MEDICAL PHYSICAL ACTIVITY LEVEL ON PROMOTING WOMEN'S CARDIOVASCULAR HEALTH

NÍVEL DE ATIVIDADE FÍSICA MÉDICA E A PROMOÇÃO DA SAÚDE CARDIOVASCULAR DE MULHERES

NIVEL DE ACTIVIDAD FÍSICA MÉDICA Y LA PROMOCIÓN DE LA SALUD CARDIOVASCULAR DE MUJERES

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Jing Bao[1,2]
(Physical Education Professional)

1. Department of Physical education teaching and research, Northwest University, Xi'an, Shaanxi, China.
2. School of Public Policy and Administration, Xi'an Jiaotong University, Xi'an, Shaanxi, China.

Correspondence
Jing Bao
Xi'an 710049, Shaanxi, China.
baojing@nwu.edu.cn

ABSTRACT

Introduction: Several studies have shown that insufficient physical activity has gradually become an independent risk factor for chronic diseases such as all-cause mortality and cardiovascular disease. Objective: We screened women with different physical activities for cardiovascular risk factors by setting up questionnaires and conducting health examinations. This research can provide some theoretical basis for women's health maintenance. Methods: This study evaluated the level of physical activity, cardiovascular risk factors, and the cardiopulmonary function of urban women aged 40-49. We tested the fundamental physiological indicators of volunteers, as well as blood sugar, blood lipids, blood pressure, etc. Results: Women who practice a great deal of physical activity had lower BMI and body fat percentage. Their physiological indicators were healthier than those with a low amount of physical activity. Conclusion: Physical education programs have a significant effect in improving the physical fitness of the human body. ***Level of evidence II; Therapeutic studies - investigation of treatment results.***

Keywords: Exercise; Cardiac Rehabilitation; Blood Glucose; Hypertension.

RESUMO

Introdução: Vários estudos demonstram que baixa atividade física tem gradualmente se tornado um fator de risco independente para doenças crônicas como mortalidade geral e doenças cardiovasculares. Objetivo: Examinamos mulheres que praticam diferentes atividades físicas para observar fatores de risco cardiovascular através de questionários e a condução de exames de saúde. Esta pesquisa pode fornecer uma base teórica para os cuidados com a saúde da mulher. Métodos: O presente estudo avaliou o nível de atividade física, os fatores de risco cardiovascular e a função cardiopulmonar de mulheres entre 40 e 49 anos de idade, em um cenário urbano. Testamos os indicadores fisiológicos básicos das voluntárias, assim como o açúcar no sangue, lipídios no sangue, pressão sanguínea etc. Resultados: Mulheres que praticam muita atividade física apresentam IMC e porcentagem de gordura corporal mais baixos. Seus indicadores fisiológicos eram mais saudáveis do que aqueles de mulheres com baixa atividade física. Conclusão: Programas de educação física têm um efeito importante na melhoria do preparo físico do corpo. ***Nível de evidência II; Estudos terapêuticos – investigação de resultados de tratamento.***

Descritores: *Exercício físico; Reabilitação Cardíaca; Glicemia; Hipertensão.*

RESUMEN

Introducción: Varios estudios demuestran que baja actividad física ha gradualmente se convertido en un factor de riesgo independiente para enfermedades crónicas, como mortalidad general y enfermedades cardiovasculares. Objetivo: Examinamos mujeres que practican diferentes actividades físicas para observar factores de riesgo cardiovascular a través de encuestas y la conducción de exámenes de salud. Esta investigación puede brindar una base teórica para los cuidados con la salud de la mujer. Métodos: El presente estudio evaluó el nivel de actividad física, los factores de riesgo cardiovascular y la función cardiopulmonar de mujeres entre 40 y 49 años de edad, en un escenario urbano. Testamos los indicadores fisiológicos básicos de las voluntarias, así como el azúcar y lípidos en la sangre, presión sanguínea, etc. Resultados: Mujeres que practican mucha actividad física presentan IMC y porcentaje de grasa corporal más bajos. Sus indicadores fisiológicos eran más saludables que aquellos de mujeres con baja actividad física. Conclusión: Programas de educación física tienen un efecto importante en la mejoría de la preparación física del cuerpo. ***Nivel de evidencia II; Estudios terapéuticos – investigación de resultados de tratamiento.***

