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Effect of Physical Excercises on Glucemic Variability in Type 1 Diabetes Mellitus

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Abstract

Aim: To evaluate the long-term effects of physical exercises on glycaemic variability in type one diabetes.

Methods: Literature review of both research and review articles using pub Med, Google Scholar, Scopus, Research Gate, using term physical activity, aerobic, anaerobic exercises along with T1-DM, glucose metabolism, metabolic control.

Background: Type 1 diabetes mellitus a congenital chronic condition that is associated with no insulin synthesis. But there are many studies which favour the positive association of physical activity one diabetes mellitus. Continuous regular physical activity can help in maintaining blood glucose level which reduce the risk of many other serious life-threatening risks. According to a study there are three pillars of management of T1-DM these are insulin therapy, nutrition, and regular practice of physical activity.

Result and Discussion: Since after reviewing many research and review articles it is acceptable that regular physical exercises help in controlling glycaemic variability in all age group patient and help in better management.

Keywords: Diabetes mellitus; Glucose metabolism; Insulin; Physical exercises; Hypoglycaemia

Introduction

Diabetes mellitus is a condition in which there is decrease in the insulin production or decrease in the glucose utilization. T1-DM is a chronic condition in which beta cells of pancreas known as islets of Langerhans produce no or little insulin. In type 1-DM, there are numerous factors which are responsible for the increase in the blood glucose level scientifically termed as diabetes mellitus. Addition of the physical activity in the daily lifestyle could be a boon for a person to stay healthy physically, emotionally, and mentally, physical exercises bring mental peace and also reduce the risk of various diseases. Such as diabetes mellitus, hypertension, coronary artery disease etc.

For type 1-DM, the management is solely based on the insulin therapy, diet, and regular exercise. The role of physical exercise in DM type-1 is something which is not very latest information but its somewhere started from ancient ayurvedic physician susrutashamita (born around 600 B.C) who says that regular physical exercise reduces the sweetness of urine in diabetic patient [1,2]. A scientist Joslin talked about "troika" which means group of insulin, diet and exercise is the treatment of DM type-1 [3]. Another scientist Lawrence signifies that regular physical exercise balances the glucose uptake and requirement of insulin to neutralize the increased glucose level [4]. Diabetes association has recommended competitive sports, pranayama, yoga beneficial for hyperglycaemia, lipid profile, insulin resistance [5-8]. There are several studies evaluating the effect of physical activity, physical fitness, aerobic and anaerobic exercises in which some studies are positively correlates the physical exercise in controlling TIDM [9-14] while others disagree [15-21]. Insulin is a hormone which usually maintains the blood glucose level so when there is destruction in the islets of Langerhans insulin level decreases and blood glucose level rises which cause T1-DM, commonly occurred symptoms are polyurea, polydipsia, increased appetite, and weight loss.

Physical Fitness

Robert et al. [22, 23] observed that there is an increase in the body metabolism that regularly does aerobic exercise which was confirmed by performing aerobic capacity test by using PWC170 and aerobic power index submaximal test. These test shows that there was an increase in physical fitness after 12 weeks.

D'hooge et al. [24] performed a study which revealed that the children who regularly involved in the physical activities required less oxygen to complete the same tasks and also take less time which them physically more active and fit.

Another study performed by the Salem et al. (2010) which evaluate blood lipid level in two groups after 24-hour duration, the study evaluates the improvement in the lipid profile after the session of physical exercise. The study resembles with another study performed by the A, ouadi et al. [25].

Quality of Life

Overall, the literature illustrates that there is positive effect of physical exercise in improving quality of life of an individual as shown in (Figure 1). A study conducted in 2013 among 106 children and adolescent which shows a positive correlation off physical exercise and VO_{2max} in which r = 0.208 but the correlation between quality of life and physical exercise goes entirely opposite [26].

