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Application of Exercise Intervention in Health Education Management of Adolescents with Type 2 Diabetes Mellitus

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Abstract: **Objective** In order to study the application of sports intervention in health education management of adolescents with type 2 diabetes mellitus (T2DM). **Methods** 184 adolescents with type 2 diabetes were selected as the research object, the experimental group was treated with aerobic exercise for 6 months, the indexes of glucose, lipid metabolism and health promotion lifestyle were compared between the experimental group and the control group, to evaluate the effect of different aerobic exercise on health promotion. **Results** After intervention, the total cholesterol, triglyceride, fasting blood glucose, insulin, C peptide, glycosylated hemoglobin and the total score of life style in the experimental group were better than those in the control group ($P < 0.05$), between the two groups of high and low density lipoprotein cholesterol mean no significant difference ($P>0.05$), there was significant differences between different sports groups of glucose and lipid metabolism and lifestyle score ($P<0.01$). **Conclusion** Six months of aerobic exercise with different forms had significant effects on the glucose and lipid metabolism in T2DM adolescents, and is conducive to the formation of a healthy lifestyle promotion on T2DM teenagers; The effects of aerobic exercise on the carbohydrate, lipid metabolism and lifestyle scores of T2DM adolescents were different. Exercise intervention plays an important role in health education management of type 2 diabetes in adolescents.

1. Introduce

Diabetes mellitus is one of the major chronic diseases that threaten human life and health. The number of patients with disease worldwide has been increasing in [1] in recent years. The prevalence of diabetes was dominated by type 2 (95%). The incidence of diabetes in China is about 5%, of which 2 cases of type 2 diabetes (T2DM) account for 90% of [2], and 70% of obese patients are overweight or overweight. Currently, type 2 diabetes is generally thought to be caused by environmental and genetic factors, such as excessive obesity, reduced exercise, and genetic susceptibility, including. Insulin resistance is the major disease in the early stages of the disease. As the course advances, insulin secretion is insufficient, and the main symptom of T2DM is chronic

blood glucose, with a protein metabolism and lipid metabolism disorder. Domestic studies have shown that the incidence of obesity in [3] and T2DM has increased in recent years. The incidence of obesity among children and adolescents who cherish our homeland's future and hope is rising. A 2020 study showed that the proportion of T2 diabetes patients in children and adolescents has increased to more than 45% of [4], and it is very important to pay attention to the prevention and treatment of T2 diabetes in Chinese adolescents.

As a new disease group, adolescents have the advantages of short onset time and less complications compared with adult patients. Therefore, most cases involve active intervention by means of exercise therapy and drug control. However, awareness of health promotion remains very weak due to the effects of age, years of education and experience. There are still many unknown questions about whether exercise interventions can enable adolescents to form a healthy lifestyle and benefit their lives. Existing studies have shown that long-term regular and moderate exercise can effectively improve insulin sensitivity, have better hypoglycemic effect, and effectively improve the quality of life of diabetic patients. It is one of the interventions for the comprehensive treatment of diabetes mellitus. Therefore, this study conducted different forms of aerobic exercise intervention in patients with type 2 diabetes. By comparing the differences between measures of glyco and lipid metabolism, and health promotion lifestyle of patients in different groups after the intervention, the value of different forms of aerobic exercise intervention in the prevention and treatment of adolescent type 2 diabetes and more desirable forms of health promotion are discussed.

2. Study Subjects and methods

2.1 Study subjects

This group selected 184 young patients with type 2 diabetes, and all of them met the diagnostic criteria for type 2 diabetes proposed by the American Diabetes Association in 1997. Eighty-seven external array personnel (original 92 cases, 5 people stopped the experiment due to physical discomfort) were divided into experimental group (90 male patients, 94 female cases) according to male and female medical order, and 92 even groups were divided into control group. The selected subjects were aged 11 – 17 years old, with a mean age of 14.8 ± and 1.2 years old. Fasting blood glucose levels and HbA 1 c were 7.36 ± 0.79 mmol/l and 6.67 ± 0.68, respectively). The results of the independent sample non-parametric test showed no significant difference between the two groups before the intervention.

