fizjoterapia polska

POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 3/2018 (18) KWARTALNIK ISSN 1642-0136

Fizjoterapia u chorych zakażonych HIV/ AIDS – demonstracja przypadku, zasady profilaktyki

Physiotherapy in HIV/ AIDS infected patients – case presentation, principles of prevention

Bezpieczny wysiłek fizyczny u pacjentów z cukrzycą

Safe physical effort for diabetic patients

Odpowiedzialność cywilna Fizjoterapeuty

Po blisko 30 latach starań fizjoterapia została uznana za niezależny zawód medyczny. Wiąże się to nie tylko z podniesieniem prestiżu zawodowego czy wzmocnieniem pozycji Fizjoterapeutów wśród innych zawodów medycznych, ale również ze zwiększeniem odpowiedzialności cywilnej.

„Zgodnie z art. 2. Ustawy z dnia 25 września o zawodzie fizjoterapeuty, profesja ta jest samodzielnym zawodem medycznym."

Obecnie odnotowywana jest rosnąca ilość i wysokość roszczeń pacjentów względem podmiotów leczniczych oraz osób wykonujących zawody medyczne. W latach 2011-2016 do sądów cywilnych pierwszej instancji wpłynęło ponad 5 400 spraw z zakresu ochrony zdrowia, a kwoty odszkodowań oraz zadośćuczynień jakich żądają pacjenci są z roku na rok coraz wyższe. Potwierdzają to dane statystyczne Ministerstwa Sprawiedliwości, z których wynika że w latach 2014–2017 kwota zasądzanych zadośćuczynień i odszkodowań wzrosła o 70% w porównaniu do lat ubiegłych.

Błąd podczas wykonywania świadczenia może kosztować nawet kilka milionów złotych.

Sąd Najwyższy w czerwcu 2018 r. na rzecz rodziców i trwale niezdolnego do samodzielnego funkcjonowania dziecka zasądził kwotę zadośćuczynienia w wysokości 3 235 000 zł. W tym precedensowym wyroku Sąd Najwyższy stwierdził, że cierpienie z powodu kalectwa dziecka można traktować podobnie jak śmierć.

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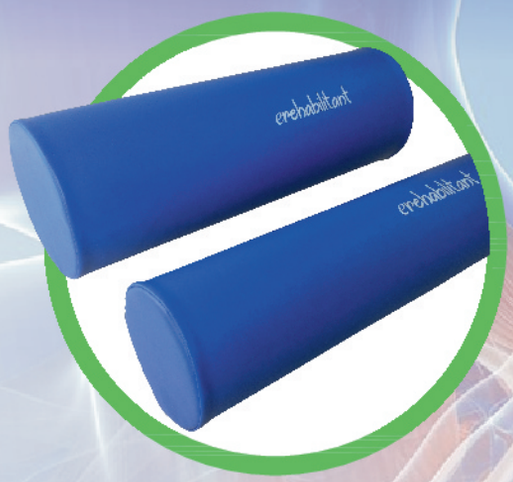

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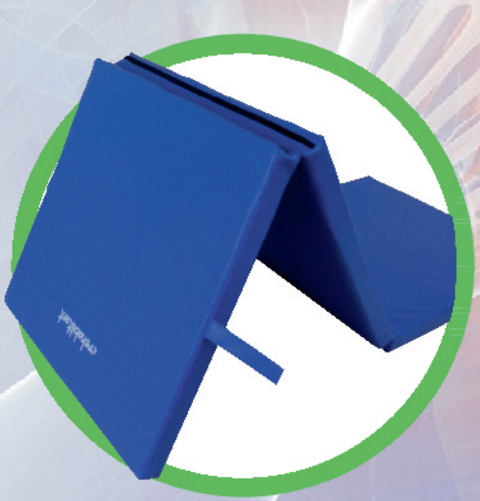