There are many factors which are also responsible open trolling type 1 diabetes mellitus in the individual who are physically active and

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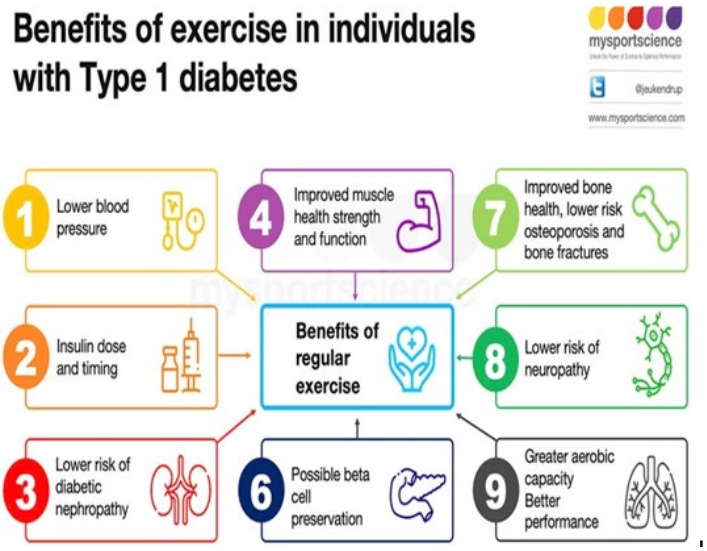

Figure 1: Benefits of exercise in type 1 diabetes mellitus.

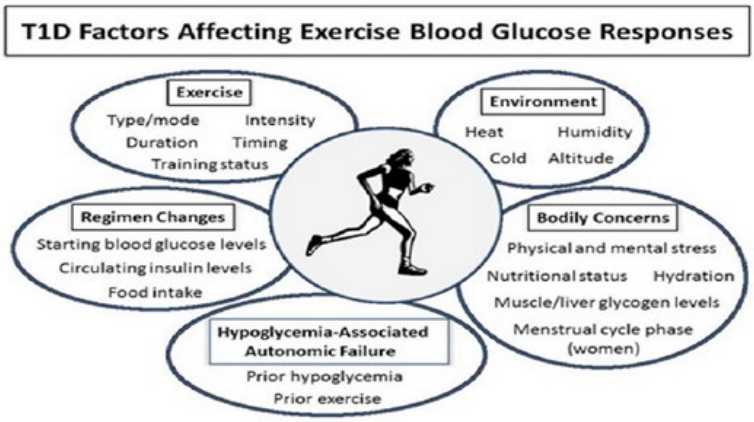

Figure 2: Showing TID factors affecting exercise blood glucose responses.

are consistent as depicted in (Figure 2) [27].

Exercise Related Factors Affecting Glucose Level

Glucose metabolism depends greatly on types of exercises, its duration and of course intensity. These three factors will give different outcome according to the involvement. For example, type of exercises and its effect is shown in the (Figure 3). Getting involved in a particular exercise for a long duration leads to more utilization of glucose and may cause hypoglycaemia. Also, large hormonal variation has been observed in athletics with T1-DM [28,29]. Variation in the intensity of exercise have different outcomes, involvement in high intensity exercise leads to more release of counter regulatory hormones such as Glucagon and epinephrine which causes prolonged increase in blood glucose level [30,31].

How the Latest Technique help in Diabetes Management

A number of new and latest technology are available now which keeps an individual more concern and updated for their physical health and related measures search as heart rate, blood oxygen, calories expended, total steps, also diabetes related devices are available such as [32]:

Calculators for exercise: The primary object of exercise calculators in T1DM is to prevent both hypoglycaemia and hyperglycaemia during the exercise and 24 to 48 hours following exercise [33]. Calculator will provide following benefits:

- It forecast hypoglycemia and hyperglycaemia based on the time of food intake and those of insulin intake [34,35].
- Suggest changes according to the condition by correcting dose and frequency.
- Make a plan of use of medication according to the previous input of glucose level [36].

Pattern recognition and learning

For an effective working out device it is necessary that it should show the real time data of all the physiological system physiological system such as heart rate, calorie intake. The correct input of data help in analysing changes and actual requirement of insulin or to increase the physical activity [37,38].

This operation is carried out with the help of mathematical and algorithms which give a real direction in the management of type one diabetes mellitus.