2.2 Experimental protocol

(1) First, we carefully examined the past medical history, medication history, exercise history, and complications of the selected patients. The dication to sports tests prescribed by the American Sports Medicine Association (ACSM) do not include. All the selected patients should sign the informed consent form and complete the health promotion lifestyle questionnaire before and half a year after the intervention; (2) Before the sports intervention, the patients should choose walking, martial arts, fitness, table tennis, badminton, empty volleyball, basketball, and football from 4:20 to 5:20 PM. From Monday to Friday, 60 minutes (including 5 minutes of preparation and arrangement); 3) Exercise intensity control is based on 40% -60% heart rate reserve + rest heart rate. subjective physical feeling level and signs response can be adjusted in real time, and synchronous telemetry of heart rate and blood pressure can be conducted, and medical staff can deal with emergency and complications at any time.

2.3 Index tests and methods

All medical indicators were tested by the physical examination department of the University Hospital, and the subjects were collected intravenously in the morning of the first intervention day and in the morning of the exercise intervention on day 1. Measurement of blood glucose and lipids were performed by a Dutch vetu choice-e + autobiochemical analyzer. Insulin and c-peptide were detected by m240172 γ radioimmunoometer produced by Beijing Western Technology Co., Ltd. The HbA 1 c detector is a US bi0-rad-10 HbA 1 c detector. The standard operation of this book is based on the investigation and evaluation of the health-promoting lifestyle conducted by the US Nurse Pender, with good reliability and validity. The test-retest reliability of this scale in this study was 0.92. The questionnaire included six dimensions (health responsibility, self-realization, nutrition, interpersonal relationships, stress response, and exercise). A total of 52 items include: level 4 scores, with higher scores indicating higher lifestyle levels, and better scores of 127 points and above.

2.4 Statistical analysis

All the statistics presented in this paper were analyzed using the IBM SPSS Statistics 22 statistical software. The measured data are expressed as the mean, standard deviation, and mean standard error. Measurement data were compared between groups using the independent sample t-test and the multiple independent sample K-W test, with a $P < 0.05$ and a significant difference.

3. Research findings

3.1 Analysis of glucose and fat metabolism indicators in adolescent type 2 diabetes patients

3.1.1 Comparison of blood lipid and blood glucose indexes between experimental group and control group

Statistical results show that after 6 months of dry prognosis, the control T2DM adolescent total cholesterol and other related indicators still have the risk of abnormal glucose and lipid metabolism, such as total cholesterol (5.15 mmol/l) only slightly lower than our dyslipidemia prevention standard (less than 5.2 mmol/l), triglyceride content (1.93) mmol / l level slightly higher than our dyslipidemia prevention standard (less than 1.7 mmol / l) average blood sugar (7. 39 mmol/l), the blood glucose is higher than the normal person's reference value (3.9-6.1mmol/l), etc. In the experimental group, the total cholesterol, triglyceride, fasting blood glucose, HbA 1 c, insulin and c-peptide all improved significantly. The t-test results of independent samples showed a significant difference between the two groups ($P < 0.05$, see Table 2).

3.2 Comparison of sugar and fat metabolism indexes in the experimental group

The results of the K-W test showed significant differences in the metabolic indicators between the different exercise groups ($P < 0.01$). As can be seen from the statistical results in Table 3, the sports walking team ranked the largest cholesterol, HDL cholesterol and fasting blood glucose, the largest insulin index and the largest exhaust, the LDL cholesterol was the highest, and the basketball team ranked triglycerides, 1 c hemoglobin and c peptide in the basketball group. The results showed that the depth of the influence of glucose and lipid metabolism varied.2.2. Lifestyle analysis of adolescents with type 2 diabetes.

3.2.1 Comparison of lifestyle scores among T2DM adolescents in the experimental and control groups

The results of the independent sample t-test in Table 6 showed that, except for the nutrition index, the were different between the experimental and control groups (P <0.05). The statistical results in Table 5 also show that the total score scores, stress response and exercise experiments were significantly higher than the control group, indicating that the six-month aerobic exercise intervention benefits the lifestyle of health-promoting T2DM youth. The logistic regression analysis of total scores of healthy lifestyle and scores for each dimension experimental groups showed that Wald statistics had greater relationships and health responsibility, indicating that a 6-month aerobic exercise intervention was more beneficial for adolescents with enhanced interpersonal relationship and health responsibility.

