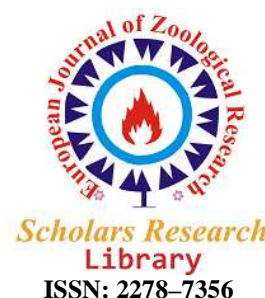




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The role of exercise in the control and prevention of diabetes type I (with approach to animal and human studies)

Mohammad Hassan Boostani^{*1}, and Saeed Khatamsaz²

¹Young Researchers and Elites Club, Zarghan Branch, Islamic Azad University, Zarghan, Iran

²Zarghan Branch, Islamic Azad University, Zarghan, Iran

ABSTRACT

Throughout the world, most people who live in towns of less physical activity. The world population is growing, yet people than unhealthy foods and high-volume use. So, the improper composition (low physical activity and unhealthy foods), uncontrollable increase in the prevalence of diabetes in the world. Diabetes is one of the most common diseases of the modern era of sugar metabolism in the body occurs. Are two types of diabetes: insulin-dependent and non-insulin dependent diabetes or insulin is low or even no insulin or insulin receptor sensitivity is reduced and people with insulin resistance are generally. People with diabetes are exposed to a variety of injuries, such as retinal damage, kidney damage, damage to the nervous and cardiovascular disease are. The effect of physical activity in the prevention, control and treatment of diabetes, has been accepted by many researchers. The research shows that regular exercise increases glucose transporter protein and thus facilitates the entry of glucose into the body cells, especially muscle cells. On the other hand, especially the large muscles twitching muscles also facilitate the entry of glucose into muscle cells are. This will consume more glucose at the cellular level. Therefore, we aerobic activities like walking, running, swimming and cycling, low to moderate intensity for 20 to 90 minutes 3 to 7 times a week at the right time of day with respect to medical care as a convenient and low-cost device can be used for the treatment and control of diabetes. Therefore, due to the extremely important topic of diabetes, the present study examined the role of exercise in the control and prevention of Type I diabetes were studied.

Keywords: Diabetes Type I, Physical activity, Exercise, Prevention

INTRODUCTION

Diabetes is one of the most common diseases of the modern era on body metabolism, especially the metabolism of sugar will happen. In Canada, approximately 5 % of the total population is diabetes [1]. While compared according to Iranian Diabetes Association, approximately 6 million people have diabetes in our country. According to the Iranian Diabetes Association, nearly 385 million diabetics worldwide have been identified, which in 2030 reached 438 million. In 91 years, more than 4 million and 500 thousand Iranians have been suffering from this disease, which in 92 years has reached more than 6 million people. More than eight and seven tenths of a percent of the total population of five Iranians who were suffering from diabetes, a person suffering from or at risk for the average cost per person with diabetes, is \$ 414.

All people with diabetes are, you do not attempt to control blood sugar and high blood sugar for a long time, exposure, eye disease, nerve and kidney are. Moreover, in those who are resistant to insulin, increased abnormal levels of very low density lipoprotein (VLDL), resulting in increased blood triglycerides and decreased abnormal

levels of high density lipoprotein (HDL) has been reported. All these factors combined with hypertension, cardiovascular disease in these patients is greater, so that the second type of diabetes is known as a mysterious killer [2].

