

The role of exercise and nutrition in type II diabetes mellitus management

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Abstract

Background:Type II diabetes mellitus is a public health problem in both developed and developing countries which has increased alarmingly, giving the disease the dimension of an epidemic. The etiology of diabetes is multifactorial involving genetic, environmental, and behavioral origins.

The aim of present study was to review the role of exercise and nutrition in type II diabetes mellitus.

Method and material:The method of this study included bibliography research from both the review and the research literature which referred to exercise and nutrition in type II diabetes mellitus.

Results : During recent years, the association between physical activity and type II diabetes mellitus management has been assessed by a number of studies. It is well established that physical activity produces general and specific health benefits for diabetic patients. The basic principles of an effective exercise program are the intensity, duration and frequency of exercise in an appropriate environment. Usually, low-intensity and long-duration exercise programs are considered the most suitable for diabetic patients. Regarding dietary choices, it is widely accepted that healthy nutrition is the basis for the treatment of type II diabetes since it contributes positively to the maintenance of blood glucose within normal range and minimizes the complications of the disease.

Conclusions : As it is supported by published evidence, encouragement to adopt healthy dietary choices in conjunction with increase of physical activity and reduce of sedentary behaviors is a successful public health approach for type II diabetes mellitus prevention and management.

Keywords: physical activity- type II diabetes mellitus-nutrition- management

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Introduction

Type II diabetes mellitus is a global health problem and one of the major causes of morbidity and mortality. The incidence of the disease is high worldwide and varies between populations because of differences in genetic susceptibility and

other modifiable risk factors. Diabetes mellitus is a metabolic disease, characterized by hyperglycaemia (increased concentration of blood glucose) and disturbance of glucose metabolism, as a

result of reduced secretion or insulin resistance or both.^{1,2}

In the literature is cited that there are approximately 145 millions of patients with type II diabetes mellitus worldwide and this number is expected to rise to 300 million by 2025, while according to other estimations the number of people with diabetes in the world will double from 171 million in 2000 to 366 million in 2030. In the United States of America (USA), approximately 20.8 millions of people which represent 7% of the population have diabetes mellitus and 90-95% of them have type II. Also, high incidence of the disease is recorded in Canada, where approximately 1.4 millions of people are already type II diabetes mellitus patients. The incidence of diabetes is increasing dramatically among young people as well, a fact that indicates the severity of the disease. In Greece, the research data about the incidence of diabetes are few, and they vary among studies.¹⁻⁵

Diabetes is a disease known since antiquity. The name diabetes was given due to increased urination that the disease causes, while mellitus is the Latin word for «honey sweetened» and describes the presence of glucose in urine. More specifically, in 200 a.C., Aretaios wrote: The term diabetes has been attributed to the disease because it looks like water passing through a pipe.¹⁻⁵

Although diabetes mellitus is a disease that exists for many centuries, the underlying mechanisms that cause it are not fully understood yet. Apart from the genetic factors, which are mainly responsible for causing diabetes, other factors that seem to be responsible as well, are environment, modern lifestyle, physical inactivity, stress, etc.

The main disorder of diabetes mellitus is the decreased secretion of insulin from pancreas that regulates the metabolism of carbohydrates, proteins and fat. There are two types of diabetes, type I (insulin dependent) and type II diabetes (non-insulin dependent). The main difference between the two is that type I is

characterized by complete lack of insulin, while type II is a combination of reduced secretion of insulin from the pancreas and resistance to insulin action in peripheral tissues. As a result, the levels of blood glucose are increased and when the concentration is higher than 180-200 mg.dl/l, then symptoms such as excessive thirst and hunger, excessive urination and weight loss occur.⁶⁻¹⁰

Besides the short-term symptoms, diabetes mellitus has severe long-term complications such as constriction of blood vessels, thrombotic microangiopathy (nephropathy and retina), neuropathy (peripheral and autonomous), peripheral angiopathy, problems of the cardiovascular system, etc. Furthermore, diabetes is associated with morbidity and premature death from complications of the cardiovascular system including vascular stroke and myocardial infarction.⁶⁻⁹

The role of exercise

Physical activity is defined as the total of planned and repetitive movements of skeletal muscles, which are performed using energy. The beneficial effects of exercise in patients with type II diabetes have been recognized since antiquity, when Aristotle observed that the symptoms of diabetes significantly improved after exercise. Today, the beneficial role of exercise has been fully documented and exercise should be incorporated systematically in the treatment of patients with diabetes.⁹⁻¹⁶

More in detail, exercise has a significant role in the regulation of blood glucose, improves insulin action, metabolism of proteins and fats, prevents complications of diabetes, improves muscle flexibility and strength, has beneficial effects on the cardiovascular system and increases life expectancy of the patients. In addition, physical activity is beneficial for the mental state of the individual, because it increases the energy of the human body, improves self-esteem and decreases depression.⁹⁻¹⁵

Based on the literature, if completely sedentary and underactive individuals participate in moderate physical activity 30 minutes a day, they would obtain at least a 30% reduction in risk not only for type II diabetes but also for other chronic diseases such as coronary artery disease, stroke and colon cancer.¹⁶

In many European countries, in contrast to Greece, exercise is prescribed by the medical doctor. Multiple factors in modern society discourage prescription of physical activity such as inadequate time for patient education and counseling to encourage physical activity, lack of necessary skills and tools for providing such counseling and lack of treatment programs.¹⁶

