REVIEW ARTICLE

Lifestyle Management for People with Diabetes – What You Need to Know From the ADA Standards of Care

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Family physicians are on the front line of diabetes care. This year, the American Diabetes Association's (ADA) Standards of Medical Care features a more robust section on lifestyle management, which is always a critical component of diabetes management. In addition, the ADA recently published an updated position statement on physical activity/exercise and diabetes.

This article highlights the most important lifestyle recommendations that are useful to busy family physicians that will help achieve good outcomes for patients with diabetes, with particular attention to the new exercise position statement. The complete ADA Standards and position statement can be found at professional.diabetes.org/ofp.

INTRODUCTION

Lifestyle management is a fundamental aspect of diabetes care and includes physical activity, nutrition therapy, smoking cessation counseling, psychosocial care, diabetes self-management education (DSME), and diabetes self-management support (DSMS).[1] Patients and physicians should work together to individualize treatment plans that set goals for lifestyle modification and establish a strong framework for follow-up education and support.

PHYSICAL ACTIVITY & EXERCISE

ADA recommends people with diabetes participate in four types of exercise: aerobic, resistance, flexibility, and balance exercises.

Aerobic

Cycling, swimming and walking constitute aerobic exercise as they rely on aerobic metabolism and involve the continuous movement of large muscle groups.[2] Performing regular aerobic exercise is associated with lower cardiovascular and overall mortality among all individuals including those with diabetes.[3] Aerobic exercises improve cardiorespiratory function and insulin sensitivity. Added benefits of aerobic exercise for individuals with diabetes include decreased A1C, blood pressure, insulin resistance, and lipid profiles.[4,5] High intensity interval training (HIIT) can be safely performed by individuals with diabetes without deterioration of control in type 1[6,7] and improved control in type 2 diabetes.[8,9]

Resistance Training

Resistance or strength training includes both body weight and weighted exercises. Adults with diabetes should engage in 2–3 sessions/week of resistance exercise on nonconsecutive days. All individuals benefit from resistance training through increased muscle mass, strength, bone mineral density, insulin sensitivity, and cardiovascular health.[10] Given diabetes is a risk factor for both low muscle mass[11] and decrease strength,[12] resistance training is an important aspect of overall fitness. Resistance exercises decrease exercise-induced hypoglycemia associated with type 1 diabetes.[13] Each resistance training session should consist of at least one set (group of consecutive repetitive exercise motions) of five or more different resistance exercises involving large muscle groups.[14] Resistance training can improve A1C by as much as 0.57%[15] and may have additional benefits.

Flexibility Exercises

Flexibility exercises take joints into full ranges of motion.[16] Flexibility training is recommended 2–3 times/week for older adults with diabetes. Since glycation end products are accelerated by hyperglycemia,[17] flexibility and balance exercises are especially important for individuals with diabetes. While stretching does not affect glycemic control, it will increase range of motion around joints.[18]

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Balance Exercises

Balance exercises are recommended 2–3 times/week for older adults with diabetes. Even with peripheral neuropathy, balance exercises are associated with a decreased fall risk.[18] Yoga and tai chi may be included based on individual preferences to increase flexibility, muscular strength, and balance; it may also promote glycemic control.[19, 20]

Further, all individuals, especially those with type 2 diabetes, should reduce sedentary behavior. This includes prolonged sitting and screen time. Light activity every 30 minutes can have blood glucose benefits in type 2 diabetes.[21-23] In type 2 diabetes, postprandial walking for 15 minutes improves glycemic control.[24] Highly sedentary individuals are at increased risk of mortality and morbidity.[25-29]

PHYSICAL ACTIVITY & TYPE 1 DIABETES

Youth with type 1 diabetes experience many health benefits from physical activity participation and doing both aerobic and resistance exercise may be beneficial.[30] In adults with type 1 diabetes, regular physical activity has been associated with decreased mortality.[31] Individuals using continuous subcutaneous insulin infusion (CSII) or multiple daily injections (MDI) as a basal bolus regimen can exercise with few restrictions.