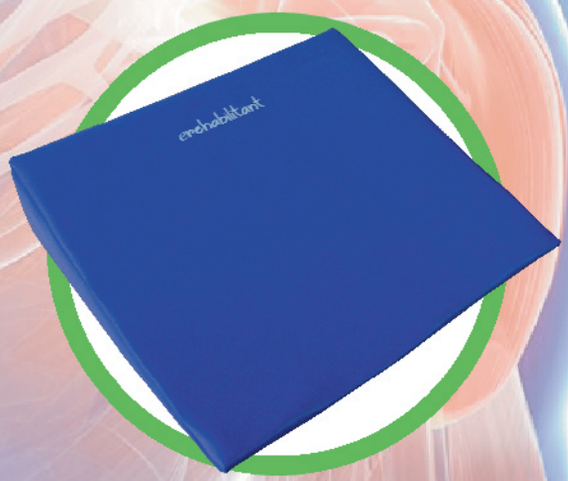

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nr 3/2018 (18)

Bezpieczny wysiłek fizyczny u pacjentów z cukrzycą

Safe physical effort for diabetic patients

糖尿病患者的安全体力消耗

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Streszczenie

Systematyczne podejmowanie regularnego, wyczynowego wysiłku fizycznego jest ważną składową leczenia cukrzycy. Dobre wyrównanie metaboliczne cukrzycy stanowi kluczowy element efektywności treningu fizycznego i sukcesu sportowego. Osoba aktywna sportowo z cukrzycą typu 1 wymaga bardzo precyzyjnego dawkowania insuliny oraz dużej wiedzy i umiejętności interpretacji zjawisk metabolicznych zachodzących w organizmie podczas treningu fizycznego. Błędy w zakresie insulinoterapii zwiększają ryzyko wystąpienia ostrych powikłań cukrzycy, hipoglikemii, kwasicy ketonowej oraz negatywnie wpływają na wyniki sportowe.

Słowa kluczowe:

cukrzyca, sport wyczynowy, insulina - dawkowanie, metabolizm węglowodanów

Abstract

Systematic undertaking of regular, competitive physical exercise is an important component of the treatment of diabetes. Good metabolic control of diabetes is a key element in the effectiveness of physical training and sports success. A person who is active in sports with type 1 diabetes requires very precise insulin dosing as well as extensive knowledge and the ability to interpret metabolic phenomena occurring in the body during physical training. Errors in insulin therapy increase the risk of acute complications of diabetes, hypoglycaemia, ketoacidosis and negatively affect sports performance.

Key words:

diabetes, professional sport, insulin - dosage, carbohydrate metabolism

摘要

定期且竞技式的体力消耗为治疗糖尿病的重要部分，有效的体能锻炼及运动上的成就为糖尿病患代谢控制良好的关键因素。积极运动的 1 型糖尿病患者在胰岛素用量上必须非常精确，且必须具备解释体能锻炼时体内所产生代谢现象的能力。胰岛素治疗上的错误会增加严重糖尿病并发症、低血糖、酮症酸中毒等症状产生的风险，对运动结果将带来负面影响。

关键词：

糖尿病、竞技运动、胰岛素 – 用量、碳水化合物代谢

Introduction

Diabetes is a metabolism disorder the core issue of which is the deficiency or no answer for insulin activity, which results in hyperglycemia development. Long-lasting organism exposure to the increased concentration of the glucose in human blood corresponds with the occurrence of complications of many organs, inter alia, eyes, kidneys, heart, blood vessels and nerves. Thus, diabetes treatment is focused on minimizing the risks of the occurrence of further organ complications. Behavioral therapy, including physical activity, proper nutrition, sleep hygiene, avoiding stimulants and stress, is the inherent part of diabetes treatment regardless its type or the patient age [1].

Progressing urbanization, ageing population, increase in obesity and decrease of physical activity induce increased incidence of diabetes. IDF (International Diabetes Federation) data shows that in 2017 diabetes prevalence reached 425 million worldwide. Almost half the number of people struggling with diabetes have not been diagnosed and have not been treated. It is estimated in 2045 the number of the ill will increase to as much as 625 million. Constantly growing number of patients suffering from diabetes constitute the considerable sociological and social problem, as treating diabetes, from the moment is has been recognized, lasts for the rest of life. Appropriate treatment and the patient's discipline allows to maintain full fitness efficiency and personal satisfaction from life.

Social importance of this notion is illustrated with statistic-epidemiologic data, according to which over 2 million of people in Poland suffer from this illness [2].
Diabetes classification is a difficult task. The notion of diabetes includes heterogeneous group of illnesses, which, through the number of various mechanisms, induce hyperglycemia. Defining this group as "the group of metabolism illnesses characterized by hyperglycemia induced by the impairment of insulin secretion or of insulin activity, or both" results from various pathophysiological mechanisms and therefore, requires varied approach towards the treatment. Currently, it is recommended to use four wide categories based on diabetes etiology. Those categories include diabetes mellitus type 1, diabetes mellitus type 2, gestational diabetes and other, specific types of diabetes.