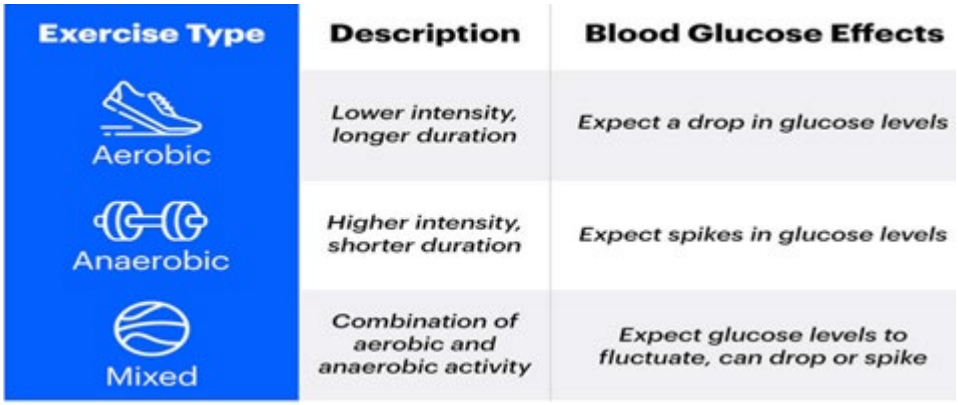

Figure 3: Effect of different type of exercise.

Table 1. Superfood helps in controlling Diabetes Mellitus.

Goat milk	It has excellent power in regulating glucose level.
Curry leaves	Increase carbohydrate metabolism and decrease blood glucose levels.
Pumpkin, cinnamon, lentils	These are magnesium rich and help in lowering blood glucose level.
Broccoli	Rich in chromium and help in decreasing blood glucose level.
Fenugreek	It is rich in fibre and decrease glucose and carbohydrate absorption.
Ginger and garlic	These are insulin sensitizers and helpful in obese patients with diabetes mellitus by reducing weight. Also decrease cholesterol level.

Artificial pancreas system

Use of all the other methods and even administration of insulin has seemed to increase the risk of hypoglycaemia.

A controversial study says that together insulin and Glucagon is helpful for this condition, but it is not fully acceptable [39-45]. Using APS is highly effective in controlling hypoglycaemia alone without any additional insulin delivery [46-50].

This has established by researchers after collecting data using APS that individual participated in mid-afternoon exercises at least 60 minutes of brisk walking produces a risk of hypoglycaemia [51].

Nutritional advice: meal plans, nutritional types, and hydration

A diabetic patient must consume between 50 and 60 percent of their daily calories as carbohydrates. The timing of the workout and the insulin dosage should be matched. This strategy is essential for achieving appropriate glycemic control, maintaining muscle mass, and storing hepatic and muscular glycogen, as well as for improving exercise performance, lowering tiredness, and avoiding problems.

Patients with T1DM should adhere to the following food guidelines before exercising:

A) Consuming 200-350 g (4 g/kg) of carbohydrates three to six hours before to exercise. This suggestion has been shown to enhance physical performance. Despite the fact that T1DM patients should consume 60–90 g of carbohydrates per meal, diabetics who are training must consume more carbohydrates per meal, monitor their blood glucose levels, and, if necessary, adjust their insulin dosage to increase their glycogen stores before competitions and physical activities.

B) One hour prior to activity, consuming an additional 1g of carbohydrate per kilogram of body weight is advised. Low-fat foods and beverages should be chosen over others.

C) A 15g snack consumed 15 to 30 minutes prior to the activity has been found to be sufficient if the exercise lasts less than 45 minutes.

Strategies to sustain glucose oxidation and avoid a drop in glycogen storage can be employed throughout physical activity lasting longer than 45 minutes, or even after it has ended.

Conclusion

The aim of this study is to increase the awareness of physical activity among the individuals of all age group since this busy schedule and sedentary lifestyle has made all of us very inactive and slothful, which is the topmost reason of various life-threatening disease and disorders including diabetes mellitus.

This study briefed about the fitness, quality of life and various Superfood through which non pharmacologically we can control high blood glucose level. Regular exercise among youth gives both physical and psychological fitness since psychological problems specially depression, anxiety is quite common in youth due to emotional breakdown in this condition yoga and meditation works magically.

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