



BE-NEW

Exercise for diabetes: beneficial effect of new educational and physical activity programs

ERASMUS+ SPORT PROJECT

Collaborative Partnerships

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BE-NEW guidelines for implementation of sport activities

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1. Introduction

"The BE-NEW project specifically targets the objective pursued by the Erasmus + program related to "promote voluntary activities in sport, together with social inclusion, equal opportunities and awareness of the importance of health enhancing physical activity, through increased participation in, and equal access to sport for all". The General Objective of the BE-NEW program is to improve the physiological condition of people with diabetes through continuous exercise of sports activity."

This project aims at uncovering the **BE**neficial effect of **NEW** educational and physical activity programs.

The acronym BE-NEW indicates the need of pursuing a novel style of life incorporating the practice of physical exercise into the daily routine. The BE-NEW project will target voluntary aspects in training, sport inclusion of poor social classes more affected by the diabetes, and give opportunities to such people to access personalized sports programs.

General Objective: Improvement of the physiological condition of people suffering from diabetes through the constant practice of sport activity.

The BE-NEW project is aimed at promoting the practice of physical activity in people with diabetes. The subjects who participate in the project will chose one of three types of physical activity: 1) activity in a gym, 2) swimming activity, 2) walking activity. Furthermore, the project will promote specific educational programs regarding teaching physical activity for children/adolescents with diabetes. The role of each partner will be to promote the different physical activity programs in its own country. The scientific team of the project will then collect all data, analyse them and provide the results for dissemination. Through the application of the sport protocols, we will evaluate differences in efficacy and safety of a physical activity program specifically designed for improving physical function and, here in after, reducing glycated haemoglobin level in a diabetic population.



2. State of the question: diabetes and exercise

Nowadays, even though the benefits of physical exercise as a therapeutic measure for diabetic patients are well known and accepted, it is difficult to put exercise recommendations into action for several reasons. Insufficient knowledge among diabetologists and exercise professionals and lack of dedicated facilities are indicated as important limitations.

Prescribing exercise is not generally undertaken, either by the general practitioner or by the diabetologist. This may be because there is insufficient awareness of the benefits of exercise or because there is a lack of specific knowledge about current recommendations. Thus, prescriptions, when suggested, are generic and more oriented towards ‘physical activity’ rather than ‘exercise therapy’, without appropriate indication about type, intensity, frequency, timing, progression and precautions.

Exercise is normally suggested in the management of type 1 and 2 diabetes mellitus and can improve glucose uptake by increasing insulin sensitivity and lowering body adiposity. Both alone and when combined with diet and drug therapy, exercise can result in improvements in glycaemic control in type 2 diabetes. In addition, exercise can also help to prevent the onset of type 2 diabetes, in particular in those at higher risk, and has an important role in reducing the significant world-wide problem of this type of pathology. Recent studies have improved our understanding of the acute and long-term physiological benefits of exercise, although the precise duration, intensity, and type of exercise have yet to be fully elucidated. However, in type 1 diabetes, the expected improvements in glycemic control with exercise have not been clearly established. Instead significant physical and psychological benefits of exercise can be achieved while careful education, screening, and planning allow the metabolic, microvascular, and macrovascular risks to be predicted and diminished.

2.1 Exercise benefits

The prescription of exercise for diabetes control should be considered for a variety of associated and independent health benefits. The full scope of these benefits can be seen in a number of reviews and include weight loss, weight loss maintenance, lipid profiles, blood pressure, psychological profile,



and the constellation of symptoms that make up the metabolic syndrome. It would appear that exercise and diet provide the first and possibly most effective interventions in improving cardiovascular risk, with exercise intervention studies now showing reduced death rates in those with impaired glucose tolerance. It has become evident that possibly the most important role for exercise will be in weight loss and weight loss maintenance. A loss of 4.5 kg or more appears to be critical in preventing the development of covert diabetes and reducing blood pressure, and evidence for the importance of exercise in increasing weight loss and helping maintain weight loss with subsequent improvements in type 2 diabetes is now overwhelming.