In general, aerobic exercise decreases blood glucose levels if performed during postprandial periods[32] and prolonged activity done then may cause exaggerated decreases[33-35] but this can be highly variable.[36] Mixed activities, such as interval training or team/individual field sports, are associated with better glucose stability than those that are predominantly aerobic.[37-41]

Variable glycemic responses to physical activity[42] make uniform recommendations for management of food intake and insulin dosing difficult. To prevent hypoglycemia during predominantly aerobic exercise lasting ≥ 30 minutes additional carbohydrate intake of 10-15 grams and/or reductions in insulin are typically required. For activities performed with relative hyperinsulinemia (after bolus insulin), 30-60 g of carbohydrate per hour of exercise may be needed.[43]

Blood glucose concentrations should always be checked before exercise undertaken by individuals with type 1 diabetes. The target range for blood glucose prior to exercise should ideally be 90-250 mg/dL. As an alternative or a complement to carbohydrate intake, reductions in basal and/or bolus insulin dose should be considered for exercise induced hypoglycemia prevention; lowering insulin levels adequately during activity may reduce or eliminate the need for carbohydrate intake. For example, a 20% reduction in basal insulin for individuals on MDI can be made for doses both before and after exercise.[44] CSII users can reduce[45] or suspend[46] insulin delivery at the start of exercise, but this strategy does not always prevent hypoglycemia.[46,47] Frequent blood glucose checks are required when implementing insulin and carbohydrate adjustments.

Continuous glucose monitoring (CGM) may decrease the fear of exercise-induced hypoglycemia in type 1 diabetes by providing blood glucose trends that allow users to prevent and treat hypoglycemia sooner.[48] CGM coverage is becoming more common and this can be a very useful tool for you and your patients.

PHYSICAL ACTIVITY & TYPE 2 DIABETES

Achieving regular aerobic exercise increases muscle insulin sensitivity in type 2 diabetes[49] and prediabetes.[50] Intensive lifestyle interventions with at least 175 minutes per week of exercise can sustain weight loss, cardiorespiratory fitness, glycemic control, and blood pressure and lipids with fewer medications and fewer associated comorbidities associated with diabetes (e.g., diabetic kidney disease, retinopathy).[51, 52]

Women with preexisting diabetes, particularly type 2 diabetes, and those at risk for or presenting with gestational diabetes mellitus should be advised to engage in regular moderate physical activity prior to and during their pregnancies as tolerated.

While the research is still inconclusive, a minimum 60 min/day of moderate-to-vigorous physical activity, including strength-related exercise at least 3 days/week is recommended for youth with type 2 diabetes.[53]

Physical activity and lifestyle changes can prevent or delay type 2 diabetes. Structured lifestyle interventions that include physical activity (> 150 min/week) can reduce the risk of developing type 2 diabetes by 40-70% in at-risk individuals with impaired glucose tolerance.[54-57]

MINIMIZING EXERCISE-RELATED ADVERSE EVENTS IN PEOPLE WITH DIABETES

Hypoglycemia

Exercise-induced nocturnal hypoglycemia is a major concern.[58] Hypoglycemic events occur typically within 6-15 h post exercise,[59] although risk can extend out to 48 h.[60] The risk of nocturnal hypoglycemia may be minimized through 20% reductions of daily basal insulin dose with reduced prandial bolus insulin and low glycemic index carbohydrate feeding following evening exercise for those on MDI.[61] For CSII users, basal rate reductions of 20% at bedtime for 6 h after afternoon exercise may limit nocturnal hypoglycemia.[62] Inclusion of a bedtime snack, glucose checks overnight, and/or use of CGM with alarms and automatic pump suspension may also be warranted.[63-64]

Hyperglycemia

Exercise-induced hyperglycemia is more common in type 1 diabetes. This may be purposeful in terms of defensive maneuvers to prevent hypoglycemia. Purposeful insulin omission before exercise can promote a rise in glycemia, as can malfunctioning infusion sets during exercise.[65] Individuals with type 2 diabetes may also experience increases in blood glucose after aerobic or resistance exercise, particularly if they are insulin users and administer too little insulin for meals before activity.[66] Overconsumption of carbohydrates before or during exercise, along with aggressive insulin reduction, can promote hyperglycemia during any exercise.[61]

To correct post exercise hyperglycemia, a conservative (50% of usual) correction can be administered.[67] Exercise should be postponed or suspended if blood ketone levels are elevated (≥1.5 mmol/L), as blood glucose levels and ketones may rise further with even mild activity.

HEAT-RELATED ILLNESS DURING PHYSICAL ACTIVITY

Physical activity increases body heat production and core temperature, leading to greater skin blood flow and sweating. With increasing age, poor blood glucose control, and neuropathy, skin blood flow and sweating may be impaired in adults with type 1 [68,69] and type 2[70] diabetes, increasing the risk of heat-related illness. Older adults with diabetes or anyone with autonomic neuropathy, cardiovascular complications, or pulmonary disease should avoid exercising outdoors on very hot and/or humid days.

