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Resistance Exercises As An Important Form Of Non-Pharmacologic Treatment Of Diabetes

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Abstract

Diabetes, which is a chronic, systemic disease, carries the risk of numerous complications. “An ounce of prevention is worth a pound of cure” - therefore it is important and cost effective to properly manage diabetes and prevent its complications, which can be achieved, among other things, by keeping proper glycemic control, taking care of the lipid profile and maintaining the recommended blood pressure values. In addition to pharmacologic treatment, non-pharmacologic treatment is also vital and often underestimated in practice. This type of treatment includes a healthy diet and physical activity. There are different types of physical activity, each of which has a different effect on metabolism. The aim of this article is to

present resistance exercises in comparison with other models of physical effort recommended for the managing of diabetes. Resistance exercises can have a greater effect on the metabolic equilibrium of diabetes than aerobic exercises due to longer and more stable decreases in post-workout glycemia levels, and a similar effect on other aspects of health. Strength training can be an effective alternative to currently recommended aerobic exercises due to the small differences in contraindications and the significant benefits. In order to be able to compare both types of physical effort more accurately and to identify the model that has a greater effect on metabolism more clinical studies are needed.

Keywords: diabetes mellitus, resistance training, exercise, physical activity

Introduction

It has been known for a long time that physical activity is an important, though often underestimated element of treatment in every person with diabetes mellitus. It has a positive effect on insulin sensitivity glucose levels, lipid profile and promotes weight reduction(1). Among the official recommendations concerning the type of physical activity for diabetic patients most often mentioned in the literature are: hiking, running, dancing, swimming, cycling and other aerobic exercises(1,2).

The influence and use of strength exercises in diabetics is rarely described in the scientific literature. On the basis of the available literature, this article presents the advantages of the use of resistance exercises as an alternative to the currently accepted standards for physical activity.

Effects on plasma glucose

Four clinical trials that evaluated the impact of strength exercises on blood glucose levels in diabetics was evaluated, and one that compared the effects of resistance and aerobic exercises were researched(3–7). The studies lasted from one up to six months and most of which consisted of three training sessions each week, preceded by a warm-up. During each session five, seven or nine different resistance exercises (using machines or free weights) were performed in sets of three of eight to ten repetitions(8). Three of these studies included patients with type 2 and one with type 1 diabetes mellitus.

In all studies changes in blood glucose levels were evaluated based on HbA1C values. Comparing the effects of strength and aerobic exercises, glucose in interstitial fluid was

measured with continuous glucose monitor for 24 hours before and after training, plasma glucose was measured during and 60 minutes after the exercises. The study showed that during aerobic exercises glycemia decreases were greater than during resistance training. Blood glucose was increased during the resting phase after aerobic exercises in contrast to the strength exercises where they remained at the same level. Interstitial glucose measured from 4.5 to 6 hours after exercise was significantly lower after strength training(6). That might explain greater effect of resistance training on lowering HbA1C(4,6). It is also associated with a lower risk of hypoglycaemia during exercise in people with diabetes - a problem that diabetics are frequently afraid of(1,2,6). Longer periods of lowered plasma glucose after resistance training are linked to an increased risk of mild nocturnal hypoglycaemia(6).

Effects on blood pressure

To investigate the effectiveness of the strength training on metabolic control in patients with diabetes, materials were collected concerning its influence on blood pressure, the monitoring and maintenance of which significantly reduces the risk of cardiovascular complications of diabetes. The results of studies for both diabetic and healthy patients show that strength training reduces values of both systolic and diastolic blood pressure at rest(4,5,9,10).

Overall effect on metabolism

Every physical activity has a positive effect on insulin sensitivity, blood glucose control, lipid profile and weight reduction(11). In order to find out the reasons for differences in metabolic control of diabetes between the two training models, attention should be paid to the elements of metabolism and the degree to which they affect them. Strength training, contrary to dynamic exercises, increases fat free mass (lean body mass) – this change in body composition translates to higher muscle mass and reduced fatty tissue mass which may be the reason for the improved insulin resistance(11–13). A higher amount of muscle mass may be responsible for a significant increase of basal metabolic rate, which may have a positive impact on post-workout blood glucose levels(12).

Last but not least is the influence of resistance training on lowering the blood ghrelin levels, and their milder growth in the post-workout period in comparison to an aerobic training, which does not affect the subjective feeling of hunger but reduces the amount of food intake(14).

Guidelines for conducting strength training

Based on the materials collected optimal training routine should consist of three sessions a week, with one day of rest between sessions. On each training three sets of seven different exercises with 8 to 10 repetitions should be performed. A 90-120 second break should be taken between each exercise and each set(8). The selection of resistance exercises remains a

matter of choice, although complex exercises should be chosen first and foremost, and isolated exercises should be avoided to mobilise as many muscles as possible at once. Exercises may utilize body weight, free weights or gym machines and should be selected according to both abilities and physical skills, considering comorbidities or previous injuries. Proper technique should be learned preferably under the supervision of a professional trainer, starting with light weights or even weightless. Each training session should be preceded by a warm-up period of 10-15 minutes, including aerobic exercises of low intensity and stretching of all muscle groups to prepare muscles, heart and lungs for a gradual increase in intensity and to reduce the risk of injury(15,16). The warm-up may include, e.g. marching on a treadmill or riding a stationary bike(15). The number of repetitions in each set and their intensity may be adjusted depending on the patient's health condition and age. Older patients (over 60 years of age) and patients with cardiovascular diseases may use the range of 10-15 repetitions and switch to less intense exercises. To maintain progress and the positive impact of training on health, it is important to remember to increase the insensitivity and weight load gradually as the training progresses. It is recommended to increase the weight load by about 5% at a time when the patient can perform the maximum number of repetitions in all three series without any problems(16).

Contraindications

People suffering from diabetes, whom we would like to recommend resistance training as an important form of non-pharmacologic treatment should undergo thorough cardiological, haematological, pulmonological, neurological and ophthalmological assessment aimed at excluding relative and absolute contraindications to this type of exercise.

Among absolute contraindications are: unstable angina pectoris, decompensated heart failure, severe pulmonary hypertension, significant valve stenosis, acute myocarditis, endocarditis and pericarditis, uncontrolled hypertension, aortic aneurysm, moderate proliferative and non-proliferative retinopathy, significant myopia, proteinuria in the course of various kidney diseases, autonomic neuropathy.

Relative contraindications include: uncontrolled diabetes, movement limitations associated with defects or previous injuries, implanted pacemakers, ischemic heart disease(17).

Summary

We would recommend the above-mentioned type of physical activity primarily to young people, because of the smaller number or lack of possible contraindications to perform this type of exercises. In this age group an increasing number of cases of type 2 diabetes is observed, which is related to an unhealthy lifestyle. Over the past few years the trend for keeping fit and maintaining our health has emerged. Exercising become an activity with greater social interaction and focus which may contribute to the promotion of health, while in the case of patients with diabetes it may motivate them to maintain active lifestyle.

It is hard for most diabetics to come to terms with the disease. An additional option of non-pharmacologic treatment, which does not strike the patient's surroundings, and on the contrary

is fashionable may help in managing the disease. This may reduce the level of anxiety caused by a chronic disease by allowing the patient to regain control over one's own health and life, and thus improve the quality of life.

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