Diabetes mellitus type 1

The prevalence of diabetes mellitus type 1 in diabetes patient population is around 10 %. Most commonly, it develops in children and adolescent age, although is may occur in patients over 30 years of age. The peak incidence is puberty age. The reasons of the occurrence of diabetes mellitus type 1 have not been explicitly explained so far. The main role in its pathogenesis is addressed to genetic predisposition (the presence of the following haplotypes: HLA DRB1*09, DQB1*030, HLA DQA1*0301), the environmental factors (inter alia, the viruses of mumps, influenza, rubella, Coxackie B) as well as acquired immunological factors (complex immunological response of cellular and humoral type), directed to destroy the beta cells of pancreatic islets. The process of auto-aggression that leads to destroying the cells of Langerhans islets that produce insulin, is malicious and symptomless at the beginning. At that time, in the organism blood, one may note the presence of antibodies (inter alia, the islet cell antibodies – ICA, insulin antibodies IAA, the antibodies against glutamic acid decarboxylase – anti-GAD, the antibodies against the phosphatase of protein tyrosine – IA-2), which are the markers of the undergoing autoimmunological process [3]. When 80 to 90% of insulin islets are damaged, sudden drop of insulin concentration in blood takes place and the fully symptomatic diabetes develops.
Diabetic ketoacidosis, which is usually the first manifestation of the diabetes mellitus type 1, results from the lack of the insulin in the organism, the consequence of which is major hyperglycemia and excessive production of ketone bodies. Due to the lack of insulin in the organism, the transport of glucose through the cellular membrane inside the cells is difficult, which leads to lowered use of glucoses as the energy substrate. As result, exacerbated lipolysis takes place, together with creating ketone bodies and lowering blood pH. Glycosuria, that is the presence of glucose in urine, is the inevitable element of deepening hyperglycemia, which leads to osmotic diuresis and dehydration, usually accompanied with electrolyte disorders (mainly, hyperkalemia and concurrent intracellular potassium deficiency). The result of undertaking biochemical processes is the pathologic increase of thirst (drinking even several liters of liquids a day) and noticeable increase of daily urine output. Limiting liquid supply facilitates cell dehydration and weight loss.

Diabetes mellitus type 2

Diabetes mellitus type 2 is the most common type of this disease, constituting 80-0% of all the cases. The factors that predispose to the development of the diabetes mellitus type 2 are genetic predispositions and the obesity. Increased fat mass, lowered physical activity, eating high caloric food are conductive to the development of the insulin resistance, which is characterized by decreased sensitivity of the peripheral tissues (mostly muscle, liver and fat tissues) to the insulin activity. As a result, decreased glucose utilization takes place, as well as increased lipolysis and releasing free fatty acids, uncontrolled glycogenolysis and gluconeogenesis. Organism resistance to insulin activity causes, at the first stage, insulin hypersecretion by the pancreas, and in the course of the illness, there occur the loss of the capability of compensation insulin secretion and finally, fully symptomatic diabetes development [4].

Diabetes mellitus type 2 is the illness mostly adults, usually after 40, suffer from, however, due to the obesity epidemic the age of the disease has considerably been lowered and currently more and more often it concerns young people. Diabetes mellitus type 2 develops slowly, apart from typical symptoms due to diabetes decompensation, such as polydipsia (increased thirst), polyuria (increased urinating), weight loss and dehydration, may be signaled by such signals, as general fatigue, lowered immunity in the form of recurrent infections, and purulent lesions of the skin, progressive visual impairment, impaired healing, disturbing itching in genito-urinary system. One of the first manifestations of the diabetes mellitus type 2 may be the occurrence of later complications, such as diabetic foot syndrome, nephropathy, retinopathy, or diabetic neuropathy, as well as accelerated development of atherosclerosis.

Currently available treatment methods, implemented models of insulinotherapy, including the ones using personal insulin pumps, launched constant blood sugar monitoring systems have profoundly increased the safety of hypoglycemic therapy and enable patients to optimally balance the blood sugar. It contributes to braver decisions concerning the style of way of life; many patients more and more often decide to practice sport actively and competitively.