Descriptores: *Ejercicio Físico; Rehabilitación Cardiaca; Glucemia; Hipertensión.*

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INTRODUCTION

Physical activity (PA) refers to various physical activities that significantly increase energy expenditure. Physical activities mainly include leisure physical activities and non-leisure physical activities. Many studies have shown that insufficient physical activity has gradually become an independent risk factor for chronic diseases such as all-cause mortality and cardiovascular disease. Epidemiological survey data also pointed out that higher PA levels can effectively improve the human heart and lung function, reducing chronic diseases. People with a higher PA lifestyle have lower cardiovascular risk than those with a lower PA.[1] In this study, the physical activity level of female college teachers aged 40 to 49 years old was investigated through questionnaires, and their health status

and cardiovascular risk were investigated. This research provides the theoretical and experimental basis for the health promotion of female teachers in colleges and universities.

METHODS

Research object

We conducted relevant questionnaire surveys on 542 female teachers aged 40 to 49 years old in 10 colleges and universities and returned 469 questionnaires, with an effective rate of 86.53%. Screen out women who have not entered menopause without clinical diagnosis and have contraindications to exercise testing. In the end, 415 qualified subjects were included in this trial.[2] We stratified the subjects according to their total energy expenditure (MET) during 7 days of physical activity. Volunteers are divided into high physical activity (PA≥3000METmin/week, H group), moderate physical activity (600≤PA≤3000MET-minutes/week, M group), and low physical activity (PA<600MET-minutes/week, L group) 3 groups. There are 70 people in group L whose age range is (44.1±3.5) years old. There are 180 people in the M group, with an age range of (44.7±4.1) years old. There are 165 people in group H, with an age range of (45.0±3.9) years old.

Research methods

Test index

We investigated the overall physical activity, medium-to-high-intensity physical activity, and light physical activity of the three subjects.[3] We collected 3 groups of subjects' health indicators, including height, weight, body mass index (BMI), waist circumference, blood pressure, body fat, resting pulse wave velocity (PWV), brachial-ankle index (ABI), blood glucose (FBG), triglycerides (TG), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C), maximum oxygen uptake (VO_2max).[4]

Data Statistics

We use the acceleration sensor to estimate the human body motion b as the state vector to obtain the state equation and observation equation of the system:

$$\begin{cases} \begin{bmatrix} \dot{\theta} \\ \dot{b} \end{bmatrix} = \begin{pmatrix} 0 & -1 \\ 0 & 0 \end{pmatrix} \begin{bmatrix} \theta \\ b \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} \omega_{gy} + \begin{bmatrix} \omega_g \\ 0 \end{bmatrix} \\ \theta_{acc} = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} \omega \\ b \end{bmatrix} + \omega_a \end{cases} \quad (1)$$

ω_{gy} represents the output angular velocity of human body motion, including a fixed deviation. Θ_{acc} represents the angle value of the acceleration sensor obtained after processing. ω_g, ω_a is the measurement noise of human body motion and acceleration sensor, respectively.[5] Assume that the two are white noise and satisfy the normal distribution. We set the system measurement noise as $\omega(k)$. The sampling period is T_s. Then we get the state equation and measurement equation of the system:

$$\begin{cases} X(k) = \begin{bmatrix} 1 & T_s \\ 0 & 1 \end{bmatrix} X(k-1) + \begin{bmatrix} T_s \\ 0 \end{bmatrix} \omega_{gy}(k-1) + \begin{bmatrix} \omega_g(k) T_s \\ 0 \end{bmatrix} \\ V_i = \begin{bmatrix} 1 & 0 \end{bmatrix} X(k) + \omega_a(k) \end{cases} \quad (2)$$

$$Kg(k) = \frac{P(k \mid k-1) H^T}{HP(k \mid k-1) H^T + R(k)} \quad (3)$$

$Kg(k)$ represents the Kalman increment at time k. $P(k \mid k-1)$ represents the covariance of the system at the time $k-1$. H is the output matrix of the measurement system. H^T is its transpose matrix. $R(k)$ represents the covariance of measurement noise. From this, the fused attitude angle is calculated:

$$\theta(k) = \theta_{gy}(k) + Kg(k)(\theta_{gy}(k) - \theta_{acc}(k)) \quad (4)$$