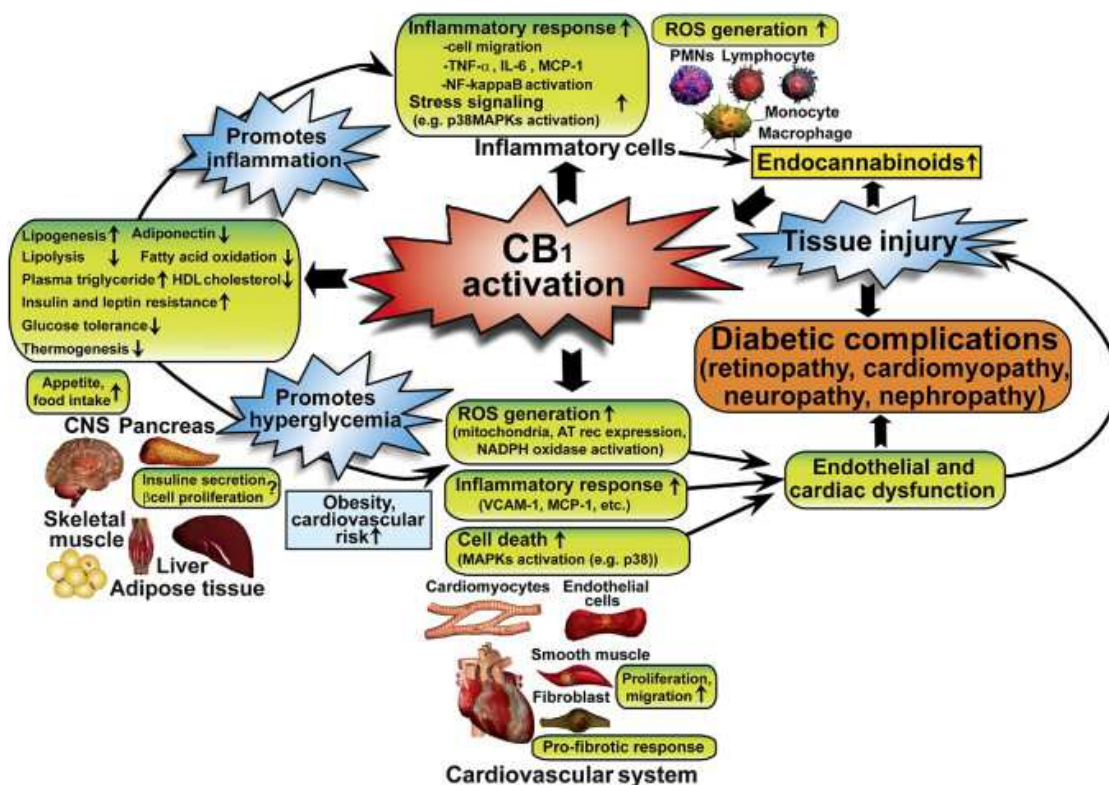
Early Complications of Diabetes: Diabetic ketoacidosis or small: a metabolic disorder that results from increased blood sugar levels in combination with Stone created which causes confusion, Lethargy, excessive thirst, fatigue, and shortness of breath, and also in some together with the coma cases may lead to death if untreated.

Recurrent infections

When blood sugar is high, your body can not react and defend themselves against infection.

Weight loss: The body instead of glucose, protein and fat, which makes use of weight loss. In cases where the diabetes is not controlled, long term complications appear that the most important ones are: 1) *Visual effects*: it may lead to complete blindness. 2) *Nephropathy (kidney disease)*: that may be on all the disability. 3) *Neuropathy (nerve damage)*: in association with circulatory problems in the legs can cause ulcers and gangrene that eventually lead to amputation.

Heart disease-cardiovascular: the effect on the heart and blood vessels and may heart attack (leading to heart attack) and stroke (one of the major causes of morbidity and mortality in patients with diabetes) result.



The diabetes type I and etiology of physiological

Diabetes Type I: Diabetes Type I insulin-dependent diabetes as it is called, is a disease that is caused by impaired metabolism of sugar occurs triple particular. The main cause of Type I diabetes, lack of insulin secreted by the pancreas gland or basal insulin levels are too low. Type I diabetics, the drivers of the increase in plasma insulin levels, or do not respond at all or very weak responses [3].

Approximately 10 to 15 percent of people with diabetes, type I diabetes, and the disease usually occurs before age 30, but any age can spread. Type I diabetics cannot do without daily insulin injections to survive. Since the advent of

insulin therapy in 1921, life expectancy has increased in type I diabetic patients. Treatment of diabetes prevention or delay long-term damage to the body is focused on a variety of devices [4].

Type I diabetes can be hereditary background, so that people with no or pancreas gland or pancreas gland to secrete insulin, is very low. In addition to the field of hereditary pancreatic damage from any cause (severe infections), pursuant to which, the beta cells fail to secrete insulin, and that sugar metabolism is impaired. Type I diabetes is also known as the younger patients [1].

