Weight Training for Persons With Diabetes Mellitus

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PHYSICAL ACTIVITY, DIET, AND medication have for many years been considered the basic components of diabetes management (2). Research and clinical medical journals abound with studies documenting the value of exercise in controlling blood glucose, reducing body fat, reducing cardiovascular disease risk factors, and modifying some of the physiological abnormalities of diabetes.

■ Types of Diabetes
The two types of diabetes, type I and type II, differ enough that exercise specialists such as strength and conditioning coaches need to understand the unique traits of each. Type I used to be called juvenile onset diabetes because diagnosis typically occurred in the first 20 years or so of life. Only about 5 to 10% of those with diabetes have this type, but they comprise the majority of diabetics that coaches work with.

The type II diabetic is typically 40 years or older, overweight, and sedentary. In this case the pancreas produces insulin, often even in excess, but the tissues are resistant to the action of insulin.

Weight loss and exercise can actually prevent the onset of type II diabetes because it makes the tissues more responsive to insulin; in other words, it inhibits insulin resistance. Both fat loss and exercise have this effect. Consequently, exercise is of particularly great value in type II diabetes. Many studies have shown that patients using medication to control blood glucose are able to eliminate medication and its side effects by exercising regularly.

■ Medical Complications
Diabetics experience far greater than normal rates of cardiovascular disease, kidney disorders, nerve damage, and blindness. These conditions develop as a result of chronically elevated blood glucose (BG) levels.

Glucose becomes toxic to most tissues when elevated past a certain threshold. Consequently, some diabetics have medical limitations regarding exercise, particularly if the condition has existed 10 years or more. It is important for the diabetic's physician to approve any exercise program including weight training. Exercise testing including electrocardiography and blood pressure may be advised.

Diabetics, especially those taking insulin, should monitor their BG several times a day including before and after exercise. This makes it easier to control blood glucose so that values stay reasonably close to normal. A recent large study showed that medical problems common to type I diabetics could be reduced to roughly half by taking insulin several times a day instead of just once or twice daily, and by monitoring BG four or more times a day (3).

If you work with diabetics, make sure those you train have permission from their physician to lift weights. Even some adolescent diabetics may not be able to train with weights if they have diabetic retinopathy. The rise in
blood pressure while lifting increases the pressure within the vessels of the eye. In retinopathy the vessels are thin, fragile, and easily damaged. To minimize the rise in blood pressure, a physician might prefer a less intense form of exercise such as walking or swimming, or the use of only very light weights.

Special Benefits for Diabetics

Diabetics can and certainly do participate in sport and vigorous exercise. A number have even gone on to professional sports, such as Catfish Hunter in baseball and Jonathan Hayes in football.

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Weight training can be a valuable asset to a diabetic athlete as well as to anyone who wishes to be more fit. For type I diabetics, a particular benefit of weight training is the potential gain in muscle mass. Those with type I tend to be nonobese and perhaps even lean. This may be due to the greater breakdown of protein and fat when the BG is elevated. Consequently, building some muscle through weight training can be particularly inviting to a diabetic.

For those who want to lose a few pounds (common in type II diabetics), the rise in metabolism associated with added muscle may well burn enough extra calories to facilitate weight loss. These benefits should be emphasized with diabetics, as it may boost their motivation to begin and adhere to an exercise program.

Exercise usually causes the BG level to drop in diabetics. In the hours after weight training, glucose is transported into the exercised muscle in order to resynthesize the glucose stored in the muscle as glycogen. Consequently, the problem of elevated BG, so common in diabetics, tends to be thwarted by weight training and exercise in general.

Exercise Guidelines and Considerations

A number of recommendations can be made to influence the safety, effectiveness, and enjoyment of weight training in diabetics.

Monitoring Blood Glucose

Assess BG before and after exercise. If a diabetic uses insulin or an oral medication to control blood glucose, the BG level needs to be moderately raised before exercise in order to prevent hypoglycemia. In these individuals the BG typically decreases throughout exercise and for hours after a workout.

If the BG drops below about 60 mg/dl, symptoms of low blood sugar or hypoglycemia may appear. These include weakness, shakiness, reduced coordination, blurred vision, and, if the BG drops excessively, reduced cognitive function and even unconsciousness may ensue. The longer a diabetic has been taking insulin shots, the more common is the inability to be aware of the symptoms of hypoglycemia. This further emphasizes the importance of monitoring BG before and after exercise.

The strength and conditioning professional must understand that a diabetic can reach such a state of hypoglycemia that he or she needs assistance. This may mean providing a sugary drink or dextrose tablet if the diabetic is conscious, or calling an ambulance.

The BG also must be monitored after exercise at least once. As noted, BG continues to drop after a workout, so a reading of BG will determine whether a carbohydrate snack is needed. A second reading may be advised several hours later if the exercise was unusually long or strenuous. Hypoglycemia associated with exercise is more common after exercise than during a workout, thus postexercise monitoring is well advised. Proneness to postexercise hypoglycemia can continue as long as 24 hrs after exertion.

