

INTERMITTENT HIGH INTENSITY EXERCISE ASSOCIATED WITH DRUGS IN PATIENTS WITH TYPE 2 DIABETES

EXERCÍCIO INTERMITENTE DE ALTA INTENSIDADE ASSOCIADO AOS FÁRMACOS EM PACIENTES COM DIABETES TIPO 2

EJERCICIO INTERMITENTE DE ALTA INTENSIDAD ASOCIADO A FÁRMACOS EN PACIENTES CON DIABETES TIPO 2



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ABSTRACT

Introduction: Some studies point out that high-intensity intermittent training exercises combined with drugs may improve the endurance of patients with type 2 diabetes. However, the information concerning blood glucose control still needs to be better evidenced. **Objective:** Explore further the effect of intermittent high-intensity exercise combined with drugs on blood glucose control in patients with type 2 diabetes. **Methods:** Through a control experiment, 100 patients were selected from volunteers, and divided equally into two groups for this experiment. A protocol with high-intensity intermittent exercise for intervention associated with drug treatment was added to the experimental group, while the control received standard drug treatment. **Results:** The results of each index in the experimental group were: TC pre 4.80 ± 1.00 , post 4.56 ± 0.78 ; TG pre 1.77 ± 1.15 , post 1.49 ± 1.16 ; LDL pre 2.94 ± 0.83 , post 2.51 ± 0.73 . The experimental results proved that all indices in the experimental group were improved, but the changes in the control group were not evidenced. **Conclusion:** Intermittent high-intensity exercise combined with drugs positively affected blood glucose control in patients with type 2 diabetes. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: High-Intensity Interval Training; Drug Therapies; Glycemic Control; Diabetes Mellitus, Type 2.

RESUMO

Introdução: Alguns estudos apontam que exercícios com treinamento intermitente de alta intensidade combinados aos fármacos possam melhorar a resistência dos pacientes com diabetes tipo 2. No entanto, as informações relativas ao controle da glicemia ainda são pouco evidentes. **Objetivo:** Explorar melhor o efeito do exercício intermitente de alta intensidade combinado com fármacos no controle glicêmico sanguíneo em pacientes com diabetes tipo 2. **Métodos:** Através de um experimento de controle, 100 pacientes foram selecionados entre os voluntários, divididos igualmente em dois grupos para este experimento. Ao grupo experimental foi adicionado um protocolo com exercício intermitente de alta intensidade para intervenção associado ao tratamento medicamentoso, enquanto o controle recebeu tratamento medicamentoso padrão. **Resultados:** Os resultados de cada índice no grupo experimental foram: TC pré $4,80 \pm 1,00$, pós $4,56 \pm 0,78$; TG pré $1,77 \pm 1,15$, pós $1,49 \pm 1,16$; LDL pré $2,94 \pm 0,83$, pós $2,51 \pm 0,73$. A partir dos resultados experimentais, comprovou-se que todos os índices no grupo experimental foram aprimorados, porém as mudanças no grupo de controle não foram evidenciadas. **Conclusão:** O exercício intermitente de alta intensidade combinado com fármacos apresentaram um efeito positivo no controle da glicose sanguínea em pacientes com diabetes tipo 2. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Treinamento Intervalado de Alta Intensidade; Tratamento Farmacológico; Controle Glicêmico; Diabetes Mellitus Tipo 2.

RESUMEN

Introducción: Algunos estudios señalan que los ejercicios de entrenamiento intermitente de alta intensidad combinados con fármacos pueden mejorar la resistencia de los pacientes con diabetes de tipo 2. Sin embargo, la información relativa al control de la glucemia sigue siendo escasa. **Objetivo:** Profundizar en el efecto del ejercicio intermitente de alta intensidad combinado con fármacos sobre el control de la glucemia en pacientes con diabetes tipo 2. **Métodos:** Mediante un experimento de control, se seleccionaron 100 pacientes voluntarios, divididos equitativamente en dos grupos para este experimento. Al grupo experimental se le añadió un protocolo con ejercicio intermitente de alta intensidad para la intervención asociado al tratamiento farmacológico, mientras que el control recibió el tratamiento farmacológico estándar. **Resultados:** Los resultados de cada índice en el grupo experimental fueron: TC pre $4,80 \pm 1,00$, post $4,56 \pm 0,78$; TG pre $1,77 \pm 1,15$, post $1,49 \pm 1,16$; LDL pre $2,94 \pm 0,83$, post $2,51 \pm 0,73$. A partir de los resultados experimentales, se comprobó que todos los índices del grupo experimental mejoraron, pero no se evidenciaron cambios en el grupo de control. **Conclusión:** El



Descriptores: Entrenamiento de Intervalos de Alta Intensidad; Terapia Medicamentosa; Control Glucémico; Diabetes Mellitus Tipo 2.