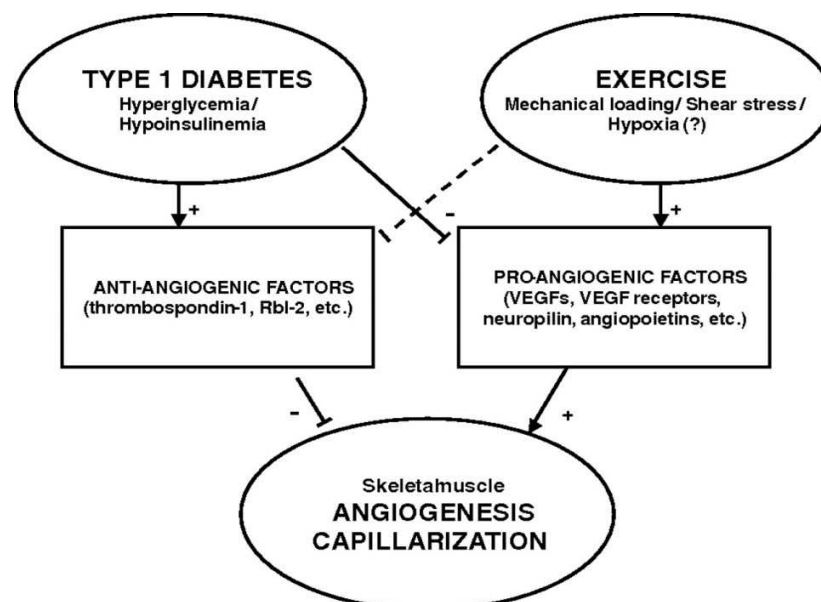
Research findings indicate, United States of America, from 10,000 diabetic, a person under 20 years, 10 patients between 20 and 40 years and 100 between 60-50 years and above 60 years are 1000 [5]. Type I diabetics need to inject insulin every day in order to maintain normal blood sugar levels are set. In these cases, daily injections are necessary because, as noted above, or the insulin is not secreted at all or its value so low that it cannot regulate blood sugar and control [6].

Common symptoms of the disease first type include thirst, too, frequent urination and frequent urination, impotence, obesity, the smell of the mouth, infections of the body especially the wound in extremities such as fingers, toes and prolonged treatment is [7].

Lack of control and treatment of Type I diabetes, eye diseases as the cause of blindness, kidney failure, nervous system problems, particularly automated system dysfunction and sensory and motor nerves, the increased risk of heart disease VLDL and low HDL levels, high blood pressure and impaired immune system cells called white special [8].

Pathology of Diabetes Type I

Type I diabetes is caused by insufficient insulin secretion of insulin by the beta cells of the pancreas is a large reduction is determined. As a result, by injection or through an insulin pump should be used instead. The cause of Type I diabetes is unclear, but it may result from a response to its "safety" is created in the beta cells, which eventually leads to their destruction. Factors that may trigger autoimmune responses are unknown, but these factors may include viruses and toxic compounds [9].



Severe injury (severe)

Diabetes Type I, coupled with falling blood sugar (hypoglycemia) is so intense that if it corrected (adjusted) does not increase blood sugar (hyperglycemia) and ketoacidosis occurs [10]. Type I diabetics control their blood sugar and insulin are usually induce their own. Sometimes leading to noncompliance dose (amount) of insulin, food intake, activity level, changes in insulin absorption from the injection zone pressures, unexpected or disease. Control

of blood glucose and ketones in the urine is useful to calculate the proper amount of insulin, but more or less the limit estimation insulin still remains a possibility [4].

When is induced insulin, blood glucose level comes down and diabetic person may sweat, dizziness and bad temper. Initial symptoms of hypoglycemia should be identified; this helps to prevent more severe symptoms. If the blood glucose decreased, blood glucose is not adequately supplied to the brain. This may lead to diabetic patients with poor coordination, difficulty in the rational branch (speaking) and sometimes cause loss of consciousness. Most diabetics are familiar with the symptoms of hypoglycemia unless they have nerve damage or chemical mediators such as beta blocker that may reveal symptoms do not, are treated. When hypoglycemia develops, eat a carbohydrate source such as fruit juices, sports drinks, candy, or glucose tablets can quickly blood glucose can provide. If a person with diabetes loses consciousness, glucose gel can be placed under the tongue, he or she must inject glucagon to stimulate hepatic glucose output [4].