It is widely accepted that although patients with diabetes are able to exercise, the majority of them do not participate in exercise programs or are physically inactive either because they lack counseling or they don't feel safe following such a program. An appropriate exercise program should be individual in order to cover each patient's needs. For example, in patients with diabetic neuropathy walking is avoided, while in people with diabetic retinopathy strength exercise is not allowed. Furthermore, training-exercise should be planned according to age, educational level, previous experience and the degree of familiarity of the patient to physical activity. Hypoglycaemia, hyperglycaemia, the deterioration of silent heart disease and aggravation of complications of the disease are the main risks during a non-safe exercise program. In order to minimize these risks and choose the proper intensity of the program, patients should undergo a full medical examination before they start exercise including a full examination of the cardiovascular system.⁹⁻¹⁶

The basic principles of an effective exercise program are the intensity, duration and frequency of exercise. The intensity of exercise should be sufficient to cause changes in the cardio respiratory system and is determined either by the physical condition of each patient or by the heart

rate. In non-fit patients, the intensity can be set to 50-60% of maximum heart rate or to the intensity that increases the resting heart rate by 20 pulses per minute. The duration of the exercise should be 30 minutes in the beginning, starting with 5-10 minutes of warm-up and finish always with recovery exercises. The lower frequency recommended is 3 times/week. Usually, low-intensity and long-duration exercise programs are considered the most appropriate and safe for diabetic patients. Finally, the subjective perception of fatigue should be continuously assessed throughout the whole exercise session.^{9,10}

Other important parameters that need to be evaluated during an exercise session are the levels of blood glucose before and during the exercise, the type of food and the time prior to exercise that it was consumed, the time and point of administration of insulin, for example, injection to the point that is going to be exercised should be avoided or the duration between the time of injection until the start of exercise should be at least one hour, etc. It is also very important for the patient to report if and how many meals he/she has missed before initiation of exercise, if the insulin dose administered was the correct one and not higher (so that the risk of hypoglycaemia is avoided) and if other medication has been used. The most common medical treatment used by patients with diabetes or obese patients with diabetes are beta-blockers, because these patients usually also have hypertension. Beta-blockers compete with epinephrine and when hypoglycaemia occurs during exercise, the usual symptoms like tremor, anxiety, and tachycardia will not occur.^{9,10}

An appropriate environment during exercise is also required. Excessive heat leads to intense sweating and dehydration. In addition, if the patient has fever, exercise is forbidden. Another factor that should not be underestimated during exercise is the use of proper footwear and maintenance of foot cleanness in order to prevent infection.^{9,10} Health professionals should inform patients about the benefits of exercise. Physical

activity counseling should become an integral component of type II diabetes mellitus treatment and prevention. Also, the state should consider more carefully the benefits from exercise for patients with diabetes and support intervention and rehabilitation programs.^{17,18}

The role of nutrition

Appropriate food choices are considered necessary for ensuring and maintaining good health. Healthy nutritional habits are established in childhood and adolescence, which are considered the crucial periods in the human's life, because during them the human body is still developing and is being built up to maintain a healthy adulthood later on. In contrast, poor nutritional habits established in these periods are responsible for the development of chronic diseases such as obesity, heart disease, osteoporosis and others. Furthermore, the westernised diet that has been established the last decades, is the main risk factor for increased morbidity and mortality.¹⁹⁻²⁶

It is widely accepted that healthy nutrition is the basis for the treatment of type II diabetes. It contributes positively to the maintenance of blood glucose within normal range and minimizes the complications of the disease. Recent literature suggests the Mediterranean Diet as the most comprehensive diet choice. It is characterized by olive oil as the main source of fat, and high to moderate consumption of fruit, herbs, cereals, fish, and legumes in combination with a small portion of meat and wine.^{27,28}

According to the literature, in most cases, hyperglycaemia, as the result of unregulated blood sugar, is the main cause of hospitalisation. These patients are usually unaware of the existence of the disease and they follow unhealthy nutritional lifestyle without including exercise in their daily activities. On the contrary, a healthy nutritional program combined with exercise regulates effectively blood glucose. According to research studies, the risk of diabetes in patients with impaired glucose

tolerance decreased after a combined program of nutrition and exercise, compared to the control group. Patients with diabetes mellitus need to be informed about the benefits of appropriate nutritional habits, which is the major key in regulation of blood glucose.¹⁹⁻²⁶

The design of a nutritional program should be individual, relative to the dietary preferences, gender, age, profession, weight, and the personal goals of each patient. Healthy nutrition also promotes quality of life, reduces the frequency of hospitalisation and therefore the high cost of the treatment.¹⁹⁻²⁶

Taken for granted that the discipline of the patients in the given instructions is reduced with time, intensive and repeated counseling by health care professionals is a matter of great importance. Counselling patients to undertake physical activity and adopt proper dietary habits to prevent and treat type II diabetes mellitus becomes a primary prevention modality.²⁹⁻³¹

Conclusions

Patients with type II diabetes should be constantly informed about the crucial role of nutrition and exercise in the management of the disease. Lack of understanding of the beneficial effects of dietary choices and exercise in the regulation of type II diabetes, may lead to inappropriate treatment methods.

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