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INTRODUCTION

For patients who have just been diagnosed with type 2 diabetes, most clinicians advocate intensive treatment by using short-term insulin, which can effectively control the blood sugar level of patients in a short time, and also can well avoid toxic events caused by high blood sugar. In the past clinical cases, most patients were treated with conventional insulin, but this did not achieve the desired goal. With the deepening of research, people gradually found that as a chronic disease, type 2 diabetes not only needs effective drug treatment, but also needs appropriate exercise and nursing intervention. However, many patients are busy with their own work, and it is difficult to devote a lot of time to exercise, which will lead to insufficient exercise and poor exercise effect.¹ Therefore, under the condition of shortening the patient's exercise time as much as possible, how to achieve effective exercise intervention and nursing intervention effect is the focus of the study.² High intensity interval training has become the research direction chosen by the author. The benefits of high intensity interval training in physical health have been confirmed by a large number of scientific research.^{3,4} High-intensity interval training is a training mode that uses a short time to carry out high-intensity training and adds a short interval time during the exercise.⁵ Compared with the original medium-intensity continuous training mode, it can be found that high-intensity interval training has similar or even better improvement effects in physiological adaptation, functional development, health improvement and performance improvement after exercise. However, high-intensity interval training also has corresponding disadvantages.⁶ High-intensity interval training has very strict requirements for training methods.⁷ This kind of sports training mode is dangerous for some groups. Therefore, when carrying out high-intensity intermittent exercise training for patients with type 2 diabetes, professional doctors and sports experts should consult with each other according to the patient's condition and physical condition, discuss a suitable exercise program for the patient, and nurses should carry out effective nursing intervention. Therefore, this article explores the effect of high-intensity intermittent exercise combined with drugs and effective nursing intervention on blood glucose control in patients with type 2 diabetes.

METHOD

Research object

In order to further explore the effect of high-intensity intermittent exercise intervention and nursing intervention on the blood sugar control effect of type 2 diabetes patients at the same time of drug intervention treatment, this paper selects 100 type-2 diabetes patients as the experimental objects, and randomly divides the 100 type-2 diabetes patients into two groups, namely, the experimental group and the control group. The study and all the participants were reviewed and approved by Ethics Committee of Guangzhou Medical University (GZMU21TP039).

Research methods

The patients in the experimental group and the control group were randomly assigned to carry out a four-week experiment. Among them,

the patients in the experimental group received an hour of high-intensity intermittent exercise training every day. The training of this hour was divided into a time unit of every 20 minutes, and 15 minutes of training and 5 minutes of rest were carried out within the 20 minutes. At the same time, the patients in the experimental group also received drug intervention treatment as usual and effective nursing intervention. The control group was only treated with simple drug intervention. In the process of training, the experimental data of each index of the experimental object shall be recorded in time, and the professional software shall be used for recording and sorting, for the analysis of the follow-up results.

RESULTS

Current status of blood glucose control of subjects

Figure 1 shows the data results of the blood glucose control status of 100 subjects before the start of the control experiment. It can be seen from Figure 1 that at each time point of blood glucose measurement, the number of people who met the standard on an empty stomach was 24, and the number of people who did not meet the standard was 76; The number of people who meet the standard 2 hours after breakfast is 15, and the number of people who fail to meet the standard is 85; The number of people who met the standard 2 hours after lunch was 18, and the number of people who did not meet the standard was 82. It can be seen that the blood sugar control of most patients was not up to the standard.

High intensity intermittent exercise combined with drug intervention to improve the physique of patients with type 2 diabetes

Table 1 shows the experimental data of type 2 diabetes patients' physical fitness improved after 1 hour of high-intensity intermittent exercise training with nursing intervention every day while they were given routine drug treatment for 4 weeks.