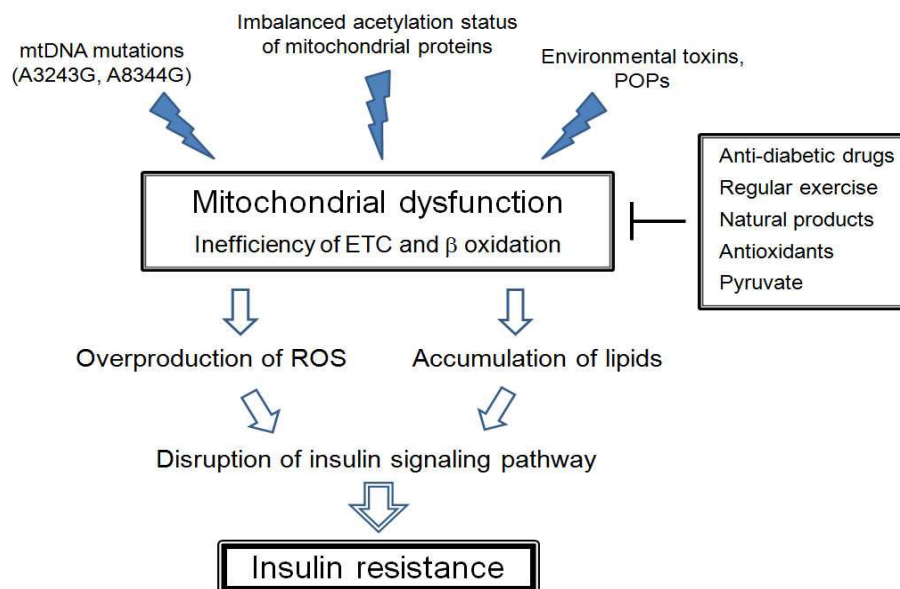
When the amount of insulin needed is much lower than the actual estimation, spread hypoglycemia because glucose out of the blood is not fast enough. In these circumstances, more fat is metabolized for energy. If you are aggravating hyperglycemia (greater than 14 mm), a large amount of ketones (acidic products resulting from the metabolism of fat) in the blood is collected. If not corrected, the state of diabetic ketoacidosis person may spread. In these circumstances, the person must be hospitalized diabetic and normal balance of acid-base and blood glucose control could be achieved [4].

Chronic injuries: type I diabetic patients at risk of developing many vessels are generally minor damage to the eyes, kidneys, nervous system and cardiovascular system is affected. Mechanisms responsible for these effects remain largely unknown [4].

Retinal damage: Damage to the retina in diabetic patients, the leading cause of blindness in adults. History of retinal damage by dilatation of the small blood vessels of the retina, or minor bleeding of the area is characterized by the shape of its great after 5 years of diabetes type I, occurs. Unpublished retinal damage, the damage is quite advanced by the death of inner retinal tissue and the capillary zone is marked closed. Reported damage to the retina, progressive condition in which the blood vessels of the retina and vitreous body high is weak. It is at once causing major bleeding [11].

Kidney damage: diabetes is the main cause of kidney failure [12]. Almost a third of people with diabetes type I, diabetes develop kidney injury. This has become purified by reduced renal reduce blood pressure and protein in the urine is a person [13]. In extreme cases, kidney damage, dialysis or a kidney transplant is needed [12].

Neurons-nerve: damage caused by diabetes, especially among those diabetics who are over 15 years of experience in the disease is common. Nerve damage in the major amputation, death of myocardial tissue, reduces hypertension, and increase the risk of severe hypoglycemia. There are different forms of nerve damage includes damage to the peripheral nervous system, autonomic nervous damage, and nerve damage are single. Peripheral vascular disease may also exist that can both sympathetic and parasympathetic systems can affect. Clinical signs of nerve damage automatically include reduced hypertension, abnormal perspiration, and difficulty in feeling symptoms of hypoglycemia.



Risk of cardiovascular disease

Diabetes, non-diabetes 2 to 4 times greater than the risk of developing heart disease - vascular. Women compared to men, in this case susceptibility [14]. In people with diabetes type I, is tough vessel lining, which causes platelet adhesion to artery wall. The platelets to a growing degree, they release a substance that stimulates the proliferation of smooth muscle and cause sudden narrowing of the vessel. People with diabetes also often have a greater concentration of light-density lipoprotein (LDL), which is strongly associated with increased formation of atherosclerotic platelets [10].

Thus, as was mentioned, a sudden onset of type 1 diabetes is distressing, which could lead to the following symptoms: Frequent urination, an abnormal thirst and dry mouth, fatigue or lack of energy, constant hunger; sudden weight loss, blurred vision, frequent infections.

The role of exercise in type I diabetes

Although many studies have emphasized that the physiological changes caused by sports activities regularly occur, and the value of exercise in the treatment of Type I diabetes, stress put [15], but the long-term metabolic effects of exercise, the diabetes appears to be somewhat suspect [8].

For example, some researchers have claimed that there is sufficient evidence to prove that long-term physical training, but they cause more sugar during strenuous physical activity, it may lead to low blood sugar (hypoglycemia), the effect Type I diabetes is another [16].

