

Using exercise to combat diabetes on children

[Health & Medicine](#), [Diabetes](#)



About 24 million people in the United States alone have Diabetes. According to the American Diabetes Association, there is no known cure for Diabetes, however treatment plans are available to combat the disease and exercise is seen as an essential component to maintain a healthy weight and blood glucose level. Diabetes is separated into two types, Type 1 diabetes is an autoimmune chronic disease in which the body's pancreas produces little to no insulin and fails to adequately regulate blood glucose levels, on the other hand, Type 2 diabetes is when the body gains a resistance to insulin and glucose levels become elevated within the bloodstream. Around 22 million cases are type 2 diabetes, while an estimated 90% of those cases could have been prevented by a healthier lifestyle (Insel, 267).

With over one fifth of children qualifying as obese and therefore at risk of developing diabetes, it has become one of the fastest growing diseases among children in the United States. Pre-diabetic refers to an individual who has elevated blood glucose levels but does not qualify as diabetic. This person will often develop type 2 diabetes if a lifestyle change is not made. Obesity, inactivity, age and family history are the major causes of diabetes. Although there may not be a cure for diabetes there are treatments. Insulin or other medications as well as healthy diet and adequate physical activity may be utilized to help maintain safe blood glucose levels. For children living with diabetes, physical activity may be one of the most important factors in controlling the disease.

In contracting the disease, obesity is one of the major factors. Of the children diagnosed with type 2 diabetes thirty three percent have a Body Mass Index (BMI) score in the morbidly obese range and another seventeen percent

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score as obese. By increasing their physical activity levels, many of these patients can lower their BMI and thus reduce the affects of diabetes. Increased amounts of activity have also proven to increase the insulin sensitivity of their cells, minimizing their dependence of medications and insulin to maintain blood glucose levels (Insel, 267). The benefits of regular exercise on a diabetic subject's ability to maintain normal blood glucose levels are great. For any individual with diabetes, especially children, regular physical activity should be strongly considered as a portion of their treatment.

Cardiorespiratory Fitness and Physical Activity

In a study conducted in 2008, Gabriel Shaibi, Melissa Faulkner, Marc Weigensberg, Cynthia Fritschi, and Michael Goran explored the relationship between type 2 diabetes and activity levels. This was done by monitoring twenty-six adolescent boys (ages 13-18 years old), thirteen with type 2 diabetes and thirteen without. The thirteen without, however, were each chosen as a match in age, BMI, and adiposity to one of the thirteen diabetic boys. Both groups however, were classified as obese.

The cardiorespiratory fitness (VO₂peak) of both subjects was then assessed through an exercise routine on a cycle ergometer. The test was designed to last 8-12 minutes but would only terminate once the subject could no longer pedal. While this was performed the subjects' heart rates as well as respiratory exchange ratios were also monitored and recorded. Using the seven day physical activity recall each was also assessed in how frequently (hours per day) they engaged in moderate to vigorous activity. Throughout

the program neither the peak heart rate nor the peak respiratory exchange ratios differed greatly between the groups. However those with type 2 diabetes scored significantly lower in both fitness levels, as well as, frequency of moderate to vigorous physical activity.

Those with type 2 diabetes had an average VO_{2peak} (mL/kg/min) of 28.7 while the control averaged 34.6 (approximately 18% higher). The subjects with diabetes also only averaged 0.6 hours of exercise per day while the control averaged 1.4 (approximately 60% higher). Although this could show that a lack of moderate to vigorous activity may correlate with a higher incidence of type 2 diabetes, it could also inversely mean that the subjects exercise less because of diabetes. Regardless the comparative study shows that the adolescents with diabetes have a lower fitness level than their counterparts.

High Volume/Low Intensity Exercise and Glycemic Control

Organized in 2007 by Lana Ruzic, Goran Sprois, and Branka Matkovic (members of the Faculty of Kinesiology from the University of Zagreb in Croatia), a study to analyze the relationship between high volume/ low intensity exercise and glycemic control in children was performed over a two week period in a controlled environment of a summer camp. The camp was designed specifically for the study. There were a total of 28 subjects, 20 of which were included in the data analysis all of which were diagnosed with type 1 diabetes. The eight omitted from data analysis were done so because they either had physical complications that would not permit them to participate in all the activities or had recently began using an insulin pump and were not yet accustomed to their new method of therapy. The subjects

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ranged in age from nine to sixteen, none of them scored obese on the BMI scale, and all were submitted to a regular check up before proceeding with the study.

The goal of the camp was to increase the children's physical activity while reducing the risk of hypoglycemia. Each day the subjects performed three sessions of physical activities at a low to moderate intensity level for one to two hours. Scheduled activities included in the program were swimming, water games, "ball games" on land, walking or cycling. Blood glucose concentrations (finger prick method), hypoglycemic symptoms (specialized nurses), glycemic control (HbA1c) and heart rate (heart rate monitor) were all monitored throughout the camp. Diet was also controlled, however, each subject had a unique diet designed by a dietician based on their individual needs. Initially insulin dosages remained constant, but as the program proceeded doses were modified according to their blood glucose data.

