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## **The role of physical activity in the treatment of type 2 diabetes – editorial article**

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## **Abstract**

Type 2 diabetes belongs to the group of civilization diseases of the 21st century. In Poland, over 3 million people suffer from diabetes, including 1 million being undiagnosed. In the initial stage, this disease does not hinder functioning in everyday life, often people get to know about being affected by this disease during other diagnostic tests related to another illness. As diabetes develops, there may be numerous complications, including: retinopathy, nephropathy, neuropathy, cerebrovascular disease, ischemic heart disease, peripheral artery disease. Untreated type 2 diabetes can lead to death, so it is very important to start treatment quickly. The aim of therapy is to balance carbohydrate and lipid metabolism, achieve optimal blood pressure, proper body weight, and prevent complications. This can be achieved by combining a properly selected diet, physical activity and pharmacotherapy. [1,2]

## **Introduction**

The World Health Organization defines diabetes as a group of metabolic diseases characterized by hyperglycaemia resulting from a defect of insulin secretion and/or its action. Chronic hyperglycaemia in diabetes is associated with damage, dysfunction and failure of various organs, especially eyes, kidneys, nerves, heart and blood vessels. The fact that someone has diabetes can be said when:

- random determination of blood glucose is at least 200 mg/dl
- double fast fasting blood glucose test will exceed 126 ml/dl each time
- 120 mg oral glucose tolerance test (OGTT) will be equal to or exceed 200 mg/dl at 120 minutes. [1]

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## **Epidemiology**

The problem of developing type 2 diabetes concerns people around the world. It is estimated that it affects 5-7% of the world's population. Lack of symptoms at the beginning of the development of the disease creates a problem of recognizing it too late. Type 2 diabetes in most cases precedes the prediabetes. In developing countries, the number of cases is rapidly growing. In Poland, the number of people with type 2 diabetes is constantly increasing. In the years 2001 - 2011 it increased by 25% (according to the NATPOL study data). Currently, about 2 million people suffer from type 2 diabetes, of which 1 million are undiagnosed. This disease affects people of all ages, but the highest incidence of the disease is between 60 and 70 years

old. In older people, there is a greater risk of getting sick compared to young people. Among people over 60, every fourth person suffers from diabetes, and among people over 80, every second person suffers from diabetes. In conducted epidemiological studies, it has been proved that environmental factors are bigger risk than genetic predisposition. Changing the lifestyle to less active, increased intake of high-calorie foods, increased living standards are the main factors affecting the development of the disease. Keeping such a lifestyle is associated with the development of overweight and obesity. Obesity is diagnosed in 60-80% of patients and this percentage is still growing. The risk of type 2 diabetes increases with weight. [3,4,5]

### **Pathophysiology**

The correct concentration of glucose is maintained by the proper release of insulin from the pancreas and tissue sensitivity to this hormone. In type 2 diabetes, an increase in blood glucose results from the disturbance of these processes. Often, the condition preceding the development of type 2 diabetes is an increase in insulin resistance of peripheral tissues. The reduced sensitivity of tissues to insulin can be caused by many factors. The most common of these are: high-calorie diet, low physical activity, alcohol abuse, cigarette smoking, genetic factors and age. [1] The highest risk of insulin resistance is observed in overweight and obese people. Hormones released by adipose tissue inhibit insulin secretion. In the blood, the concentration of free fatty acids increases, which are then used as a source of energy. Glucose is then not burnt and stored in the tissues, which increases its concentration in the blood. To reduce blood glucose, the pancreas produces more insulin. This mechanism was created in response to too much energy in the body. Too intense cell work may lead to exhaustion of pancreatic cell functional reserves. Such increased B cell function is only possible for a limited time. [3,4,5]

### **Clinical picture**

The clinical picture of diabetes varies from patient to patient. Usually depends on the severity of the disease. Symptoms can be altered or accelerated by co-morbidities. In most cases, diabetes develops asymptotically. [1]

Symptoms in type 2 diabetes are divided as follows:

1. Clinical symptoms associated with abnormal glucose concentration:
  - a. symptoms associated with hyperglycaemia,
  - b. symptoms associated with hypoglycaemia.
2. Clinical symptoms associated with the co-morbidity of diabetes complications:

- c. symptoms of macroangiopathy,
- d. symptoms of microangiopathy [1]

Typical symptoms in hyperglycaemia are:

- polyuria
- polydipsia
- concentration disorders
- fatigue
- weight loss
- increased tendency to infection
- blurred vision

Symptoms associated with hypoglycaemia are:

- increased sweating
- tachycardia
- impairment of renal and hepatic function
- adrenal insufficiency
- high blood pressure
- memory problems
- headaches
- paraesthesia
- coma
- 

There are two groups of diabetes complications:

1. Microanopathies that are caused by damage to small vessels capillaries:
  - retinopathy,
  - nephropathy,
  - neuropathy.
3. Macroangiopathies that are caused by damage to large vessels:
  - ischemic heart disease,
  - vascular disease of the brain,
  - peripheral artery disease [6]

## **Treatment**

Treatment of type 2 diabetes is a process requiring the use of both pharmacological and non-pharmacological methods. One should strive to modify the style of life increasing physical activity and reducing caloric content of meals and in the case of advanced diabetes treatment for complications. These treatments aim to balance the carbohydrate and lipid metabolism, achieve optimal blood pressure and gain proper body weight. The treatment methods are adapted to each patient and depend mainly on his condition, complications, duration of illness, age, and involvement in therapy. [7,8] Studies carried out in European countries have shown that 40-70% of respondents do not participate in any physical activity during their free time. In addition, 50% of respondents work in a profession involving minimal physical effort. In parallel with the reduced activity, the development of metabolic diseases and cardiovascular diseases occurs. Type 2 diabetes appears much more often in inactive people than in those who spend their free time actively [9].