Further study and analyze the change of P value of each index in the data in Table 1. The P value of muscle mass index is 0.0131, the P value of skeletal muscle content is 0.0075, the P value of grip strength is 0.0261, the P value of six meters is 0.0076, and the P value of sitting up for 30 seconds is 0.0183. The P value of all indicators is less than 0.05,

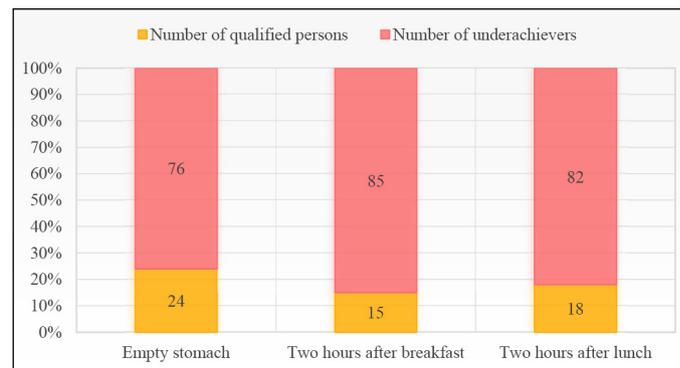


Figure 1. Optimization of Pilates Training on Aerobics Performance of College Students.

which indicates that there is a significant difference between the two groups of data before and after the experiment, which proves that the patients' physique has been greatly improved by high intensity intermittent exercise training and drug intervention, especially in the aspects of skeletal muscle content index and six-meter duration.

Table 2 shows the experimental data obtained after the patients with type 2 diabetes only received simple drug intervention treatment for 4 weeks.

In Table 2, the P value of muscle mass index is 0.0364, the P value of skeletal muscle content is 0.0318, the P value of grip strength is 0.0384, the P value of six-meter use is 0.0365, and the P value of sitting up for 30s is 0.0339. It can be seen that the P value of all index data is less than 0.05, indicating that there are significant differences between the data of each index before and after the experiment. It is proved that simple drug intervention can improve the physique of patients with type 2 diabetes. However, after one-to-one comparison of the P values of the data indicators in Table 1 and Table 2, it is found that the experimental indicators in Table 1 are higher than those in Table 2, which proves that the physique of the patients undergoing high-intensity intermittent exercise training and drug intervention is more improved than that of the patients with drug intervention alone.

Effect of high-intensity intermittent exercise combined with drug intervention on blood glucose control in patients with type 2 diabetes

Table 3 shows the experimental data of the improvement of blood sugar control in type 2 diabetes patients after training with 1 hour of high-intensity intermittent exercise training and nursing intervention every day, while the patients with type 2 diabetes received routine drug treatment for 4 weeks

In Table 3, the P value of TC index is 0.0056, the P value of TG index is 0.0182, the P value of HDL index is 0.0248, the P value of LDL index

Table 1. High intensity intermittent exercise combined with drug nursing intervention to improve the physique of patients with type 2 diabetes.

Index	Before intervention	After intervention	P value
Muscle mass (kg)	37.640 ±2.705	38.834 ±2.596	0.0131
Skeletal muscle content (kg)	27.083 ±1.927	26.897 ±2.037	0.0075
Grip strength (kg)	23.225 ±4.617	24.048 ±4.595	0.0261
Six meters (minutes)	4.835 ±0.546	4.446 ±0.569	0.0076
30S sit up (pcs)	14.871 ±2.417	16.747 ±4.013	0.0183

Table 2. Effect of simple drug intervention on constitution of type 2 diabetes patients.

Index	Before intervention	After intervention	P value
Muscle mass (kg)	37.301 ±3.681	37.881 ±3.735	0.0364
Skeletal muscle content (kg)	26.761 ±2.676	26.431 ±2.767	0.0318
Grip strength (kg)	25.328 ±4.844	25.177 ±4.267	0.0384
Six meters (minutes)	5.142 ±0.596	5.252 ±0.609	0.0365
30S sit up (pcs)	19.311 ±2.427	18.869 ±2.404	0.0339

Table 3. Effect of high-intensity intermittent exercise combined with drug intervention on blood glucose control in patients with type 2 diabetes.