Medication Effects

Insulin secretagogues can contribute to exercise-induced hypoglycemia. If exercise-induced hypoglycemia has occurred, a decreased dose on exercise days may help reduce further hypoglycemia risk. Metformin, dipeptidyl peptidase 4 inhibitors, glucagon-like peptide 1 receptor agonists, sodium–glucose co-transporter 2 inhibitors, and thiazolidinediones are generally safe and no dose adjustment for exercise is necessary.

Managing Physical Activity with Health Complications

Macrovascular and microvascular diabetes-related complications could develop and worsen with inadequate blood glucose control.[71,72] Vascular and neural complications of diabetes often cause physical limitation and varying levels of disability requiring precautions during exercise. However, for most patients with diabetes-related complications, physical activity is beneficial.

Cardiovascular Disease

After a stroke or myocardial infarction, exercise should be started in a supervised cardiac rehabilitation program. Starting at a low intensity and progressing as able to activities that are more moderate is recommended. Patients with coronary artery disease should also consider exercising in a supervised cardiac rehabilitation program, at least initially. Exertional angina may be silent in some with diabetes and during exercise heart rate should be kept ≥10 bpm below that heart rate in which exercise-related angina in induced.

Both aerobic and resistance training may lower resting blood pressure and should be encouraged. Blood pressure medications can cause exercise-related hypotension, making monitoring important. Patients should be instructed to stop exercise immediately if symptoms of myocardial infarction (such as chest pain, radiating pain, shortness of breath, and others) or stroke (occurring suddenly and often affecting only one side of the body) occur during physical activity and seek medical attention.

Patients with heart failure should be advised to avoid activities that cause an excessive rise in heart rate and instead consider doing low- or moderate-intensity activities.

Peripheral Artery Disease

Those with peripheral artery disease should be taught that lower-extremity resistance training improves functional performance[73] and the preferred aerobic activities include low- or moderate-intensity walking, arm ergometer, and leg ergometer.[74]

Retinopathy

If proliferative diabetic retinopathy or severe non-proliferative diabetic retinopathy is present, vigorous-intensity aerobic or resistance exercise may be contraindicated because of the risk of triggering vitreous hemorrhage or retinal detachment. Consultation with an ophthalmologist before engaging in an intense exercise regimen may be appropriate.

Peripheral Neuropathy

Decreased pain sensation and a higher pain threshold in the extremities result in an increased risk of skin breakdown, infection, and Charcot joint destruction with some forms of exercise. Therefore, a thorough assessment should be done to ensure that neuropathy does not alter kinesthetic or proprioceptive sensation during physical activity, particularly in those with more severe neuropathy. Studies have shown that moderate-intensity walking may not lead to an increased risk of foot ulcers or reulceration in those with peripheral neuropathy who use proper footwear.[75]

In addition, 150 min/week of moderate exercise was reported to improve outcomes in patients with prediabetic neuropathy.[76] All individuals with peripheral neuropathy should wear proper footwear and examine their feet daily to detect lesions early. Anyone with a foot injury or open sore should be restricted to non–weight-bearing activities.

Autonomic Neuropathy

Autonomic neuropathy can increase the risk of exercise-induced injury or adverse events through decreased cardiac responsiveness to exercise, postural hypotension, impaired thermoregulation, impaired night vision due to impaired papillary reaction, and greater susceptibility to hypoglycemia.[77] Cardiovascular autonomic neuropathy is also an independent risk factor for cardiovascular death and silent myocardial ischemia.[78] Therefore, individuals with diabetic autonomic neuropathy should undergo cardiac investigation before beginning physical activity more intense than that to which they are accustomed.

Diabetic Kidney Disease

Physical activity can acutely increase urinary albumin excretion. However, there is no evidence that vigorous-intensity exercise increases the rate of progression of diabetic kidney disease, and there appears to be no need for specific exercise restrictions for people with diabetic kidney disease.[79]

Orthopedic Limitations

Individuals with diabetes are more prone to structural changes to joints that can limit movement.[80] Regular flexibility training will help maintain greater joint range of motion.[81] Strategies include stretching within warm-ups or after an activity to increase joint range of motion, strengthening muscles around affected joints with resistance training, and avoiding activities that increase plantar pressures with Charcot foot changes.