2.2 Exercise prescription

Once a patient has been screened and the risk factors and exercise capacity determined, regular exercise may then be considered. The typical patient with type 2 diabetes is sedentary, overweight, and middle aged or older. In this group of patients, exercise may well be beneficial but needs to be carefully implemented. Guidelines issued jointly by the American Diabetes Association (ADA) and the American College of Sports Medicine (ACSM) suggest a gentle warm up period of 5–10 minutes, a period of stretching, and then an active cool down period of 5–10 minutes to allow gradual adjustment of heart rate and blood pressure. The intensity, duration, and frequency of exercise necessary for good health has been adjusted; the target of an adult should be to achieve 30 minutes of continuous moderate intensity activity, equivalent to brisk walking on five or six days a week, with the flexibility of shorter bouts of more intense activity increasingly being considered important. Vigorous activity is widely implicated in health benefits and can be safely undertaken in

diabetics provided that cardiovascular and hypertensive problems are taken into consideration. As no studies have accurately defined the most suitable exercise programme for diabetics, it is inappropriate to be too prescriptive, and instead we should concentrate on adherence and compliance. It seems that relatively informal exercise programme with mixed high and low intensity exercise have gained wider acceptance and much greater success. Exercise prescription must also consider patients' readiness to exercise, attitudes, and belief systems, while positively encouraging decisions to exercise. Support



can be provided through a team of doctors, nurses, physiotherapists, lifestyle counselors, and exercise consultants and even through health policy decision-making at government and local level.

2.2.1 Diabetes Type 1

All levels of physical activity, including leisure activities, recreational sports, and competitive professional performance, can be performed by people with type 1 diabetes who do not have complications and are in good blood glucose control. The ability to adjust the therapeutic regimen (insulin and medical nutrition therapy) to allow safe participation and high performance has recently been recognized as an important management strategy in these individuals. In particular, the important role played by the patient in collecting self-monitored blood glucose data of the response to physical activity and then using these data to improve performance and enhance safety is now fully accepted. Hypoglycemia, which can occur during, immediately after, or many hours after physical activity, can be avoided. This requires that the patient has both an adequate knowledge of the metabolic and hormonal responses to physical activity and well-tuned self-management skills.

General guidelines that may prove helpful in regulating the glycemic response to physical activity can be summarized as follows:

1. Metabolic control before physical activity

- a. Avoid physical activity if fasting glucose levels are >250 mg/dl and ketosis is present, and use caution if glucose levels are >300 mg/dl and no ketosis is present.
- b. Ingest added carbohydrate if glucose levels are <100 mg/dl.



2. Blood glucose monitoring before and after physical activity

- a. Identify when changes in insulin or food intake are necessary.
- b. Learn the glycemic response to different physical activity conditions.

3. Food intake

- a. Consume added carbohydrate as needed to avoid hypoglycemia.
- b. Carbohydrate-based foods should be readily available during and after physical activity.

Because diabetes is associated with an increased risk of macrovascular disease, the benefit of physical activity in improving known risk factors for atherosclerosis is to be highly valued. This is particularly true in that physical activity can improve the lipoprotein profile, reduce blood pressure, and improve cardiovascular fitness. The challenge is to develop strategies that allow individuals with type 1 diabetes to participate in activities that are consistent with their lifestyle and culture in a safe and enjoyable manner. In general, the principles recommended for dealing with physical activity in adults with type 1 diabetes, free of complications, apply to children, with the caveat that children may be prone to greater variability in blood glucose levels. In children, particular attention needs to be paid to balancing glycemic control with the normalcy of play, and for this the assistance of parents, teachers, and athletic coaches may be necessary. In the case of adolescents, hormonal changes can contribute to the difficulty in controlling blood glucose levels. Despite these added problems, it is clear that with careful instructions in self-management and the treatment of hypoglycemia, physical activity can be a safe and rewarding experience for the great majority of children and adolescents with type 1 diabetes.