Beneficial effects of exercise are that, when these people reach optimal fitness, glucose tolerance also develops. Furthermore, endurance, strength and maximum oxygen consumption has increased and the amount of LDL, VLDL, blood pressure and body fat percentage and the risk of coronary artery narrowing, reduced. Research findings also indicate that a significant correlation between physical activity and reduce daily intake of insulin to control blood sugar in there [17].

Although physical therapy, long-term monitoring of diabetes is [18], however, diabetes type one, for many reasons, from doing physical activities - sports, refuse, and often compared with their age, fitness less important, so that in these patients, maximal oxygen uptake, reduced their heart rate at a certain activity, the more normal rises [8]. Because people with diabetes first type of sports activity, horror and fear, is that, they think of physical activity, the severe drop in blood sugar are. While, if ever, at the discretion of the treating physician, under the supervision of fitness experts, sports activities, possibly, not only the risk of hypoglycemia, are not affected, but also help to control blood sugar and reduced insulin daily, they too, will be [6].

Exercise for Diabetes Type I

What you see below, type I diabetes is basic advice about exercise. Diabetes type I, before starting to exercise or change their normal exercise, you should consult your doctor [4].

Type of exercise: Aerobic exercise, usually for diabetes type I, is more appropriate. Activities such as brisk walking, swimming and cycling, if you are doing the proper duration and intensity, aerobic exercises are. These exercises will help to lower blood glucose and reduce the risk of cardiovascular disease. Furthermore, this activity is less risk for damage to the vessel to perform high-intensity anaerobic activities. These exercises especially for diabetics who will stand up for long or vascular complications such as damage to the retina that is important [4].

Exercise Intensity: The intensity of exercise should be between 60-50 to 80% of maximal oxygen consumption (VO_{2max}) is. Younger diabetic and uncomplicated disease who are less experienced, perhaps higher-intensity exercise (70 to 80% VO_{2max}) do, however, increase the likelihood of hypoglycemia at higher intensities, there. Type I diabetics who have long suffered from diabetes, vascular disease, or diabetes that they should exercise at a lower intensity (50 to 65% VO_{2max}) do to reduce the risk of developing vascular complications. Systolic blood pressure during exercise should be from 180 to 200 mm Hg in patients who have vascular complications, more. Patients who have peripheral nerve damage may be due to poor control of heart disease-Coronary heart unable to determine the intensity of use. In this group of people is better than alternative methods, such as the Met is used for estimating exercise intensity.

Exercise duration: Exercise should be between 20 to 40 minutes. This recommendation is based on studies on normal people, because these people, it has been shown that aerobic exercise if done in less than 20 minutes, no significant effect on cardiovascular disease [19]. If you exercise more than 40 minutes, the risk of hypoglycemia is high.

Repeat the exercise: the range recommended for exercise, 4 to 7 days a week, is. Sport should be done in 7 days; it is because this makes it possible to regulate insulin, and design appropriate diets, providing them easier to control. However, daily exercise may be difficult. Hence, a more realistic proposition 4 to 6 days a week [4].

Warming up and cooling down: before starting any exercise, 5 to 10 minutes of warm-up exercises, which include static stretching and low-intensity exercise is important. Also, after a workout, cool down for 5 to 10 minutes is recommended, as it will help to return the body to the situation before exercise [20].

Exercise time: the time of exercise, diabetes, type I, due to the action of insulin and eating schedule should be considered. May exercise the morning after eating a small snack before a morning injection of insulin should be done. This is likely to reduce the risk of hypoglycemia, and the greatest impact from exercise helps the blood sugar stable throughout the day. Exercising at sunset is not recommended because it may cause the appearance of hypoglycemia during sleep is late.