Arthritis is common in lower-extremity joints, particularly in older adults who are overweight or obese. Participation in regular physical activity is possible and should be encouraged, as moderate activity may improve joint symptoms and alleviate pain. Most low- and moderate-intensity activities are acceptable, but more

non–weight-bearing or low-impact exercise may be undertaken to reduce stress on joints. Patients should perform range-of-motion activities and light resistance exercise to increase strength of muscles surrounding affected joints and avoid activities with high risk of joint trauma, such as contact sports.

Technology

Wearable activity trackers such as pedometers are a helpful behavior-change tool for increasing total steps but not improving A1C.[82] Technology-based strategies using Internet delivered physical activity recommendations have been successful among individuals with type 2 diabetes at increasing physical activity compared to usual care.[83]

NUTRITION THERAPY

For many, the most challenging part of a treatment plan is determining what to eat and following a food plan. There is not a one-size-fits-all eating plan. All individuals with diabetes should receive individualized medical nutrition therapy (MNT), preferably provided by a knowledgeable registered dietitian. MNT delivered by a registered dietitian is associated with A1C decreases of 0.3-1% for people with type 1 diabetes[84-86] and 0.5-2% for people with type 2 diabetes.[87-90] Emphasis should be on healthy eating patterns containing nutrient-dense, high-quality foods with less focus on specific nutrients. The Mediterranean,[91] Dietary Approaches to Stop Hypertension (DASH),[92,93] and plant-based diets[94] are all examples of healthful eating patterns.

GOALS OF NUTRITION THERAPY

- To promote and support healthful eating pattern, emphasizing a variety of nutrient-dense foods in appropriate portion sizes, in order to improve overall health and specifically to:
  a. Achieve and maintain body weight goals
  b. Attain individualized glycemic, blood pressure, and lipid goals
  c. Prevent or delay the complications of diabetes
- To address individual nutrition needs based on personal and cultural preferences, health literacy and numeracy, access to healthful foods, willingness and ability to make behavioral changes, and barrier to change
- To maintain the pleasure of eating by providing nonjudgmental messages about food choices
- To provide an individual with diabetes the practical tools for developing healthy eating patterns rather than focusing on individual macronutrients, micronutrients or single foods

Weight Management

There is strong consistent evidence that modest persistent weight loss can delay the progression from prediabetes to type 2 diabetes.[95,96] Also beneficial in type 2 diabetes management, a sustained reduction of 5% of initial body weight has been shown to improve glycemic control and reduce the need for glucose-lowering medications.[97-99] A sustained weight loss of ≥7% is optimal for many obese individuals in order to improve glycemic control, lipids and blood pressure.[100] Intervention programs can facilitate weight loss by the combination of reduction of calorie intake and lifestyle modification.

Carbohydrates

Carbohydrate intake from whole grains, vegetables, fruits, legumes, and dairy products, with an emphasis on foods higher in fiber and lower in glycemic load, should be advised over other sources, especially those containing sugars. People with diabetes and those at risk should avoid sugar-sweetened beverages in order to control weight and reduce their risk for CVD and fatty liver and should minimize the consumption of foods with added sugar that have the capacity to displace healthier, more nutrient-dense food choices.

Protein

Research is inconclusive regarding the ideal amount of dietary protein need to optimize either glycemic control or CVD risk.[101] Some research has utilized meal plans with slightly higher levels of protein (20-30%), thought to contribute to increased satiety, to successfully manage type 2 diabetes.[93] Dietary protein should be maintained at the recommended daily allowance of 0.8 g/kg body weight/day for those with diabetic kidney disease. In individuals with type 2 diabetes, ingested protein appears to increase insulin response without increasing plasma glucose concentrations. Therefore, carbohydrate sources high in protein should not be used to treat or prevent hypoglycemia.

Dietary Fat

Diets emphasizing monounsaturated fats, such as a Mediterranean-style diet, may improve glucose metabolism and lower CVD risk.[102] Eating foods rich in long-chain omega-3 fatty acids, such as fatty fish and nuts and seeds, is recommended to prevent or treat CVD; however, evidence does not support a beneficial role for omega-3 dietary supplements.

Sodium

Patients with diabetes should follow the guidelines for the general population and limit sodium consumption to <2,300 mg/day. There is some evidence that lowering sodium to 1,500mg/day may be indicated for those with hypertension and diabetes.[103]

Micronutrients & Supplements

In people with diabetes, there is no clear evidence of benefit from herbal or other supplementation without underlying deficiencies.[104] However, in a recent report from the Diabetes Prevention Program Outcomes Study, vitamin B12 deficiency may be associated with metformin use.[105] Periodic testing of vitamin B12 should be considered in patients treated with metformin particularly in those with anemia or peripheral neuropathy.