2.2.2 Diabetes Type 2

A standard recommendation for diabetic patients, as for non-diabetic individuals, is that physical activity includes a proper warm-up and cool-down period. A warm-up should consist of 5–10 min of aerobic activity (walking, cycling, etc.) at a low intensity level. The warm-up session is to prepare the skeletal muscles, heart, and lungs for a progressive increase in exercise intensity. After a short warm-up, muscles should be gently stretched for another 5–10 min. Primarily, the muscles used

during the active physical activity session should be stretched, but warming up all muscle groups is optimal. The active warm-up can either take place before or after stretching.

After the activity session, a cool-down should be structured similarly to the warm-up. The cool-down should last about 5–10 min and gradually bring the heart rate down to its pre-exercise level.

There are several considerations that are particularly important and specific for the individual with diabetes.

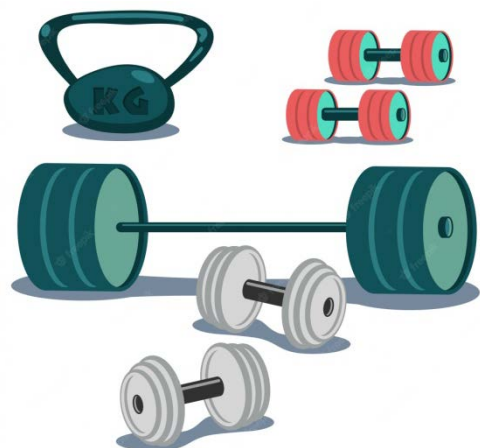
1. Aerobic physical activity should be recommended, but taking precautionary measures for physical activity involving the feet is essential for many patients with diabetes.

2. Proper hydration is also essential, as dehydration can affect blood glucose levels and heart function adversely. Physical activity in heat requires special attention to maintaining hydration. Adequate hydration prior to physical activity is recommended. During physical activity, fluid should



be taken early and frequently in an amount sufficient to compensate for losses in sweat reflected in body weight loss, or the maximal amount of fluid tolerated. Precautions should be taken when exercising in extremely hot or cold environments.

3. High resistance exercise using weights may be acceptable for young individuals with diabetes, but not for older individuals or those with long-standing diabetes.



4. Weight training programs that utilize light weights and high repetitions can be used for maintaining or enhancing upper body strength in nearly all patients with diabetes.

5. Several long-term studies have demonstrated a consistent beneficial effect of regular physical activity training on carbohydrate metabolism and insulin sensitivity, which can be maintained for at least 5 years. These studies used physical activity regimens at an intensity of 50–80% VO_{2max} three to four times a week for 30–60 min a session.



2.3 Resistance Training

Improvements in glycemic control, adiposity, and blood lipids are evident after a resistant training period. The results demonstrate a significant improvement in glycemic control, despite lower baseline HbA1c values, suggesting that the incorporation of Resistance Training early after an “at-risk” diagnosis may serve as an effective strategy to prevent the progression to type 2 diabetes. The combined aerobic training and resistance training show improvements in cardiometabolic outcomes, both the strength and aerobic aspects of the training protocols decrease HbA1c levels.

There are multiple potential mechanisms by which Resistance Training can improve glycemic control. The characteristics of resistance training enhance muscular hypertrophy which in turn improves glycemic control. An indirect mechanism by which Resistance Training can improve glycemic control is through increased basal metabolic rate due to increased muscle mass, which aids in fat loss. Decreased levels of adipose tissue can increase insulin sensitivity, as obesity is a contributing factor to peripheral insulin resistance. The resistance training may be an effective intervention for delaying or preventing the onset of type 2 diabetes and can be recommended by health care professional to those at risk for type 2 diabetes to improve cardiometabolic outcomes.