3.2.2 The analysis of the factors influencing the total lifestyle score of adolescents with type 2 diabetes

Multivariate analysis of variance Results of total lifestyle scores were shown in adolescents with type 2 diabetes (see Table 8), no differences between different gender (P> 0.05), and significant differences were mainly reflected in the total score in different project groups (P <0.05). To determine whether there were differences in the overall distribution of total lifestyle scores among different project groups, multiple independent sample non-parametric tests of total lifestyle scores among different project groups (see table below).

The results of multiple independent sample non-parametric tests of the lifestyle total scores of the different project groups showed that the scores of the different project groups were significantly different (P <0.01). The average ranking statistics in Table 9 show that the average ranking of badminton, football and table tennis is large, indicating that different forms of aerobic exercise have different effects on the total lifestyle score.

4. Discuss

4.1 Effect of different aerobic exercise on glucose metabolism index in adolescents with type 2 diabetes

Experimental group mean fasting blood glucose is significantly lower than the control group (P <0.01), indicating that six months of aerobic exercise has a good effect on adolescent type 2 diabetes blood glucose reduction, results also showed that exercise group fasting blood glucose is significantly lower than the control group (P <0.05), Huahua Jiang [5] showed mulan boxing group, fast walking group and fitness route group fasting blood glucose also decreased (P <0.05). The average experimental group of serum insulin and c-peptide was significantly higher after intervention than that of the control group (P <0.05), indicating that six months of aerobic exercise can effectively improve the glucose metabolism ability of adolescent type 2 diabetes, which is in line with the results of many scholars. The results of Songgahua et al showed that a 6-month moderate-intensity aerobic exercise intervention could significantly improve glucose and lipid metabolism and insulin resistance in community patients with type 2 diabetes. The results of Zheng Xiaojing et al. [6] showed that regular exercise for 6 weeks enhanced insulin secretion in pancreatic islet B cells and increased serum insulin and c-peptide concentrations. Moreover, the statistical results in Table 3 show that different sports events have different regulatory effects on the glucose metabolism index. Basketball has a profound effect on HbA 1 c levels and c-peptide content in T2DM patients, while badminton has a profound effect on fasting blood glucose levels in T2DM

patients, and martial arts has a greater effect on their insulin levels.

Aerobic exercise can reduce sugar, improve insulin sensitivity may be because exercise can increase glucose transporter 4 (GLUT-4) and its receptor sensitivity [7] on the membrane of skeletal muscle cells, skeletal muscle cells using glucose-4, enhance extracellular glucose, into cells to promote glucose energy metabolism, may be due to the exercise intensity used in this study is close to the patient. The study confirms that when humans perform relatively stable aerobic exercise of moderate intensity, 70% of the energy supply comes from fat. Persistent fat consumption not only reduces skeletal muscle cells, pancreatic cells and hepatocytes, but also the toxic effects of lipids on them, thus improving the ability of skeletal muscle cells to take glucose, enhancing insulin sensitivity and the ability of pancreatic cells to secrete high-quality insulin.

4.2 Effects of different aerobic exercise on lipid metabolism in adolescents with type 2 diabetes

The results indicate that the lipid metabolism disorder in patients with diabetes is the result of various metabolic disorders, such as the lack of triglyceride metabolism that leads to the rise of hepatic free fatty acids, overproduction of VLDL and hepatic hypertriglyceridemia. Before the intervention, triglycerides, total cholesterol and LDL cholesterol were all in the range of "marginal elevation" or "rise", and triglyceride and total cholesterol levels decreased significantly after dry treatment, indicating that six months of aerobic exercise significantly affected improved total cholesterol and triglycerides in type 2 adolescents, and had a significant effect on regulating lipid metabolism. The statistical results in Table 3 indicate that different sports events have different regulatory effects on the lipid metabolic index. Basketball has a profound effect on triglyceride levels in adolescents with type 2 diabetes, and exercise walking is more likely to cause cholesterol levels in patients with type 2 diabetes. The results showed that long-term regular exercise decreased LDL in and increased HDL in diabetic patients, while no similar results were seen in this group.

