovascular health in the experimental group is greater than that in the control group. In addition, this experiment also conducted a questionnaire analysis on the muscle health and cardiovascular risk factors of 100 middle-aged and elderly women. The main factor affecting cardiovascular risk of middle-aged and elderly women was hypertension, accounting for 28.24%, followed by hyperlipidemia, accounting for 27.43%, followed by overweight and obesity, smoking, drinking, unreasonable diet, insufficient physical activity, and adverse psychosocial factors Genetics and other aspects.

The author declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: The author has completed the writing of the article or the critical review of its knowledge content. This paper can be used as the final draft of the manuscript. Every author has made an important contribution to this manuscript. Kuan Li: writing and execution.

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