Common recommendations of the Polish Diabetological Association and the Polish Society of Sports Medicine have been created in order to enable diabetologists and sport medicine specialists to qualify the patients with diabetes to practice sports safely, also in professional manner. Thanks to the development in diabetes treatment, the situation changed during the last decade. Patients suffering from diabetes mellitus type 1 are successful in professional sport equally to the healthy, diabetes is no longer the barrier in taking part in PE classes, practicing both amateur and professional sport in sport sports club and in competing.

The role of physical activity and diabetes treatment

Exercise is the basic and inevitable element of appropriate functioning of the organism; it is the factor activating and stimulating metabolism processes. Positive effects of regular

and systematic physical activity of the patients suffering from diabetes are visible in the range of compensation and adjustment changes. More effective glucose development by the cells and effective insulin activity in the organism contribute to the normalization of the increased blood glucose level, to reduce insulin resistance and daily insulin requirement. Clinical studies have shown that patients suffering from diabetes that are physically active there occur lower risk of cardiovascular incidents, including the death resulting from them.
In EURODIAB studies the prospective impact evaluation have shown that average and intensive physical effort, undertaken at least once a week, lowers the risk of death with almost 40% regardless the sex, age, BMI, smoking, drunk alcohol, nutrition or the presence of chronic complications of diabetes [5]. Moreover, regular physical activity improves mental, physiological and physical well-being, which is visible in general assessment of the patients' life quality.

Glucose metabolism and the intensity of the physical effort

The way the type and the time of the practiced physical effort influence blood sugar level depend on its initial value. It is known the regular and systematic physical activity at average level leads to lowering blood sugar level without dangerous hypoglycemia incidents. Lowering blood sugar level results there from greater peripheral glucose ejection than the liver ejection. If the physical effort takes place shortly after the meal, then usual increased blood sugar level, induced by it, is lower, and the patients who are characterized by the sustained pancreatic secretion, gain lowered both blood sugar and plasma insulin level [6]. In diabetes mellitus type 1 and among the patients suffering from the diabetes mellitus type 2 who use exogenous insulin or the medicine that increase the insulin ejection there exists the increased risk of hypoglycemia occurrence during the effort and after it due to the lack of physiological lowering of the insulinemia.
In physiologic conditions, in case of healthy organism, during the intensive physical activity there takes place the adequate increase of blood sugar and its ejection to the blood system, and directly after the effort has ended, the level of glucose production is lowered. As the glucose production during the physical activity is conditioned with the catecholamines level, it is believed the patients suffering from the diabetes mellitus type 1 during the intense physical activity are less exposed to the hypoglycemia incidents, and in case of diabetes mellitus type 2 dangerous hypoglycemia incidents have been observed more often during very intensive physical activities, which has been caused by the abovementioned reaction of the catecholamines and the quicker increase of the liver glucose production [7].
Intensive endurance exercise predispose to the hypoglycemia incidents. In cases when during physical effort exogenous insulin therapy is in use, the insulin concentration is not lowered, what is more, it may even be increased if the insulin has been taken in the body part covered with the physical exercise. On the other hand, the glucagon concentration is not changed, the effect of which is the lack of lowering the ratio of insulin to glucagon in liver, as it occurs in case of healthy people. The result of the above, there appears no glucose liver production that is adequate to the increased need, which creates the risk of dangerous hypoglycemia episode.

In case of the patients suffering from diabetes the episodes of short, intensive physical effort may lead to hyperglycemia. In the time of the effort, catecholamines stimulates glucose production, where the insulin concentration in diabetics does not change and is shown as hyperglycemia. What is more, after the effort the insulin concentration does not increase, moreover, the after-effort hyperglycemia is also not observed, as it takes place in case of the healthy. Moreover, the lack of physiologic hyperinsulinemia that accompany the after-effort hyperglycemia may cause the impaired rebuilding of the glucose reserves in skeletal muscles. The problem that is connected with both oxygen trainings and anaerobic training is the late hypoglycemia that may take place from 6 to 15 hours after the physical effort has ended. Such phenomenon may be linked to transferring GLUT-4 to the cell surface and to the increased ejection throughout 3 to 24 hours after the physical effort, the important issue in the context of the process of rebuilding glycogen in the skeleton muscles, which in case of diabetics, may lead to hypoglycemia.