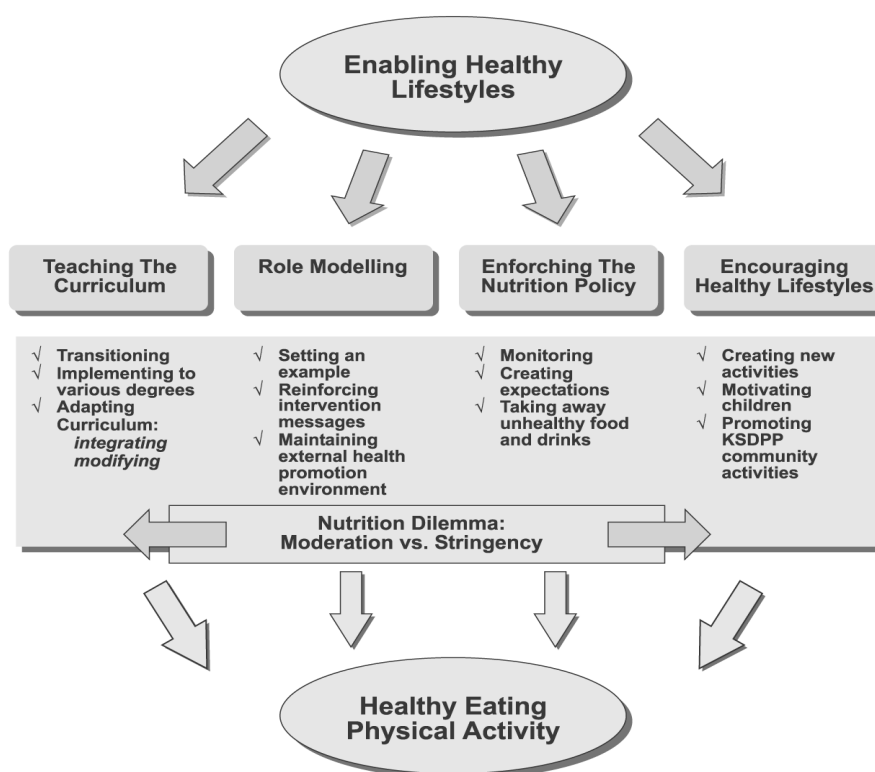
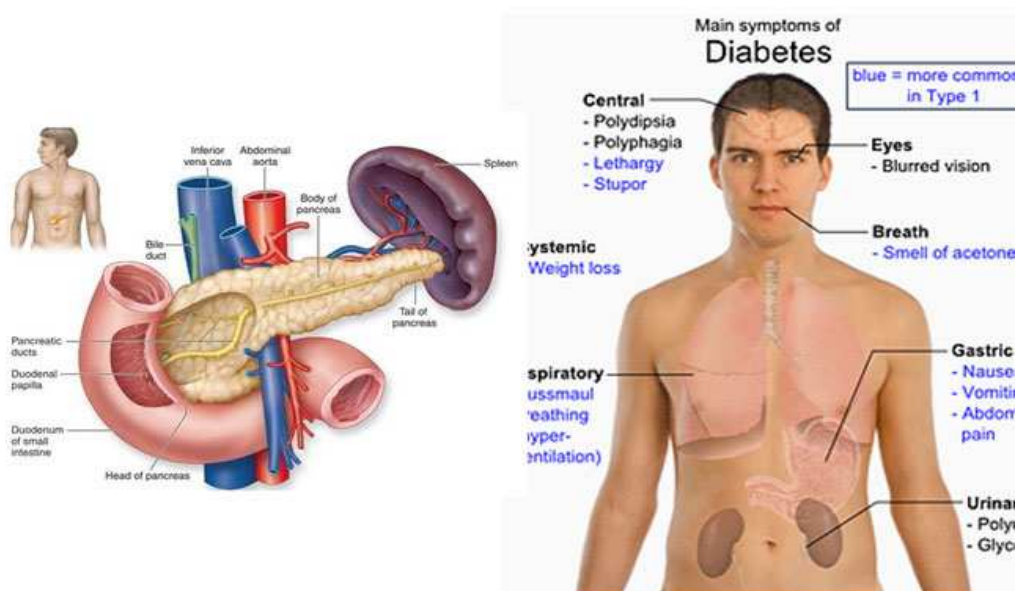
The reasons for the use of exercise in patients with diabetes type I

The use of exercise as part of diabetes treatment, which has been expanded several years. After insulin synthesis method was developed, it was found that the simultaneous impact sports such as insulin in lowering blood glucose [21]. However, in some cases, exercise can disrupt blood glucose control. Basically, exercise is very important for people with diabetes. Health and public prosperity and happiness, because it improves a person with [20]. Later it became known that regular exercise also leads to improved long-term control of glucose (normal glucose keeping constant). However, more recent studies in maintaining blood glucose for a long time doing exercise, have failed. Describe the differences between the effects of acute (immediate) exercise to lower blood glucose and reduce the long term due to the improvements in glucose control, it is difficult [19].