2.4 Mix Exercises Training

Currently, the available scientific evidence calls for the performance of mixed exercise sessions that combine aerobic activity with resistance exercises as the non-pharmacological treatment of choice for patients with type 2 diabetes mellitus. It is concluded after the analysis of the means of fasting



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insulin levels, insulin resistance, fasting blood glucose, glycated hemoglobin, and body mass index, the effectiveness of structured programs of aerobic exercises and resistance in reducing insulin resistance. Specifically, the results of a meta-analysis on the performance of structured and combined exercise showed that the activity of more than 150 minutes per week induces a significant decrease compared to the performance of the same exercise for a shorter time in the glycated hemoglobin figures.



3. Conclusion: our experience as trainers

With the Diabetic population increasing, the goal of the project is now more important than ever, to provide the people who need the most to practice sport, the possibility to do it for free and adapted to them.

Most of the people with Diabetes type 2 are people who haven't practice sport for a long time or haven't done it at all. From our experience, most of them tried to go to the gym at some point in their lives, but gyms usually are harder, general trainers and staff don't have time to explain the exercises slowly, they cannot be focus on just one person - usually, groups are big - and you need to pay too much to have a personal trainer. So, for most of them, it wasn't a fun experience and don't want to repeat it, so in their mind's gyms are not an option.

We need to know the people we are working with, because are people that, because of personal reasons choose not to have a healthier life until now, so we need to encourage them to continue on this path and don't give up.

We must know which are their interests and hobbies, what they like and dislike, and try to make trainings more attractive for them. Moreover, we must know if they have any other pathology, what they can do and don't, and how they can or can't train, etc.

We need to adapt the trainings to them and not them to the trainings as in the normal and populated gyms. For that, we need to work with very small groups, 5 to 8 people maximum, to be aware of their posture, their attitude and if they are doing the exercises correctly. We need to explain to them very carefully every step of the process, every move and every position of the body.

At the same time, they must ask about all their doubts, they need to express all their feelings and their sensations with different exercises, they must feel secure and comfortable at all times. We need to be very close to them, to make them feel comfortable with us and with the training. They want to enjoy training, to have fun while practicing sport, and not to suffer. Of course, they don't need to feel pain either.

All the sessions must be divided in three parts: warm-up, main part and cool down/stretching.

3.1 Warm-up

It's important to prepare the body before we do any kind of sport, so we always spend between 5 and 15 minutes warming-up. If we are going to walk, we start with 5 minutes warm-up with joint mobility, and if we are going to do strength training, we add another 10 minutes of muscles warm-up, cardio and big structures movement involving arms and legs.



3.2 Main part

We spend no less than 35 minutes walking or strength training.

For the Walking Group, it is important to bear in mind the level of the participants and choose the right route, starting from an easy one -it is a must that everyone has to be comfortable with it- and, little by little, going a bit further and making the route a bit longer. For instance, we have been increasing the length of the route once a month.

For the Training, we are working with small groups -no more than 8/10 people- as we want to focus on each one of them. As to start, it is important to explain clearly each exercise and practice it with them with no weight. When they feel easy with the posture, and we assure that they are executing the exercise correctly, is the moment to add some weight, but be aware of not doing it before.

Repetition is important to achieve results, but try to change a bit the routines to be fun for the participants and try not to be boring, monotonous or tedious.

Prepare the materials beforehand and take note about the exercises you are going to work within the next session, taking into account the number of participants you have, the level of each one of them and the general objectives of both, the session and the whole training.

3.3 Cool down / stretching

Save at least 8 to 10 minutes as a rule for the Cool Down and Stretching part. It is as important as the Warm-Up, and if it is necessary to shorten some minutes because we are late, it is preferable to do it on the main part than on the stretching / cool down.



You can start from the feet and go up, or go down starting from the head. In any case, it is important to stretch very carefully all the muscles that were used on the main part of the session.

Do not use bounces, but try to maintain the stretch for 20 seconds, it must not be very intense.





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Project webpage: <https://site.unibo.it/benew/en>

Despite all recommendation being based in evidence, always please follows the advice of a medical/health provider.

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