During the time of rest after less intensive physical effort it is recommended to eat more carbohydrates or to limit the due insulin dose, whereas in case of more intensive activities such could exacerbate hyperglycemia in the after-effort period. Patients suffering from diabetes mellitus type 1 do not have the possibility to increase the endogenous insulin, which in physiologic conditions leads to return of blood sugar to its basic state after the effort. Therefore, too low value of insulinemia in the system circulation, eating carbohydrates or both of the abovementioned at the same time may result in prolonging the period of after-effort hyperglycemia and reduce the positive effect the physical activity has on glucose metabolism control – one ought to consider providing additional dose of the insulin.

Hormones, inter alia, insulin, catecholamines, glucagon, glycocorticosteroids and growth hormones play important role in maintaining energy balance during the physical effort. Sportsmen, including diabetics, are recommended to follow high-carbohydrate diet, covering 60-70% of daily energy requirement. Long-lasting physical effort requires, apart from glucose, providing another sources of energy in the form of fatty acids, released during the lipolysis. Sportsman diet ought to contain appropriate amount of proteins, which is needed to better use the provided carbohydrates. When setting the insulin doses to be given before the meals, one needs to take into consideration not only the amount of eaten carbohydrates, but also the proteins and fats [8].

The rules of practicing sport for diabetics – how to behave during the physical effort

Unstandardized fluctuations of blood sugar level that are induced by the training increase the risk of both hypoglycemia and hyperglycemia. Both issues are disadvantageous and they make the training less efficient. However, in extreme situations, hypoglycemia may lead to disturbance in consciousness, convulsions and even death. When setting the individual scheme of recommendations, one ought to take into consideration the frequency, intensity, type and length of physical effort.

Due to the increased risk of ketoacidosis, patients suffering from diabetes mellitus type 1 should avoid physical effort in the situation when sugar blood exceeds 250 mg/dL (13,9 mmol/L), and ketone bodies are present in the urine. Physical training is also not advised when, despite the lack of acetone in the urine, sugar blood exceeds 300 mg/dL (16,7 mmol/L). For diabetics, during endurance workout, the sugar blood levels from 100 to180 mg/dL (5,6–10,0 mmol/L) are safe and optimal metabolically. Limitations for the intensive physical effort are also advanced diabetes complications – people with proliferative retinopathy may be exposed to the risk of the stroke to the vitreous body, or of the detachment of retina, patients with diabetic kidney disease risk the increased urine excretion of albumin and the progress of this complication, diagnosed autonomic neuropathy and present orthostatic hypotension may cause static prompt cardiac function and thermoregulatory disturbances. Due to the above it is not recommended to practice physical exercises in too low or too high temperatures.

In case of diabetic foot issue, there is the increased risk of the occurrence of injuries, mostly bone breakings due to coexisting osteoporosis [9]. Usually, the incidents of silent myocardial ischemia due to vascular complications are extremely dangerous.

Complete contraindications for physical training are the following: acute phase of infarction, unstable coronary heart disease, decompressed heart failure, respiratory failure, ineffectively treated hypertension, static tachycardia, severe arrythmias and conduction, aneurysm of the aorta and of the heart, pericarditis and myocarditis, obesity over 160% of the due body weight, active inflammation, thromboembolic incidents [10]. What kind of physical activity a patient suffering from diabetes mellitus type 1 would choose depends on their age, the time diabetes lasts, physical fitness to date, and the presence of the stage of chronic complications of the illness.

The patients undertaking physical effort should by fully trained as far as the method of intensive functional insulin therapy is concerned. People over 35 and older, with the sedentary lifestyles, especially with coexisting other factors of the risks of the coronary heart disease, are advised to perform electrocardiographic exercise test before they decide to change the lifestyle and undertake physical activity. In case of the intensive insulin therapy with the use of pen-type injector, the model allowing to dose the insulin with the 0,5 u. accuracy is recommended. The therapy with the use of the insulin pump allows to dose insulin with the accuracy of 0,025-0,1 u [11].