$\Theta(k)$ is the output value of the attitude angle at the time k after fusion processing. At the same time, the covariance of the system state at the time k is obtained:

$$P(k \mid k) = (1 - Kg(k)H) P(k \mid k-1) \quad (5)$$

Formula (1) to formula (5) are the complete *kalman* filter calculation process. Formula (3) and Formula (5) are used to ensure the recursiveness and continuity of the filtering algorithm. When the system receives the angular velocity output of the human body motion $k+1$, it returns to equation (1). Currently, the system enters the filtering operation at the time $k+1$.

RESULTS

Results of cardiovascular risk factors index for female teachers in colleges and universities

BMI and body fat percentages among female teachers of different physical activities among different colleges and universities decreased with increased physical activity levels.[6] With the increase in physical activity, the FBG index of the M group was significantly lower than that of the L group ($P<0.05$). But the difference between the H group and the M group was not statistically significant (Table 1). This reflects the PWV and ABI index of vascular function status in each group without significant changes.

In the proportion of people at risk, the number of people in groups M and H was significantly less than in group L ($P<0.05$). At the same time, the number of people in group M was significantly less than that in group H ($P<0.01$) (Table 2).

Relevant results of exercise test for female teachers in various colleges and universities

There was no significant difference in the time to complete the exercise and the maximum heart rate after the exercise in the three

Table 1. Results of fundamental physiological indexes and blood indexes of female teachers in colleges and universities.

	Group L	Group M	Group H
BMI/kg·m^{-2}	22.4±5.3	22.1±4.3	21.5±2.4
Waist circumference/cm	83.9±8.8	83.0±9.1	82.1±8.9
Body fat percentage/%	31.4±9.0	30.6±7.5	29.9±7.3
SBP/mmHg	111.5±17.6	117.7±14.9	113.1±9.8
Quiet state PWV/cm·s^{-1}	74.2±13.1	74.0±11.1	74..0±15.1
DBP/mmHg	6.0±2.9	5.2±0.5	5.2±0.4
FBG/mmol·L^{-1}	177.6±31.3	175.2±29.6	175.1±32.0
TG/mg·dL^{-1}	166.3±51.1	158.2±79.6	155.4±100.1
TC/mg·dL^{-1}	59.8±3.5	61.0±8.7	60.9±10.0
HDL-C/mg·dL^{-1}	111.0±65.7	102.3±99.3	106.3±42.6
LDL-C/mg·dL^{-1}	1436.8±152.5	1362.7±148.6	1520.1±151.6
Quiet state ABI	1.2±0.1	1.1±0.1	1.1±0.1

Table 2. The proportion of the number of cardiovascular risk stratification of female college teachers in each group.

Cardiovascular risk level	Group L	Group M	Group H
Proportion of low-risk persons/%	38.2	66.7	60.1
Percentage of people at risk/%	42.5	25.5	22.4
Proportion of high-risk persons/%	29.3	7.8	17.5&

groups (P>0.05). The test result of VO_2max in the M group was significantly higher than that in the L group (P<0.05). The H group was very significantly higher than the L group (P<0.01) (Table 3).

ST-segment decrease ≥ of 0.1mv is also a vital sign for judging myocardial ischemia and injury. Excessive increases in blood pressure can also easily cause abnormal cardiac reactions in subjects and lead to myocardial ischemia.[7] Therefore, abnormalities in the ST segment and blood pressure are essential indicators for the termination of exercise tests. (Table 4).

Table 3. Exercise test situation of female teachers in colleges and universities in each group.

