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Exercise as Medicine for Diabetes: Prescribing Appropriate Activities and Avoiding Potential Pitfalls

Sheri R. Colberg, Guest Editor

In this issue, I have the pleasure of further reinforcing for you the benefits of engaging in regular exercise, along with the more expansive realm of appropriate physical activities for people with diabetes. Although physical activity is a cornerstone in the management of diabetes, and the health benefits of exercise are widely touted as “medicine” for diabetes, many individuals with this chronic disease fail to become or remain regularly active (1).

One barrier to being active is that exercise potentially has a large impact on the body’s metabolism, which, in some cases, can complicate the management of blood glucose levels. For example, a number of factors influence the exact contribution of various fuels to exercise metabolism, including (but not limited to) nutritional status, age, type of activity, physical fitness level, and glycemic balance. However, the most important influences on fuel utilization—and the resulting glycemic balance—are the intensity and duration of physical activity (2–10).

This *Diabetes Spectrum* From Research to Practice section on exercise covers the latest trends, practices, suggestions, recommendations, and concerns regarding getting people with all types of diabetes more physically active to improve their health and, hopefully, their glycemic balance. The goal is to allow you to think more broadly about being active and how that can become a

reality for each and every one of your patients, one way or another.

Before you begin prescribing exercise to everyone, I need to add a word of caution related to advising sedentary individuals, in particular, to become more active. Before embarking on a new exercise program or even increasing their usual patterns of physical activity, people with diabetes are advised to undergo a detailed medical evaluation with appropriate screening for the presence of diabetes-related health complications that could potentially be worsened by exercise, including poor glycemic control, joint issues, and various macrovascular and microvascular complications (11). Generally, for individuals planning to participate in low-intensity physical activity such as walking, health care providers should use their clinical judgment in deciding whether to recommend additional pre-exercise testing (11).

At present, the need for exercise stress testing before engaging in all physical activity is controversial. Before undertaking exercise more vigorous than brisk walking or that exceeds the demands of everyday living, however, previously sedentary individuals with diabetes are advised to be assessed for cardiovascular disease risks or other conditions that might contraindicate specific types of exercise or predispose them to injuries (12). The benefit of conducting diagnostic exercise stress testing for asymptomatic, low-risk individuals has not been established and is not

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currently recommended if undertaken for this purpose alone.

As you will read in this issue, exercise to manage diabetes is better addressed in the broader context of physical activity, and benefits can be derived from a variety of activities, not just the traditionally prescribed aerobic ones. In the first exercise-related article (p. 14), Marni J. Armstrong, Ronald J. Sigal, and I discuss the importance of other forms of physical activity, including resistance, balance, flexibility, yoga, Tai Chi, and alternative forms of physical training that can benefit diabetes management and overall health. Resistance training, particularly with weights and weight machines, is an essential component of healthy living that helps maintain muscle mass and functional independence and should be recommended and promoted to all adults with diabetes, along with more commonly undertaken aerobic activities, but also balance and flexibility training to lower the risk of falls and injuries (13–17). However, more high-quality research is needed to establish the benefits of resistance training with bands alone (18), yoga (19), and tai chi (20,21).

Although we have traditionally examined the acute and chronic effects of exercise using changes in A1C (as a measure of overall glycemic control) or oral glucose tolerance testing (insulin sensitivity), on p. 24, Jan-Willem van Dijk and Luc J.C. van Loon report on what we now know about exercise and glycemic management in type 2 diabetes from the relatively new technology of continuous glucose monitoring (CGM). The 24-hour effects of exercise (as measured by CGM) are not always reflected in our usual glycemic parameters (22). Of particular importance is the positive effect that almost any type of exercise appears to have on both postprandial peaks in blood glucose and the amount of time during 24 hours spent in a hyperglycemic state.

With these findings in mind, we may need to change how we prescribe exercise to include more postprandial activity and a little more flexibility in exercise type, intensity, duration, and frequency—which is all good news for our patients because it gives them many more options for becoming active to manage diabetes. Even very short bouts (2–15 minutes) of light physical activity are associated with improvements in glycemic control (23). As shorter, easier activity may be easily implemented in daily life, this strategy seems to be particularly valuable for patients who are unable or reluctant to perform traditional or structured exercise.