Ten days after and again two months after the completion of the program glycemic control, insulin dosage and hypoglycemic episodes were monitored in the 20 patients. This gave the researchers three sets of data to compare. The first set was the data previous to camp, the second was ten days after camp and the final set was two months after the completion of the program. The results indicated that ten days after the program ended they had better glycemic control than when they entered, however, two months after, they had returned to the same levels as before the program. By comparing each set of data they were then able to determine that high volume/ low intensity exercise is an effective method of managing type 1 diabetes as long as it is

on going. Without a constant exercise program the benefits are lost rather quickly.

Exercise with and without an Insulin Pump

For some diabetes patients, use of an insulin pump is a viable method to control their blood glucose levels. This would be used as an alternative to the traditional insulin injection.

In a 2005 study described in an article by Gil Admon, Yitzhak Weinstein, Bareket Falk, Naomi Weintrob, Hadassa Benzaquen, Ragina Ofan, Gila Fayman, Levana Zigel, Naama Constantini, and Moshe Phillip, the effects of exercise both with and without an insulin pump were investigated. Six female subjects and four male subjects, ages ranging from ten to nineteen years old, all of whom had been diagnosed with type 1 diabetes were used in this single-blind, randomized, case-crossover study. All ten patients were also required to have been using an insulin pump for at least three months.

The study consisted of four meetings. The first meeting was used to examine the subjects in a multitude of areas. They were given a physical examination and had blood and urine samples analyzed. The second visit was used to determine their VO₂max by using a cycle ergometer. During the last two visits the subjects were first given a standard breakfast. After an hour and forty-five minutes they were given 20 mg of complex carbohydrates. This was done to ensure the subjects had appropriate blood glucose levels.

Fifteen minutes after the consumption of the carbohydrates, they pedaled a cycle ergometer for 40 to 45 minutes at approximately 60 percent of their VO₂max. One of the tests was done with the subject's insulin pump on while

the other was done with it off (subjects were unaware of the particular setting during each trial). Cardiorespiratory data and blood samples were taken both during exercise and again forty-five minutes after completion. A continuous monitoring system was used to measure blood glucose for the 24 hours following the study. This allowed the researchers to compare the data between the two exercise tests.

When analyzing the data, they found little to no difference when exercising with an insulin pump on or off in terms of cardiorespiratory response (heart rate, VO₂, and respiratory exchange ratio), metabolic response, or hormonal response. During exercise four subjects exhibited symptoms of hypoglycemia, however two were while the pump were on and another two when the pump was off. The largest difference was that there were six instances of late hypoglycemic episodes after exercising with the pump off and nine after exercising with it on. This was deemed insignificant in the study however it led to the researchers to two conclusions. First, hypoglycemic episodes were more prevalent after exercise than during and second, that exercising with the pump on could be " associated with a trend of increased risk for late hypoglycemia."

Acute Exercise and Adiponectin Concentrations

Adiponectin is directly related to insulin sensitivity and inversely related to adiposity. Using this concept, Nelly Mauras describes a study that measures adiponectin concentrations in children with type 1 diabetes during exercise. The study was done using 49 children between the ages of eight and eighteen who had been using an insulin pump for greater than one month. The study was comprised of two 75 minute exercise routines. The first was <https://assignbuster.com/using-exercise-to-combat-diabetes-on-children/>

done with the insulin pump off until 45 minutes after exercising. The second test was done with the pump on. The exercise sessions were comprised of fifteen minute walking periods followed by a five minute resting period for a total of 75 minutes. Blood glucose levels were measured before exercise, during each five minute break and 45 minutes after exercise was completed. Adiponectin was measured both before and after the exercise sessions.

When looking at the data they first saw that a higher BMI measurement did indeed correlate with a lower adiponectin concentration. However other than BMI, they found no other relationship between adiponectin levels and other factors such as gender, duration of diabetes, or pre-exercise glucose. They also found that adiponectin concentrations did not change significantly with exercise. However, there was clear indication that those with a higher concentration of adiponectin were less likely to experience symptoms of hypoglycemia. They concluded that adiponectin concentrations vary little from day to day and are not altered by exercise. However, they declare that more research is needed to research adiponectin and its ability to protect against " exercise-induced hypoglycemia".

Conclusion

With the increased prevalence of both type 1 and type 2 diabetes in children throughout the world, there has been and there will continue to be, a great deal of research done on the subject. New theories will be presented and tested to determine the best way to treat the disease. Currently there is no cure. However, as these articles have described, living an active lifestyle is an important factor in managing diabetes.

Work Cited

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