

Effects of Long-Term Physical Dance Exercise on Serum Immunoglobulin and T Lymphocyte Subsets in Middle-Aged and Elderly People

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ABSTRACT. This study explored the effect of long-term aerobic dance exercise on serum immunoglobulin and T lymphocyte subsets in middle-aged and elderly people. 16 healthy middle-aged and elderly people volunteered to participate in the experiment, 8 subjects performed 3 times exercises per week, and 8 subjects performed 5 times exercises per week, each exercise time was 60 minutes. After 12 weeks, the changes of serum immunoglobulin IgG, IgA, IgM and T lymphocyte subsets were observed after participating in sports dance exercises. In the present pilot study, we found that, the serum immunoglobulin IgG of subjects who performed 3 times a week and 5 times a week significantly increased ($P < 0.01$), and $CD4+$, $CD4+/CD8+$ all increased significantly ($P < 0.05$), and the increase in serum index of the group who exercised 5 times a week was relatively high. But compared with the exercise 3 times a week, there was no significant difference between the groups ($P > 0.05$). The serum IgA and IgM in both groups only showed an increasing trend, while $CD8+$ decreased slightly ($P > 0.05$). The 12-week sports dance exercise can significantly increase the ratio of serum immunoglobulin IgG content and serum $CD4+/CD8+$ in healthy middle-aged and elderly people, and improve the immune function of the body. It seems that the effect of the exercise on the group who did it 5 times per week is better.

KEYWORDS: Sports dance, Middle-aged and elderly people, Serum immunoglobulin, T lymphocyte subsets

1. Introduction

Immune function is a sign of the body's resistance and one of the representative indicators of the body's physique. As an immune globulin reflecting the level of immune function, immunoglobulin can not only directly fight against corresponding

pathogenic microorganisms and toxins, but also induce various other functions, such as complement activation and phagocytosis, so it is an important defense function of the body. Immunoglobulin A (IgA), Immunoglobulin M (IgM) and Immunoglobulin G (IgG) are mostly issues used in sports immunology. IgG is the main component of serum immunoglobulin. Most antibacterial antibiotics and antiviral antibodies belong to IgG, which plays a major role in heat infection. Secretory IgA is the main substance of the body's mucosal defense against infections. It forms a local immune system with surrounding cells, which can resist bacteria, fungi, viruses, respiratory tract and digestive tract infections. IgM plays an important role in preventing bacteremia. T-lymphocyte subsets are also an important component of cellular immunity. Together with immunoglobulin, they are commonly used as indicators of immune function evaluation. It is found that the maximum and high intensity exercise can reduce the content of serum immunoglobulin and the body's immunity [1]. Small-intensity exercise has little effect on the serum immunoglobulin content, while moderate-intensity aerobic exercise can improve the content of serum immunoglobulin and the positive immune response of T lymphocyte subsets, so as to improve the immune function of the body [2].

With the increase of age, the cellular immune function of the elderly declines, the anti-infective ability and the ability to remove pathogens decrease, and the self-morbidity rate is high. Therefore, improving the elderly's self-immunity is essential for improving the elderly's disease resistance. Sports dance is an entertainment and fitness project that integrates sports, music, aesthetics, and dance. It can bring health and vitality to the middle-aged and elderly people, cultivate their temperament, benefit physical and mental health. Therefore, sports dance is very popular amongst middle-aged and elderly people. In recent years, with the vigorous development of public fitness in square dance, more and more middle-aged and elderly people have joined the group of sports dance exercises. So far, there has been no research on the effect of sports dance on the immune function of middle-aged and elderly people.

In this study, 16 healthy middle-aged and elderly people were selected as subjects, and observe 12 weeks of different frequency (5 times a week and 3 times a week) dance exercise on the serum immunoglobulin content and T lymphocyte sub Group influence. In order to provide reference for middle-aged and elderly people to carry out sports dance fitness.

2. Methods

2.1 Research Objective

In this study, a total of 16 healthy middle-aged and elderly people (aged 58.7 ± 6.5 years) were selected to participate in the experiment. the average weight was (54.9 ± 3.1) kg, and there were no major cardiovascular diseases. All subjects volunteered to participate in the experiment, and abide by the relevant experimental rules. During the experiment, the subjects did not engage in other high-intensity

exercises, and their daily life and work and rest rules remained unchanged.