Index	Before intervention	After intervention	P value
TC	4.804 ±1.006	4.562 ±0.783	0.0056
TG	1.770 ±1.158	1.496 ±1.166	0.0182
HDL	1.435 ±0.396	1.478 ±0.388	0.0248
LDL	2.942 ±0.839	2.517 ±0.739	0.0239
HbA 1c	7.197 ±0.925	6.984 ±0.835	0.0295
FBG	8.286 ±2.402	7.492 ±1.688	0.0144

is 0.0239, the P value of HbA 1c index is 0.0295, and the P value of FBG index is 0.0144. The P value of all the experimental data indicators is less than 0.05, which proves that the high intensity intermittent exercise training combined with drug intervention treatment has improved the blood sugar control of patients.

Table 4 shows the experimental data indicators obtained after the blood glucose control of the constitution of type 2 diabetes patients who only received drug intervention for 4 weeks. Among them, the data of TC indicators before the experimental intervention was 4.364 ± 0.553, and the data after the experimental intervention was 4.572 ± 0.446; The data of TG index before experimental intervention was 2.182 ± 0.989, and the data after experimental intervention was 2.090 ± 1.054; The data of HDL index before and after intervention were 1.718 ± 0.357 and 1.418 ± 0.328 respectively; The data of LDL index before experimental intervention was 2.893 ± 0.495, and the data after experimental intervention was 2.964 ± 0.519; The data of HbA 1c index before the experiment intervention was 7.349 ± 1.233, and the data after the experiment intervention was 7.631 ± 1.237; The data of FBG index before experimental intervention was 8.693 ± 3.386, and the data after experimental intervention was 9.765 ± 2.779.

In Table 4, the P value of TC index is 0.0352, TG index is 0.0327, HDL index is 0.0396, LDL index is 0.0384, HbA 1c index is 0.0328, and FBG index is 0.0344. The P value of all indicators is less than 0.05, which proves that only drug intervention can also improve the blood sugar control of patients' physique. After a one-to-one comparison of the P values of the data indicators in Table 3 and Table 4, it was found that the experimental indicators in Table 3 were higher than those in Table 4, which proved that the effect of glycemic control of the constitution of the patients who received high-intensity intermittent exercise training with drug intervention was better than that of the patients who received drug intervention alone.

Figure 2 shows the status quo of blood glucose control of the subjects after the experiment, and the data results of the 100 subjects after the experiment in terms of the status quo of blood glucose control. It can be seen from Figure 2 that the number of people who met the standard on an empty stomach was 56, and the number of people who did not meet the standard was 44; The number of people who met the standard 2 hours after breakfast was 68, and the number of people who did not

Table 4. Effect of simple drug intervention on blood glucose control of type 2 diabetes patients.

Index	Before intervention	After intervention	P value
TC	4.364 ±0.553	4.572 ±0.446	0.0352
TG	2.182 ±0.989	2.090 ±1.054	0.0327
HDL	1.718 ±0.357	1.418 ±0.328	0.0396
LDL	2.893 ±0.495	2.964 ±0.519	0.0384
HbA 1c	7.349 ±1.233	7.631 ±1.237	0.0328
FBG	8.693 ±3.386	9.765 ±2.779	0.0344

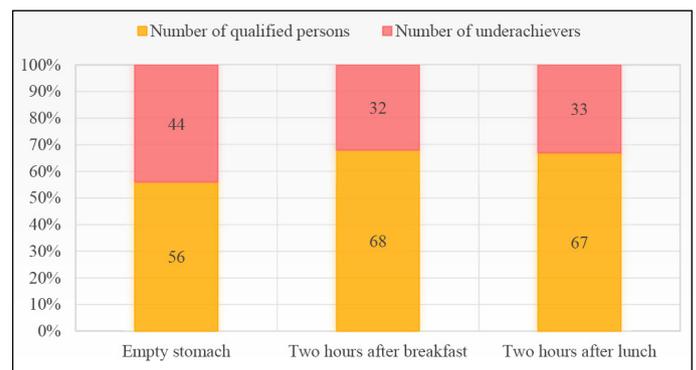


Figure 2. Status quo of blood glucose control of subjects after the experiment.

meet the standard was 32; The number of people who met the standard 2 hours after lunch was 67, and the number of people who did not meet the standard was 33. Compared with the data in Figure 1, it was found that more than half of the patients' blood sugar was controlled after the experiment.