Alcohol

Moderate alcohol use (one drink per day for women and two drinks per day for men) does not have major detrimental effects on long-term blood glucose control in people with diabetes. Hypoglycemia, weight gain and hyperglycemia are risks associated with alcohol consumption in those with diabetes.[106]

Nonnutritive Sweeteners

The use of nonnutritive sweeteners has the potential to reduce overall calorie and carbohydrate intake if substituted for caloric sweeteners without compensation by intake of additional calories from other food sources. Nonnutritive sweeteners are generally safe to use within the defined acceptable daily intake levels.[107]

SMOKING CESSATION: TOBACCO & E-CIGARETTES

Physicians should advise all patients not to use cigarettes and other tobacco products or e-cigarettes. One study in smokers with newly diagnosed type 2 diabetes found that smoking cessation was associated with amelioration of metabolic parameters and reduced blood pressure and albuminuria at 1 year.[108]

Although some patients may gain weight in the period shortly after smoking cessation, recent research has demonstrated that this weight gain does not diminish the substantial CVD benefit realized from smoking cessation.[109]

There are no rigorous studies that have demonstrated that e-cigarettes are a healthier alternative to smoking or that e-cigarettes can facilitate smoking cessation. More extensive research of their short- and long-term effects is needed to determine their safety and their cardiopulmonary effects in comparison with smoking and standard approaches to smoking cessation.[110-112]

PSYCHOSOCIAL CARE

Motivating patients with diabetes to make lifestyle changes can be very challenging. However, it is also important to recognize when patients are overwhelmed from the demands of managing this complex, chronic disease. Physicians should routinely assess psychosocial status, including diabetes distress.

Diabetes distress (DD) is very common and is distinct from other psychological disorders.[113-115] DD refers to significant negative psychological reactions related to emotional burdens and worries specific to constant behavioral demands including physical activity and food intake. The prevalence of DD is reported to be 18–45% with an incidence of 38–48% over 18 months.[116] DSME has been shown to reduce DD.[117] It may be helpful to provide counseling regarding expected diabetes-related versus generalized psychological distress at diagnosis and when disease state or treatment changes.[118]

DIABETES SELF-MANAGEMENT EDUCATION & SUPPORT

In accordance with the national standards for diabetes self-management education and support, all people with diabetes should participate in DSME to facilitate the knowledge, skills, and ability necessary for diabetes self-care and in DSMS to assist with implementing and sustaining skills and behaviors needed for ongoing self-management, both at diagnosis and as needed thereafter. Health care teams can collaborate to improve outcomes. After physicians work with patients to create a care plan, educators, dieticians, and other members of the care team can provide reinforcement, encouragement and knowledge to adhere to the plan.

Four critical time points have been defined when the need for DSME and DSMS should be evaluated by the medical care provider and/or multidisciplinary team, with referrals made as needed:[119]

1. At diagnosis
2. Annually for assessment of education, nutrition, and emotional needs
3. When new complicating factors (health conditions, physical limitations, emotional factors, or basic living needs) arise that influence self-management
4. When transitions in care occur DSME focuses on supporting patient empowerment by providing people with diabetes the tools to make informed self-management decisions.[120]

Studies have found that DSME, in an individual or group setting, is associated with improved diabetes knowledge and self-care behaviors, lower A1C, lower self-reported weight, improved quality of life, healthy coping, and reduced health care costs.[121-123] Better outcomes were reported for DSME interventions that were over 10 h in total duration, included follow-up with DSMS, were culturally and age appropriate, were tailored to individual needs and preferences, and addressed psychosocial issues and incorporated behavioral strategies.[124]

DSME is associated with an increased use of primary care and preventive services and less frequent use of acute care and inpatient hospital services.[125] Patients who participate in DSME are more likely to follow best practice treatment recommendations, particularly among the Medicare population, and have lower Medicare and insurance claim costs.[126] The ADA has a finder on its website to access its recognized diabetes education programs: professional.diabetes.org/erp.

SUMMARY

Lifestyle management is central diabetes care. Lifestyle changes can reduce a person's risk from developing type 2 diabetes, can reduce risk of complications in people with diabetes and can improve glucose control. While physical activity and MNT recommendations will vary for each patient, physician engagement in therapeutic lifestyle change can help all people with diabetes. The American Diabetes Association has resources for the busy physician to help patient engage in healthy lifestyle change. A team-based approach that utilizes mental health professionals, registered dietitians, and diabetes educators also can benefit the patient and reduce the education burden on the physician.

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