2.2 Exercise Protocol

All of the subjects were divided into two groups of equal number, each group of 8 people. Those who exercise 3 times a week are in the D3 group (Monday, Wednesday, Friday), and those who exercise 5 times a week are in the D5 group (exercise from Monday to Friday, with rest on Saturday and Sunday). The subjects learned the dance exercised in the experiment 2 weeks before the official start of the experiment, and performed adaptive exercises for two weeks. The formal test was a 12-week medium-intensity aerobic dance exercise, each exercise for 60 minutes (7:30-8:30pm). The heart rate during exercise is controlled between 100-120 beats/min.

2.3 Measurement of Exercise Capacities

The researchers took 6ml of elbow venous blood from the subjects' fasting before the start of the experiment and in the morning after the end of the experiment, and heparinized them to select the fluorescent labeling method for single cells. The T4 lymphocyte subsets CD4 and CD8 of the subjects were measured using a flow cytometer produced by Coulter Corporation of the United States. Serum immunoglobulin IgG, IgA, IgM content was detected by Italian BT224 semi-automatic biochemical analyzer using immune transmission turbidimetry.

2.4 Statistical Analysis

SPSS20.0 was used for statistical analysis. Significant differences were analyzed by paired T test within the group. The significance level was $P < 0.05$, and a very significant level was $P < 0.01$.

3. Results

3.1 Changes of Serum Immunoglobulin in 12 Weeks Sports Dance Exercise

It can be seen from Table 1 that after 12 weeks of physical dance exercise, serum IgG in D3 and D5 groups were significantly increased ($P < 0.05$), serum IgA and IgM in both groups were slightly increased ($P > 0.05$). Serum in the D5 group showed that the increase of IgG, IgA and IgM was greater than that of the D3 group, but there was no significant difference between groups ($P > 0.05$).

Table 1 Changes of Serum Immunoglobulin ($\bar{x}\pm s$) g/l

in 12-week aerobic dance exercise

| Grouping | pre- and post-training | IgA | IgM | IgG |
|----------|------------------------|-----------|-----------|--------------------------|
| D3 | Pre-training | 1.78±0.72 | 1.52±0.54 | 10.71±1.12 |
| | Post-training | 1.93±0.74 | 1.74±0.62 | 11.76±1.85 ^{*)} |
| D5 | Pre-training | 1.80±0.69 | 1.55±0.59 | 10.56±1.09 |
| | Post-training | 2.02±1.03 | 1.92±0.63 | 12.27±2.37 ^{*)} |

1)Compared with before experiment $P<0.05$; 2) Compared with before experiment $P<0.01$

3.2 The Effect of 12-Week Sports Dance Exercise on *t* Lymphocyte Subsets

Table 2 indicates that after 12 weeks of sports dance exercise, serum CD4+ in both D3 and D5 groups increased significantly ($P<0.05$), CD8+ decreased slightly ($P>0.05$), and CD4+/CD8+ also increased significantly ($P<0.05$). The increase of CD4+/CD8+ in the D5 group was relatively high, but there was no significant difference between the groups ($P>0.05$).

*Table 2 Changes of Serum *t* Lymphocyte Subsets*

in 12-week aerobic dance exercise ($\bar{x}\pm S$)

| Grouping | pre- and post-training | CD4+% | CD8+% | CD4+/CD8+ |
|----------|------------------------|--------------------------|------------|--------------------|
| D3 | Pre-training | 41.17±4.83 | 39.78±5.11 | 1.04 |
| | Post-training | 42.06±5.12 ¹⁾ | 38.92±4.91 | 1.08 ¹⁾ |
| D5 | Pre-training | 41.39±4.92 | 40.05±6.34 | 1.03 |
| | Post-training | 43.56±4.88 ¹⁾ | 38.97±6.78 | 1.12 ¹⁾ |

1)Compared with before the experiment $P<0.05$; 2) Compared with before the experiment $P<0.01$