Risks of exercise for diabetics Type I

Exercise could be some risk for Type I diabetes is associated with. Insulin may cause an increase in plasma insulin concentration during exercise is too tremendous. However, the increase in plasma insulin concentration, the liver is unable to produce enough glucose to match the consumer's environment and hypoglycemia develops. If you exercise at a time when blood glucose is too low insulin continuously increases (greater than 14 mm), which may lead to severe conditions. Plasma glucagon tends to be increase during exercise, leading to increased hepatic glucose

production and increase glucose concentration in the blood. In addition, during exercise, greater amounts of fat - which is considered as a source during exercise-is the metabolic process, especially when carbohydrate metabolism is impaired? Thus, a small rise to blood glucose and insulin concentrations are increased production of ketone bodies, which in diabetic patients with severe hyperglycemia and ketoacidosis are at risk to [4].



Hypoglycemia may also be extended to several hours after exercise. This is due to increased glucose. Concluded that exercise-induced increase in insulin sensitivity in muscle is exercised [21]. Adequate carbohydrate intake during exercise can prevent hypoglycemia in patients with diabetes type I, help [4].

Initial studies have shown that people with diabetes must take insulin in muscles that are mainly involved in sports, they injected (e.g., quadriceps), because it increases glucose uptake by muscle activation, and so it is perhaps hypoglycemia [22]. Generally, the longer the interval between the onset of exercise on insulin and insulin refrain from the active muscle, is of little importance. As a rule, the exercise should begin after 60 to 90 minutes after insulin injection, because this interval, the peak insulin action [4].

The risk of heart disease-Coronary is reduced and improves mental vitality

People with diabetes and normal hepatic arteries are at risk of spreading disease. Epidemiological results suggest that regular exercise risk of heart disease-Coronary decreases in diverse populations. Exercise also helps to increase the amount of HDL in diabetic patients [10]. People with diabetes are also at risk for hypertension has been shown that exercise reduces pressure medium [14]. Regular exercise often needs less insulin to diabetics, which might in turn has a positive effect on blood pressure [23]. Finally, too much insulin in the blood associated with large vessel disease in diabetes is type I [24]. Perhaps the reason is that insulin can stimulate the growth of vascular smooth muscle [25]. Reduced insulin requirements when combined with exercise, is likely to reduce the spread of large-vessel disease.

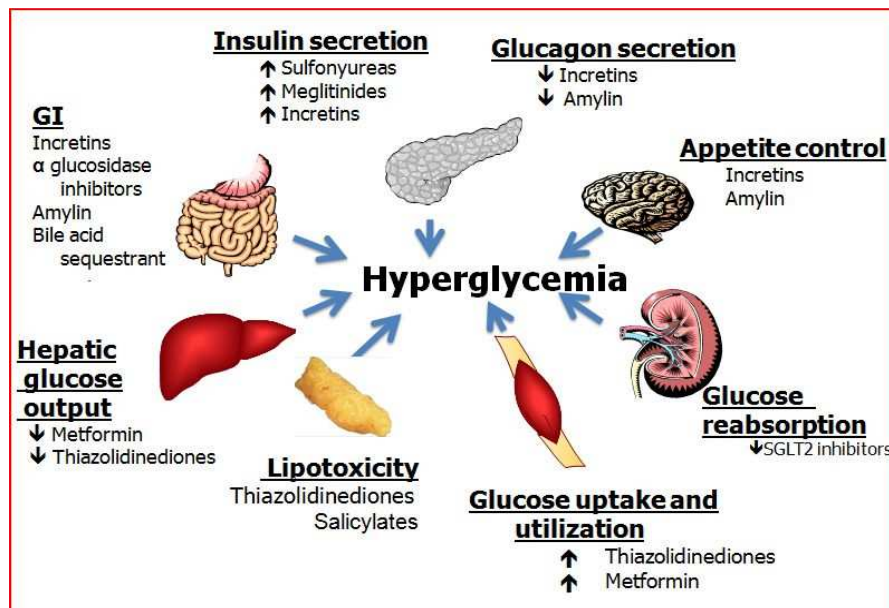
Reduce stress and subsequent favorable outcomes in mental prosperity, the result of regular exercise and, thus, the quality of life in people with diabetes has negative effects. Stress can be a way of increasing concentrations of glucagon, epinephrine and cortisol (a hormone that tend to raise blood glucose) by increasing ketone bodies and free fatty acids, and by increasing urine output, blood glucose control is difficult. Stress may also follow a diabetes treatment regimen, which is a risk factor for developing heart disease - disease has been identified, said. Exercise may be associated with a decrease in arousal, mental, and emotional stress (e.g., hostility and depression) [26].