## **Effect of physical exercise on human body**

In long-term studies, a significant effect of regular exercise on carbohydrate metabolism and peripheral tissue sensitivity to insulin was observed. The effect lasted up to 5 years. Patients attempted physical activity of 50-80% intensity of maximum oxygen consumption, 3-4 times a week for 30 - 60 min. After the end of the training program, a constant reduction in blood glucose was observed by as much as 20%. It has also been proven that regular physical activity lowers the concentration of VLDL-rich triglycerides. However, there has been no positive impact of regular exercise to lower LDL cholesterol. There are also publications describing the beneficial effect of exercise on hypertension in patients with elevated insulin levels in the blood. It was also observed that physical exercise has a positive effect on the loss of visceral fat. Its presence is often associated with the occurrence of metabolic disorders [11]. Systematic movement increases the sensitivity of peripheral tissues to insulin. The best results can be seen when practicing aerobic exercises of moderate intensity. Glucose transport to the cell takes place thanks to the GLUT 4 transporter, which is activated by insulin. Systematic physical exercise increases the number of transporters, which increases the uptake of glucose by the tissues. This effect can persist up to 24 hours after the end of the activity and then the glycogen stores are replenished. [4]

### **Evaluation of the patient's condition before exercise**

Before starting physical exercise, the patient should undergo tests to determine indications and contraindications. Research should include : glycaemic test, evaluation of peripheral circulation, examination of the eye, evaluation of the presence and severity of chronic diseases [11]. Before determining the form and intensity of the effort, it is necessary to determine the patient's options. The training program should take into account the duration of the disease, the presence of complications and comorbidities, metabolic control of diabetes and age.

The recommended exercise in people with type 2 diabetes is a moderate intensity endurance exercise (50% - 70% maximal oxygen uptake capacity), lasting a minimum of 150 minutes, 3-5 times a week. The maximum interval between workouts should be 2 days.

The most recommended forms of effort in type 2 diabetes are:

- march,
- swimming,
- Cycling,
- badminton,
- Cross country skiing,
- skating,
- dancing.

Patients with type 2 diabetes may also perform a resistance exercise that will maintain or increase muscle mass. For this type of training, a stable course of glycemia during workout is characteristic. Resistance training can be performed up to 2 times a week, 3 sets of 8-10 repetitions. [12]

### **Undesirable consequences of physical training**

Even during physical exercise, all precautions should be taken, because during and after physical exercise there may be a decrease in blood glucose. Post-exercise hypoglycaemia may occur after a very intense exertion. The most common cause is increased tissue sensitivity to insulin and glycogen resynthesis. The reasons for lowering blood sugar levels may be:

- too long or intense effort
- wrong meal composition
- no reduction of the insulin dose

During physical activity there may also be an increase in the blood glucose level that may be caused by:

- eating too much carbohydrates before exercise

- they will supply too little insulin
- high level of stress
- too little physical activity

Very intense endurance and anaerobic exercise contributes to hyperglycaemia. It has been demonstrated that during such type of exercise, the excretion of noradrenaline, adrenaline, cortisol, glucagon and growth hormone increases [12].

### **Contraindications to physical exercise**

Situations in which the patient can not undertake physical activity, because it will not bring any therapeutic effects:

- when the blood glucose level exceeds 250mg/dl when ketones are present in urine
- when blood glucose levels exceed 300 mg/dl despite the lack of acetone in urine
- when the glucose concentration is less than 70 mg / dl
- decompensated diabetes
- a recent heart attack
- unstable coronary heart disease
- respiratory failure
- resting tachycardia
- severe disturbances of the conductivity and rhythm of the heart
- myocarditis and pericarditis
- overweight above 160% of body weight
- active inflammation. [1,2]

## **Bibliography**

1. Sieradzki J., Czupryniak L., Małecki M. i wsp. Cukrzyca, Via Medica, Gdańsk 2015, Tom I; 308- 341
2. Czupryniak L., Strojek K., Diabetologia 2016, Via Medica, Gdańsk 2016
3. Strojek K., Wróbel M., Rokicka D. i wsp. Diabetologia. Praktyczny poradnik,
4. Termedia Wydawnictwo Medyczne, Poznań 2014
5. Czupryniak L., Diabetologia – kompendium, Tormedia Wydawnictwo Medyczne, Poznań 2014
6. Nowakowski A. Epidemiologia cukrzycy, Via Medica, Lublin 2002
7. Tatoń J., Czech A. Bernas M.: Diabetologia kliniczna. Wydawnictwo Lekarskie PZWL, Warszawa 2008
8. Czech A., Tatoń J., Standardy rozpoznawania i leczenia cukrzycy, PZWL,
9. Polskie Towarzystwo Diabetologiczne. Zalecenia kliniczne dotyczące postępowania u chorych na cukrzycę. Diabetologia Kliniczna 2013; 2(supl. A).
10. Kelly Dawid B. Leczenie Cukrzycy typu II. Via Medica, Gdańsk 2002
11. Czech A., Tatoń J., Otyłość: zespół metaboliczny, PZWL, Warszawa 2007; 409 – 424
12. AT Diabetologiczne Cukrzyca i wysiłek fizyczny, Via Medica, Gdańsk 2001
13. Stanowisko American Diabetes Association. Cukrzyca i wysiłek fizyczny.
14. Diabetologia Praktyczna 2002; 3(supl.A)
15. Fabian W., Koziarska- Rościszewska M., Strojek K., Cukrzyca, PZWL, Warszawa 2008