4. Discussion

4.1 The Effect of Long-Term Sports Dance Exercise on the Serum Immunoglobulin of the Elderly

The determination of serum immunoglobulin (Ig) is the most commonly used method to check the humoral immune function. Usually, the three types of Ig, such as IgG, IgM and IgA, can represent the level of serum Ig. It is generally believed that exercise intensity is the primary factor that changes the secretory function of lymphatic B cells. If the intensity is too small or not long, it will not cause changes in antibody levels. Moderate exercise can enhance the immune function, but long-term high-intensity exercise will lead to immunosuppressive reactions, increase the susceptible source of acute infectious diseases, reduce the body's immune

function against infection, and it has a negative impact on the body's immunity. The study found that the subjects who performed aerobic aerobics training 3 times a week, had their serum IgG levels increased significantly after 12 weeks ($P < 0.05$), but the serum IgA, IgM did not change significantly. The serum IgG, IgA and IgM of exerciser who played once a week did not show any significant changes [3]. These data suggested that only when a certain exercise frequency is reached can the body's immune cells respond obviously. Another study also found that female college students who took part in aerobics 3 times a week had higher serum IgG levels than the control group and with those who exercised once a week. There was a significant difference between week 10 and week 12 ($P < 0.05$), but there was no significant difference in serum IgM and IgA levels between the experimental group and the control group [4]. The research of Fan Jinqin also showed that the 16-week regular dragon dance training can also increase the IgG of college students [3].

The results of this study found that after 12 weeks the 3 times a week (D3) sports dance exercise and 5 times a week (D5) sports dance exercise, showed that the level of serum IgG in subjects significantly increased ($P < 0.01$). Although the serum IgM and IgA also increased in each experimental group, there was no significant change ($P > 0.05$), and the serum IgG increase in the D5 group was significantly greater than that in the D3 group, but there was no significant difference within the individual groups ($P > 0.05$). It is indicated that exercising 5 times and 3 times a week can effectively increase the level of immunoglobulin IgG in the elderly. Exercising 5 times a week seems to be more effective. The analysis may be due to 12 weeks of sports dance promoting the body's release of immune-enhancing hormones such as auxin, endorphins, and cytokines that enhance the immune response, thereby raising the level of serum immunoglobulin and enhancing the body's humoral immune function. In the experimental data, only IgG was significantly increased, which may be related to the highest IgG content in the serum and the most sensitive response.

4.2 The Effect of Long-Term Sports Dance Exercise on t Lymphocyte Subsets in the Elderly

T lymphocyte-mediated cellular immunity plays a central role in body immunity. CD4+ and CD8+ in T cell subsets are two subpopulations with different functions in T lymphocytes, but coordinate with each other and stably regulate the body's immune response. CD4+ is a helper T cell, which can help and induce the immune response; CD8+ is a suppressor T lymphocyte, which has an inhibitory or killing effect in the immune response. The ratio of CD4+/CD8+ represents the overall immune balance level. The change in the ratio reflects the change of the body's immune function to some extent [5]. Studies have shown that CD4+ cells decrease, while CD8+ cells increase, and the ratio of CD4+ /CD8+ decreases. The decrease in the level of deliberate immune response results in decreased immune function and an important factor of body aging [5]. Moderate-intensity exercise can promote a positive immune response in healthy people and improve the immune function of the body [6-9]. Another research report shows that long-term moderate exercise can make the sub-healthy people's immune function positively change, improve the

body's cardiorespiratory and immune function [10-12]. The results of this study found that 3 times of weekly physical dance exercise and 5 times of weekly physical dance exercise can significantly increase the level of serum CD4+ ($P < 0.05$), and significantly increase the ratio of serum CD4+/CD8+ ($P < 0.05$), which is basically consistent with the previous research results. Although there was no significant difference between the D3 and D5 groups ($P > 0.05$), the serum CD4+/CD8+ increased in the D5 group was relatively high, and the serum CD8+ in both groups decreased slightly ($P > 0.05$). The data suggest that exercising 3 times a week and 5 times a week can effectively improve the body's immune function, and the effect seems to be better if you exercise 5 times a week.

In conclusion, 12-week sports dance exercise can significantly increase the ratio of serum immunoglobulin IgG content and serum CD4+/CD8+ in healthy middle-aged and elderly people, and improve the body's immune function. Those who exercise 5 times a week have relatively high changes in immune indexes, and the exercise effect seems to be better.

Acknowledgements

This paper is associated with the Project of Guangdong Provincial Department of Science and Technology (Research on the Effect of Sports Dance Exercise on Serum Immunoglobulin and T Lymphocyte Subgroups in Middle-aged and Old People, No. 2017ZC0231)

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