DISCUSSION

Type 2 diabetes is actually a very common disease. With the continuous improvement of people's living standards, the number of patients with this disease is increasing year by year. In the past clinical practice, most of them will give corresponding suggestions and guidance on diet, medicine and exercise to control the blood sugar of patients. Although these methods can alleviate the disease to a certain extent, many patients lack the degree of control, so there is no way to strictly comply with the doctor's instructions, resulting in the unsatisfactory effect of blood sugar control. According to the analysis of many clinical case studies, for patients newly diagnosed with type 2 diabetes, intensive treatment with insulin in a short period of time can effectively improve the blood sugar level and control it. Although the blood sugar level can be controlled and has a good effect, it will rebound once the patient stops using it. Therefore, it is particularly important to implement nursing intervention for patients with diabetes. Nursing intervention includes two aspects. One is the nursing of patients during hospital treatment. Effective measures should be taken at the beginning of the disease. Drug intervention combined with nursing intervention should be used to control the blood sugar level of patients, delay the development of patients' conditions, and try to control the patients' conditions within a certain limit, so that patients can leave hospital as soon as possible. On the other hand, it is the nursing intervention of patients in their daily life after discharge. This part of nursing mainly focuses on health education intervention nursing. It mainly includes helping patients to correctly understand their own conditions, cultivate correct convalescence concepts, correctly grasp the use of drugs and instruments, and cultivate self-care ability; Assist patients in making daily life plans, including changing bad

habits, healthy diet, physical exercise, etc., strengthen nursing awareness, standardize patients' daily life, and cultivate patients' self-management awareness, etc. Many existing studies can prove that the endurance of type 2 diabetes patients can be well improved by carrying out various high-intensity interval training. However, the specific effect will be affected by different factors in actual training, such as the intensity of exercise, interval time, and the proportion of exercise between exercise time and interval time. Therefore, nursing staff should fully master the relevant knowledge of high-intensity intermittent training, keep continuous records of the patient's physical condition in their charge, master the patient's training status, consult sports experts in time according to the changes in physical conditions, develop new training plans, urge patients to exercise on time, treat on time, obey the doctor's advice, better play the role of nursing intervention, and help patients with type 2 diabetes live a healthy life.

CONCLUSION

This article aims to improve the physique of patients by carrying out various high-intensity interval training, combined with necessary drug treatment and effective nursing intervention. High-intensity interval training is very flexible and convenient. In terms of training content, training intensity and interval time arrangement, different types of high-intensity interval training methods can be used for different groups of people. However, due to the high intensity ratio of high-intensity interval training, we need to pay attention to the changes in heart rate of experimental subjects at all times, This requires nursing staff to strengthen the nursing of type 2 diabetes patients in all aspects, help them establish correct health awareness and sports concepts, and carefully supervise patients to complete the established training plan, so as to achieve better sports effects on the premise of ensuring the patient's body, help patients reduce pain and improve the quality of life.

All authors 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. Liu Huiying: writing and execution; Osama Omara: Data analysis.

REFERENCES

1. Buchheit M, Laursen PB. High-intensity interval training, solutions to the programming puzzle. *Sports Med.* 2013;43(5):313-38.
2. Gibala MJ, Little JP, MacDonald MJ, Hawley JA. Physiological adaptations to low-volume, high-intensity interval training in health and disease. *J Physiol.* 2012;590(5):1077-84.
3. Kessler HS, Sisson SB, Short KR. The potential for high-intensity interval training to reduce cardiometabolic disease risk. *Sports Med.* 2012;42(6):489-509.
4. Gibala MJ, Jones AM. Physiological and performance adaptations to high-intensity interval training. *Nestle Nutr Inst Workshop Ser.* 2013;76:51-60.
5. Shiraev T, Barclay G. Evidence based exercise: Clinical benefits of high intensity interval training. *Aust Fam Physician.* 2012;41(12):960-2.
6. Taylor JL, Holland DJ, Spathis JG, Beetham KS, Wisløff U, Keating SE, et al. Guidelines for the delivery and monitoring of high intensity interval training in clinical populations. *Prog Cardiovasc Dis.* 2019;62(2):140-6.
7. Chen L, Magliano DJ, Zimmet PZ. The worldwide epidemiology of type 2 diabetes mellitus-present and future perspectives. *Nat Rev Endocrinol.* 2012;8(4):228-36.