Sports general recommendations for diabetic's type

Sport specific advice for diabetics type I, according to the degree of metabolic control and disease damage, it is different. In general, patients who have difficult situations do not have to limit physical activity, but you have to take note of hypoglycemia. Avoid certain activities, especially activities that cause blood pressure to rise strongly-for example, weightlifting [20] is to be considered. Sports activities, has many beneficial effects for diabetics and if regularly at least three times a week to run, balance blood sugar and diabetes increases a person's overall better health for the patient to bring [27,28]. Hence, observe the following recommendations can be more effective exercise in type I diabetic patients, can help:

- 1) Before starting the exercise, the doctor should be consulted.
- 2) The amount of insulin to be accurately determined.
- 3) When doing exercise, due to the timing of insulin, is planned.
- 4) To avoid the risk of a sudden drop in blood sugar (hypoglycemia), exercise in the morning, after breakfast, and before insulin injections done. If you have insulin after exercise, this will be done in 60 to 90 minutes after injection.
- 5) If possible, do the exercise, in the final hours of the afternoon, should be avoided because it may cause a drop in blood sugar during the night, causing unconsciousness in a person with diabetes, sleep is.
- 6) Primary heats up and cools down the body at the beginning and end of each training session are required.
- 7) Most of aerobic activities such as walking, slow jogging, cycling and swimming are used.
- 8) Recommended that aerobic exercise, intensity 60-50% to 80% of maximum heart rate, and for 20 to 60 minutes (in some sources are listed for 20 to 40 minutes), with the aim of further Energy is accomplished.
- 9) If you are new, first and second week with 15 minutes of exercise to start and then every two weeks for a period of 5 minutes will be added to practice until the nineteenth and twentieth weeks to arrive 60 minutes.
- 10) Exercises three times a week start and gradually are increased, so that can safely take up to 7 days per week increase.
- 11) Of resistance activities such as heavy weightlifting, which led to higher systolic pressure is avoided.
- 12) In case of eye symptoms, the reverse activities, such as handling balance, which causes a rise in intraocular pressure, and collection of blood vessels in the eye to be avoided?

13) In the exercise of good shoes and comfortable to use, and care of foot ulcers potential, which may be due to peripheral nerve injury reduced pain sensitivity may be [6].



Practical approach

- 1) Testing blood glucose before and after exercise - if blood glucose is over 14 mmol (250 mg per deciliter), the exercise when blood glucose drops below this value, the delay. During exercise and then be available carbohydrate. Are reminded that hypoglycemia can be experienced for several hours after exercise.
- 2) Be prepared, when you start an exercise program, do not change the amount of insulin. Such changes should be tested by the error, and should be done under the supervision of a doctor.
- 3) 60 to 90 minutes after injection of insulin or when the insulin peak action is reached, do not exercise.
- 4) Damage to the retina of diabetic patients have been active in sports should not be too severe, or inverted (activities that they are head down), be involved, because such exercises, the risk of retinal hemorrhage, increases. Diabetic peripheral nerve injury, have activities such as cycling or swimming, are selected because such exercises, they provide little physical shock.
- 5) Before, during and after exercise, adequate fluid intake. By following these tips, especially for patients with impaired autonomic nervous is important.
- 6) Leg (from waist down) to look good. Wear cotton socks and good shoes and a pair of legs and feet regularly check. By following these tips, especially for patients with peripheral nerve damage is important [4].

Therefore, the main points about exercise and diabetes type I are as follows:

- 1) Type I, insulin injections are needed, in order to maintain normal blood glucose levels are set.
- 2) Regular exercise for people with diabetes type I is useful, but blood glucose levels such people before starting the program, should be controlled.
- 3) Continuous monitoring of blood glucose to stabilize blood glucose control is essential. It helps people with diabetes to exercise in a safe environment.
- 4) Patients with diabetes should only do aerobic activities. Weightlifting and intense anaerobic activities, causing blood pressure to rise.
- 5) exercise in which large muscle groups, is said to be 4 to 7 days a week, and activity sessions every day, between 20 to 40 minutes (some sources cite up to 60 minutes Say), with 60-50% to 80% of maximum oxygen consumption, be done.
- 6) Patients with diabetes should consult their doctor before starting an exercise program can.
- 7) A lifestyle physical activity, part of which is probably the combined affects of type I diabetes, the less will reduce health care costs, and improves quality of life [4].

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