Diabetics obviously need to work closely with their physician and medical team—which today often includes consulting with a dietitian and an exercise physiologist—to determine a plan for modifying food intake and possibly medication that allows exercising without BG problems.

In type I diabetics (taking insulin), BG will rise rather than fall during exercise if there is not enough insulin in the blood. This is signaled by a preexercise BG of 250 to 300 mg/dl.

Because high BG levels are often associated with elevated ketone (derivatives of fat metabolism) levels, diabetics must not exercise while in this state. The ketone level will rise even further, possibly leading to ketoacidosis. This condition may require hospitalization. Most diabetics understand that this is one more reason why their BG must be measured before exercising.

Exercise

Realize that regular exercise reduces the need for insulin and
oral medication. Over several weeks or months, the requirement may drop about 30 to 40%. Some type II patients may be able to slowly wean themselves off all medication for BG control.

**Monitoring BG After Exercise**
Extremely vigorous weight training and competition may stimulate the adrenal gland to secrete stress hormones in amounts large enough to make the liver release glucose into the blood. Consequently, BG may be drastically elevated after such events. To some extent, however, the body adjusts to these intensive efforts with continued exposure by secreting less of the stress hormones and showing a smaller rise in BG. Once again, monitoring of the BG after exercise is mandatory for good diabetic management.

**Emergency Carbohydrate**
A diabetic lifter should always have emergency carbohydrate on his or her person in case hypoglycemia occurs. Quick treatment with a dextrose gel or tablets will ward off the symptoms of hypoglycemia fairly quickly and prevent a more serious, prolonged hypoglycemic state that could lead to unconsciousness.

**Identification Tag**
A diabetic lifter should wear a bracelet or necklace that clearly identifies him or her as being diabetic. Emergency medical personnel can only treat an unconscious diabetic appropriately if rapid identification is possible.

**Recognizing the Symptoms**
A knowledgeable strength and conditioning coach should be aware of the symptoms of hypoglycemia (weakness, tremor, sweating while not exercising, blurred vision, reduced mental function) and treatment (ingestion of glucose or sugar).

When a medical history identifies a client or student as diabetic, a brief meeting can help the trainer convey his or her understanding and concern and make the individual feel safer and more comfortable. For example, the coach or trainer might offer to keep a dextrose supplement in his or her office along with the name and phone number of the physician.

**Frequent Monitoring**
Closely monitor the BG several times a day, certainly before and after lifting sessions. This will aid performance during each workout in that it will allow you and excessively high levels of BG to be identified and treated. Consequently, faster progress in strength, muscle hypertrophy, and performance in general will occur. Poor BG control will blunt muscle growth because muscle is degraded and used as a bodily fuel when BG is elevated for long periods.

**Dangers of Overeating**
Some diabetics realize that overeating results in rapid weight loss. Overeating elevates the BG, causing glucose to be lost in the urine. Fat and muscle are also broken down in abnormal amounts that act as a diuretic and enhance a diabetic’s capacity to lose weight rapidly.

This process is counterproductive to overall BG management and the avoidance of complications such as blindness, cardiovascular disease, or kidney disease. It also slows metabolic rate, making it easier to regain weight, and curbs muscle growth and repair.

**Site for Insulin Injection**
Insulin should not be injected into an area that will be used subsequently in lifting. For example, injecting insulin into the triceps or deltoid and then lifting will greatly speed up the absorption of insulin into the blood. This may lead to a rapid drop in BG.

The abdominal fat pad is the site that most consistently absorbs insulin at a constant rate. Therefore it is favored by many physicians and patients as the preferred injection site. The fat in this area slows the absorption rate.

**Snacking**
Lean diabetics who use insulin or oral medication can snack before working out to raise the BG level moderately—no higher than 200 mg/dl. When the BG before a training session is about 130 to 180 mg/dl, one carbohydrate exchange or about 60 kcal (one slice of bread, half cup of juice; one apple or orange) should be consumed for each 30 to 45 min of exercise (1). Two carbohydrate exchanges, or about 120 kcal should be used if the BG is below 130.

Type II diabetics who are not on oral hypoglycemic medication or insulin usually require no supplemental food, since their BG response to exercise typifies that of nondiabetics in that it remains fairly constant.

Overweight individuals can use exercise as a means of reducing the dosage of their oral medication; they should avoid eating additional food to cover the energy expenditure associated with exercise unless they become hypoglycemic. Little or no weight loss will occur if they eat extra food every time they exercise. Consequently, people trying to lose weight can usually exercise about an hour after a meal when the BG level peaks.
Summary

Some 12 to 15 million Americans are diabetic, so strength and conditioning coaches are likely to work with them occasionally. Diabetics are physically trainable, especially if BG is normalized as much as possible.

Although there are unique health risks in many diabetics, professionals should understand these risks in order to maximize safety, effectiveness, and enjoyment for those who select weight training as a way to enhance fitness and to manage their condition.

References


Kris Berg holds the Paul Kennedy Professorship and directs the Exercise Physiology Laboratory at the University of Nebraska at Omaha. He has authored two books, six book chapters, and numerous articles in professional publications. Many of these works deal with exercise and diabetes.

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