The mechanism of long-term exercise can improve lipid metabolism as follows: 1) When the body is in a resting state, skeletal muscle mainly depends on the energy supply of free fatty acids, and the substances involved in the energy supply are glucose, free fatty acids and muscle glycogen. Although free fatty acids in the blood increase during exercise, they can still be increased through muscles and liver, and decomposition can provide energy; 2) Long-term exercise can not only accelerate the body's fat mobilization ability, but also provide the energy materials needed for the liver and muscles during exercise. The concentration of free fatty acids in the blood ensures that the human body can obtain sufficient energy supplement and supply during the excessive recovery stage; 3) Exercise can not only mobilize the fat group, but also fat weaving can also reduce the lipid deposition in adipose tissue and skeletal muscle cells by regulating triglycerides in skeletal muscle cells. At the same time, triglycerides in skeletal muscle are another energy supply material, which reduces the lipid quality in adipose tissue and skeletal muscle and improves lipid metabolism.

In addition, the meta-analysis of Rich SK and other patients showed that 0.8% to 1.3% of adolescent patients with lipid metabolism disorders were ineffective through dietary adjustment and exercise intervention, and only through medication; the study by O et al. showed that many adolescents with type 2 diabetes have obvious hyperlipidemia at the time of initial diagnosis, but only 1% of diabetic children receive hyperlipidemia drugs, and dyslipidemia, especially hypercholesterolemia, is one of the main risk factors for coronary heart disease, and elevated TG and LDL is the main risk factors for coronary heart disease, the combination of protein cholesterol and cholesterol is also easy to constitute a high risk of coronary heart disease. Therefore, when choosing the intervention object, the investigation and inquiry work must be done well. If necessary, medication should be performed concurrently with an exercise intervention, not only for the benefit of exercise, but also for the course of treatment for these patients.

4.3 Effects of different aerobic exercise on lifestyle in adolescents with type 2 diabetes

Studies have shown that unhealthy lifestyles are health hazards, easily overlooked through the details of life; that unhealthy lifestyle changes and developing good habits have a positive role in the prevention and treatment of before meeting the diagnostic criteria for the disease. As the majority of type 2 diabetes adolescents lack enthusiasm for health knowledge intake and the development of health behaviors, the prevention and treatment of type 2 diabetes should focus on increasing awareness of health promotion. The results of this study showed that, one year later, the total scores of lifestyle, stress coping ability, and exercise ability in the experimental group were significantly higher than that of the control group (P <0). 05), indicates that the 6-month aerobic exercise intervention is beneficial to the formation of healthy lifestyle in T2DM adolescents; the logistic regression results of healthy lifestyle total score showed interpersonal relationship and health responsibility, and the non-parametric test results of multiple independent samples also showed different effects and significant differences (P <0.01). Badminton, football, table tennis and other events have a greater impact on the total score.

The results of Qin Lin and Zhu Huan showed that 16 weeks of walking combined with table tennis can improve the quality of life of elderly patients with type 2 diabetes to a certain extent, and can easily enable patients to form good follow-up exercise habits. Different intervention programs and means are recommended for different type 2 diabetes populations. Therefore, in the type 2 diabetes youth exercise health promotion intervention, we can establish a scientific sports health promotion support platform, according to the adolescent physical health, exercise habits and personal preferences, adopt the principle of personalized and scientific guidance, choose the right sports program for intervention, comprehensive use of all kinds of health promotion means, improve the health level of teenagers. According to the current relevant research results, Wang Jihong, based on Confucianism, basic medical indicators and behavior patterns, Yu Lijuan et al. Building decision support systems for physical and physical health promotion of civil servants, including exercise prescription, nutrition prescription, psychological regulation and lifestyle regulation, provides new ideas for health promotion research, and also deserves promotion and reference to the work of T2DM youth health promotion.

In conclusion, the results of this study showed that 6 months of personalized aerobic exercise had a significant effect on the glucose and lipid metabolism in 2DM adolescents, and that different exercise had different regulatory effects on the glucose and lipid metabolism indicators. Basketball has a profound impact on HbA 1 c levels, triglycerides and c-peptide content in adolescent type 2 diabetes patients, and badminton effects on fasting blood glucose, greatly affecting martial arts on insulin levels. Fitness walking exercise is more likely to cause changes in cholesterol content in adolescents with type 2 diabetes. The results of the follow-up survey one year later showed that different aerobic exercise interventions at 6 months were very beneficial to the formation of healthy lifestyle in adolescents with type 2 diabetes, and the effects of different exercise on total lifestyle scores was significantly different. The main influencing factors are badminton, football, and table tennis.

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