Insulin absorption depends on the place of injection (e.g. the limbs under intense strain), the length of the injection, environment temperature, etc. in contact sports, such as basketball, football, combative sports, it is recommended for the sportsmen to use the injections implanted under the sharp angle, placed tangentially to the skin.

Dangers and limitations combined with physical activity of the patients suffering from diabetes mellitus

The organism of the patient suffering from diabetes possesses certain mechanisms, adapting it to perform certain amount of physical effort and only under the condition of performing adequate, systematic physical activity it functions properly. In order to gain optimal therapeutic effect, one needs to remember about several important rules, such as the following:

- the effort should be undertaken at least every 2-3 days,
- when starting intense physical activity, one should perform initial exercises that last 5 to 10 minutes, and at the end of it – relaxing ones;
- physical effort may increase the risk of severe or delayed hypoglycemia;
- alcohol may increase the risk of hypoglycemia occurrence after the effort;
- one needs to pay attention to prevent dehydration in high temperature environment;
- one needs to remember about the risk of damaging the feet during the effort (especially with coexisting peripheral neuropathy and lowered pain threshold), about the foot care and comfortable shoes [12].

The most appropriate form of the effort for the patients suffering from diabetes mellitus type 2 over 65 years of age or overweight is the fast (until out of breath) walk, 3 to 5 times a week (around 150 minutes a week). The suggested form of physical effort for such patients, if they also suffer from being overweight or obese, is Nordic walking. Patients with no particular contraindications, especially younger, are advised to undertake high level of physical activity, including professional sports. Obviously, such patients require additional education as far as the glycemic effects due to various type of physical activity is concerned (e.g. anaerobic, resistant or interval exercise).

During physical effort, the patient should be aware of the risks due to inadequate training plan and pharmacologic treatment plan. The following risks ought to be eliminated:

- hypoglycemia — one needs to mark sugar blood before the physical effort and after it;
- before planned physical effort one needs to consider 30–50% (depending on individual reaction) reduction of the dose of the fast-/short- acting insulin, which acting peak is reached at the time of the effort or directly after it;
- during the treatment with the insulin pump it is recommended to limit the basic insulin flow by 20–80%, depending on the effort intensity and duration, best: 2 hours before its start;
- before unplanned physical effort one needs to eat extra portion of simple sugars (20– –30 g/30 minutes of the effort), consider potential reduction of the dose of the insulin that is taken after the effort;
- one needs to avoid insulin injection in the limbs that would be under the strain in case the physical effort starts 30–60 minutes counting from its injection;
- on days in which the physical effort is not practiced, and the insulin dose is not reduced, using complex and extended boluses depends on the percentage of proteins, fat and low glycemic index carbohydrates in the meal;

• insulin pump (OPI) may be disconnected for 3 hours maximum;
◦ if the training is planned 1-2 hours after the meal, the estimated insulin dose ought to be reduced by 30-50%;
◦ if the training is planned over 2 hours after meal bolus, one needs to eat extra portion of carbohydrates – depending on actual sugar blood value;
◦ OPI disconnecting time may be longer than 3 hours if own insulin secretion is maintained; it is also possible to connect the insulin pump for short time during the training and provide insulin bolus. In special cases, basic injection may be replaced with providing 2-4 doses of insulin with prolonged operation. when the physical activity is ended it is recommended to connect OPI as soon as possible and provide insulin bolus as well as eat carbohydrate meal;
• very intensive physical activity (> 90% VO2max) and the effort undertaken under the conditions of hypoxia (e.g. rock climbing) may lead to hyperglycemia and acidosis;
• if sugar blood value exceeds 250 mg/dL (13,9 mmol/L), the patients suffering from diabetes mellitus type 1 should perform marking the ketone bodies in urine and in case of ketonuria do not undertake intensive effort;
• patients suffering from diabetes mellitus type 2 should consider corresponding limiting in case the sugar blood level exceeds 300 mg/dL (16,7 mmol/L).

Taking care of sportsmen suffering from diabetes requires the knowledge and experience of the team of doctors and sports trainers. Appropriate dosing of insulin should be consciously adjusted to the type of the physical effort and the nutrition plan. Current blood sugar levels during physical activity comprise of the following: the amount of active insulin, eaten carbohydrates, fitness condition, current metabolic diabetes compensation. Only individual education and adjusting the treatment model to sport requirements may result in the situation when diabetics who practice sport become more and more numerous.

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