Although a lesser concern in most individuals with type 2 diabetes, hypoglycemia is a common outcome of being active for people who use exogenous insulin, whether for type 1 or type 2 diabetes (24–28). Exercise by insulin users requires balancing both insulin and food intake to remain in as close to a euglycemic state as possible. Not only does hypoglycemia frequently occur during and immediately after exercise, but it also can occur 7–11 hours after exercise, which is often overnight during sleep (29). In fact, fear of hypoglycemia is a limiting factor keeping many individuals with type 1 diabetes from engaging in regular physical activity (30,31). Jane E. Yardley and Ronald J. Sigal (p. 32) address the ever-important topic of hypoglycemia from an unusual angle: how to use certain types of exercise strategically to prevent hypoglycemia, rather than to cause it (32,33).

The latest exercise craze is using high-intensity interval training (HIIT). Recent research has shown that HIIT can promote improvements in glucose control and cardiovascular health in individuals with type 2 diabetes (34,35), but is this type of training safe and appropriate for people with type 2 diabetes, many of whom are older, overweight, and sedentary? What about for people with diabetes who have orthopedic or other health issues?

Monique E. Francois and Jonathan P. Little address this topic in the fourth article (p. 39). Personally, I feel that much more research is needed along these lines before I would recommend this form of training universally to older adults with type 2 diabetes, and especially to anyone who has been living a sedentary lifestyle or has long-term complications.

Another craze that is likely here to stay is the use of high-tech tools for behavioral change and exercise motivation. Most patients have access to the Internet and cell phones, although seniors who are 65 years of age or older tend to lag behind other adults in their adoption of technology. Even in an older population, Internet-delivered interventions for physical activity promotion have generally had better outcomes than usual care strategies (36). Deborah F. Tate, Elizabeth J. Lyons, and Carmina G. Valle tackle this topic head on, along with the use of social media and video games to increase physical activity levels, in the article starting on p. 45.

In addition to the articles in this research section, two articles published elsewhere in this issue of *Diabetes Spectrum* also address topics related to exercise. In the “Nutrition FYI” department starting on page 55, Dessi P. Zaharieva and Michael C. Riddell address exercise-associated dysglycemia, using a case study-based approach that suggests how exercisers with type 1 diabetes can determine appropriate nutritional adjustments (such as the optimal amount of carbohydrates to consume) and insulin adjustments to prevent hypoglycemia or hyperglycemia during and after a bout of activity (37,38). It is also crucial to know the possible interactions of prescribed medications (other than insulin) with exercise and the risk of hypoglycemia that may arise when people who take them exercise (39). In the “Pharmacy and Therapeutics” department starting on p. 64, Jackie Shahar and Osama Hamdy share what patients

and health care providers need to know about which medications may affect the ability to exercise safely and effectively so preventive measures can be taken to lower the risk and facilitate being active.

In conclusion, research overwhelmingly demonstrates that physical activity of many varieties can benefit people with diabetes and can be undertaken safely. With this new perspective, my hope is that all health care providers will feel more comfortable prescribing daily movement to their patients to benefit both their glycemic management and their overall health. Truly, the most important factor to maximize is quality of life, regardless of the age of the individual with diabetes (40). In this regard, exercise really is medicine that can improve both aspects of living (quality and longevity) simultaneously in individuals of all ages.

Duality of Interest

No potential conflicts of interest relevant to this article were reported.

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Guest Editor



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In the past two decades, Dr. Colberg has become one of the world's leading experts in her field and has written 10 books, 13 book chapters, and more than 275 articles. She was the lead author of the joint American College of Sports Medicine and American Diabetes Association (ADA) 2010 position statement "Exercise and Type 2

Diabetes" and the sole author of *Exercise and Diabetes: A Clinician's Guide to Prescribing Physical Activity*, published by ADA in 2013.

Among exercisers with type 1 diabetes, she is well known around the world as the author of *Diabetic Athlete's Handbook* and recently founded a new website, diabetesmotion.com, to help anyone with diabetes exercise safely and effectively. She also posts general educational articles on her website (shericolberg.com) and dLife.com, as well as monthly columns for diabetes professionals on DiabetesInControl.com.

With almost 47 years of personal experience living well with type 1 diabetes, she is an avid recreational exerciser who advocates healthy lifestyles for everyone.