

Exercise is medicine for preventing Type 2 diabetes

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Type 2 diabetes is a metabolic condition in which the person's fasting blood sugar becomes higher than normal. In 2012, diabetes affected ~29.1 million adults in the US. Its economic burden was \$245 billion; this represents a 41% cost increase from 2007 to 2012. Attention is now being given to a high risk group called "pre-diabetics" in which a person has a blood sugar that is higher than normal but does not meet the criteria for T2DM (Type 2 Diabetes Mellitus). In 2012, the estimated number of adults with pre-diabetes was 86 million and 70% of these patients transition to T2DM within 3 to 6 years. Current treatment for pre and diabetes includes pharmaceutical and lifestyle intervention. In 1995, Metformin became the medication of choice for diabetes and it is recommended by the American Diabetes Association as the first line medication. However, since 1995 the incidence of diabetes has risen almost 73% from 8 million to 29.1 million. In a study by the Diabetes Prevention Program, participants were divided into placebo, metformin or lifestyle intervention groups and followed for an average of three years. The incidence of diabetes was lower in the lifestyle group than metformin group; 58% and 31% respectively. After 10 years, the incidence of diabetes was still better in the lifestyle group than metformin group; 34% to 18% respectively. If the rise in diabetes is to be turned back then lifestyle interventions must become the first line agent.

Although physical activity (PA) is a key element in the prevention and management of type 2 diabetes, many with this chronic disease do not become or remain regularly active. High-quality studies establishing the importance of exercise and fitness in diabetes were lacking until recently, but it is now well established that participation in regular PA improves blood glucose control and can prevent or delay type 2 diabetes, along with positively affecting lipids, blood pressure, cardiovascular events, mortality, and quality of life.

Structured interventions combining PA and modest weight loss have been shown to lower type 2 diabetes risk by up to 58% in high-risk populations. Most benefits of PA on diabetes management are realized through acute and chronic improvements in insulin action, accomplished with both aerobic and resistance training. The benefits of physical training are discussed, along with recommendations for varying activities, PA-associated blood glucose management, diabetes prevention, gestational diabetes mellitus, and safe and effective practices for PA with diabetes-related complications.

Introduction-

Diabetes has become a widespread epidemic, primarily because of the increasing prevalence and incidence of type 2 diabetes. According to the Centers for Disease Control and Prevention, in 2007, almost 24 million Americans had diabetes, with one-quarter of those, or six million, undiagnosed. Currently, it is estimated that almost 60 million U.S. residents also have prediabetes, a condition in which blood glucose (BG) levels are above normal, thus greatly increasing their risk for type 2

diabetes. Lifetime risk estimates suggest that one in three Americans born in 2000 or later will develop diabetes, but in high-risk ethnic populations, closer to 50% may develop it. Type 2 diabetes is a significant cause of premature mortality and morbidity related to cardiovascular disease (CVD), blindness, kidney and nerve disease, and amputation. Although regular physical activity (PA) may prevent or delay diabetes and its complications, most people with type 2 diabetes are not active.

In this article, the broader term "physical activity" (defined as "bodily movement produced by the contraction of skeletal muscle that substantially increases energy expenditure") is used interchangeably with "exercise," which is defined as "a subset of PA done with the intention of developing physical fitness (i.e., cardiovascular [CV], strength, and flexibility training).

The intent is to recognize that many types of physical movement may have a positive effect on physical fitness, morbidity, and mortality in individuals with type 2 diabetes.

Treatment-

The goal of treatment in type 2 diabetes is to achieve and maintain optimal BG, lipid, and blood pressure (BP) levels to prevent or delay chronic complications of diabetes. Many people with type 2 diabetes can achieve BG control by following a nutritious meal plan and exercise program, losing excess weight, implementing necessary self-care behaviors, and taking oral medications, although others may need supplemental insulin. Diet and PA are central to the management and prevention of type 2 diabetes because they help treat the associated glucose, lipid, BP control abnormalities, as well as aid in weight loss and maintenance. When medications are used to control type 2 diabetes, they should augment lifestyle improvements, not replace them.

Combined aerobic and resistance and other types of training-

A combination of aerobic and resistance training may be more effective for BG management than either type of exercise alone. Any increase in muscle mass that may result from resistance training could contribute to BG uptake without altering the muscle's intrinsic capacity to respond to insulin, whereas aerobic exercise enhances its uptake via a greater insulin action, independent of changes in muscle mass or aerobic capacity. However, all reported combination training had a greater total duration of exercise and caloric use than when each type of training was undertaken alone.

Supervision of Exercise-

Exercise intervention studies showing the greatest effect on BG control have all involved supervision of exercise sessions by qualified exercise trainers. The most direct test of the incremental benefits of supervised training was the Italian Diabetes and Exercise Study. In this 1-year trial, all 606 participants with type 2 diabetes received high-quality exercise counseling that increased self-reported PA substantially. The

intervention group also received supervised, facility-based combined aerobic and resistance exercise training twice weekly, resulting in greater improvements in overall BG control, BP, BMI, waist circumference, HDL cholesterol, and estimated 10-year CVD risk.

A recent systematic review of 20 resistance training studies on type 2 diabetes found that supervised training of varying volume, frequency, and intensity improved BG control and insulin sensitivity, but that when supervision was removed, compliance and BG control both deteriorated.

Conclusion-

Exercise plays a major role in the prevention and control of insulin resistance, prediabetes, GDM, type 2 diabetes, and diabetes-related health complications. Both aerobic and resistance training improve insulin action, at least acutely, and can assist with the management of BG levels, lipids, BP, CV risk, mortality, and QOL, but exercise must be undertaken regularly to have continued benefits and likely include regular training of varying types.

Most persons with type 2 diabetes can perform exercise safely as long as certain precautions are taken. The inclusion of an exercise program or other means of increasing overall PA is critical for optimal health in individuals with type 2 diabetes.

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