	Group L	Group M	Group H
Complete exercise time/min	8.5±2.0	9.0±1.8	9.1±2.0
VO_2max/ml·(kg/min)-1	24.9±7.9	27.2±5.2	28.1±8.2
HRmax/b·min^{-1}	157.4±20.1	159.5±19.7	155.4±18.4

Table 4. The occurrence of abnormal blood pressure and electrocardiogram in the exercise test of female college teachers in each group.

	Group L	Group M	Group H
Number of abnormal ST segment%	10.2	5.5	9.7
People with abnormal blood pressure%	9.9	9.1	17.3

DISCUSSION

Analysis of cardiovascular risk factors for female college teachers aged 40-49 with different levels of physical activity

With the increase of mental work, prolonged sitting and working time, and increased work pressure, the intake of high-oil and high-fat foods by female teachers in colleges and universities has greatly affected female teachers' health in colleges universities.[8] This shows that insufficient physical activity can easily lead to fat accumulation of female teachers in colleges and universities to accelerate the formation of obesity further. With the increase in physical activity, the incidence of obesity can be reduced. The mechanism for increasing physical activity to reduce the incidence of obesity may be that more intense physical activity accelerates the rate of lipolysis by increasing energy consumption. This can also reduce eating and reduce body fat accumulation.

PWV is an excellent indicator to reflect the degree of vascular stiffness, while ABI is used to reflect the atherosclerosis of the lower extremities. Studies have shown that the increase in physical activity can slow down vascular sclerosis that occurs with age, reducing hypertension and the development of atherosclerotic diseases.[9] The results of this study did not see significant differences in the blood pressure, PWV, and ABI levels of female college teachers at different levels of physical activity. This shows that as physical activity increases, it may not improve blood vessel elasticity in the short term directly. If you want to bring about good changes in blood vessel elasticity, you need to form regular physical exercise by increasing physical exercise time. In blood indicators, only significant differences in the decline of FBG were observed as physical activity increased. The increase in physical activity increases the number of glucose transporter 4 and increases the number of insulin receptors in the muscle cell membrane. This can increase the amount of glucose uptake by muscles and improve insulin sensitivity, lowering blood sugar.

Analysis of Cardiopulmonary Endurance and Cardiovascular Risks of Female Teachers in Colleges and Universities between 40 and 49 Years Old

Cardiopulmonary endurance mainly reflects the human body's ability to take in, transport, and utilize oxygen, which can comprehensively reflect a person's health level. College teachers have significantly increased morbidity and mortality with abnormal blood lipids, blood sugar, blood pressure, cardiorespiratory endurance, and other cardiovascular risk factors. As the level of physical activity increases, the functions of the body's various systems can be improved to increase the body's cardiorespiratory endurance. Group H completed higher power when completing the incremental load test.[10] At this time, as the intensity increases, the oxygen consumption of the myocardium is increased. Shortening the diastole and coronary perfusion time results in reduced venous return. The increase in blood pressure causes the pressure on the arterial wall to increase, which can easily cause arterial spasms or distortion in the diseased area and induce cardiovascular risk during exercise.

Most of the ST segment drops ≥ 0.1mv as the criterion to terminate the test. Some studies use QRS and QTC as essential indicators for predicting the risk of cardiovascular disease. In this study, ST-segment abnormality mainly refers to ST-segment depression, and the probability of ST-segment depression in group M is relatively small.[11] This shows that the safety of its exercise is higher, and the probability of cardiovascular risk is lower. Regular physical activity can reduce the risk factors of coronary arteries and can effectively reduce dyslipidemia and abnormal blood pressure. Regular physical activity further improves vascular endothelial function and improves autonomic nerve function and blood coagulation function during exercise. This leads to a further decrease in cardiovascular risk during exercise.

CONCLUSION

The physical activity of female teachers in colleges and universities is primarily medium and high, and the number of low physical activity is relatively small. The increase in physical activity can reduce cardiovascular risk in a resting state and improve health. However, in increasing load exercise, subjects with different physical activity levels have different cardiovascular risks during exercise. This shows that moderate physical activity can reduce cardiovascular risk during exercise by improving heart function during exercise and enhancing cardiovascular regulation.

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