I'm not a robot

 You've likely heard that getting 150 minutes of moderate intensity exercise each week can help you manage your diabetes. But dedicating that much time to exercise can seem daunting if you're busy, don't enjoy working out or have diabetes-related complications that make physical activity difficult. But don't worry: Tackling 150 minutes of exercise is much easier than you might think!Be sure to check with your health care provider before starting or changing your exercise plan.Why 150?Any physical activity is better than none at all, but most health organizations say you need a minimum of 150 minutes of activity per week to reap significant results. But a slow stroll won't cut it. To benefit, you'll need to work out at a moderate intensity—at this pace, you'll be able to talk, but not sing.Regular physical activity has lots of benefits for people with diabetes, including improved blood pressure and blood glucose (blood sugar) control. Plus, research has shown that doing 150 minutes per week of moderate-intensity exercise can reduce your chances of heart disease and premature death, compared with being sedentary.Spread it outInstead of viewing weekly exercise as one huge goal, think of it as a series of mini goals. Depending on your schedule and preference, you could aim for 50 minutes of exercise three times a week, 30 minutes five times a week or 25 minutes six times a week.Each breakdown will have a slightly different impact on your blood glucose. To really reap the benefits of exercise on glucose control, keep your muscles in a constant state of increased glucose uptake. To do that, try to go no more than 48 hours between exercise sessions. To maximize the benefits, aim to exercise five to six days a week.Shorten your sessionsIt's easy to brush exercise aside if you don't have a 30 to 60-minute chunk of time, but you don't need a wide-open schedule to meet your fitness goals.Think about three spots in your day where you could fit in 10 minutes of exercise. It could be a 10-minute jump rope session before work, a 10-minute walk at lunchtime and 10 minutes on an exercise bike after dinner.The health benefits remain: 10 minutes of exercise three times a day gives you the same cardiovascular benefit as 30 minutes at one time. Just don't go too fun-sized with your sessions. When you're working at a moderate intensity, sweat sessions that clock in at 10 minutes or more are the most beneficial for heart health.Setting smart goalsIf a goal is specific, measurable, attainable, realistic and time-bound, there is a higher chance of sustaining the new behavior, seeing results and avoiding any lapses or relapses.Sure, you might be aiming for 150 minutes of mountain biking each week. But you might also fill those 150 minutes with shorter, less-intense activities. Something as simple as vacuuming for 10 minutes could get your heart rate up. Doing this type of mini activity throughout the day is a more realistic and attainable fitness goal for people who have diabetes-related complications, too.Fine-tuning your fitness levelAre you a novice exerciser or total pro? It makes a big difference in the type of exercise routine that will work best for you.If you're new to fitness, create goals that help you gradually build toward 150 minutes of exercise. If you sit at a desk all day and don't have an exercise routine, your first goal might be to get up from your desk twice every hour and do a walking tour of the office. From there, add 10 minutes of exercise a week until you reach the 150-minute mark. It's not about how long it takes you to get to that goal, what's more important is taking the steps to get there.Make time for fitnessA successful exercise routine works into the demands of your day. To find a time that works for you, think about when you have availability and when you're at your most energized.Your medication regimen may also affect your workout timing. Certain diabetes drugs, such as insulin and sulfonylureas, can increase your risk for low blood glucose (hypoglycemia). Add in the blood glucose–lowering effect of exercise, and your evening workout may up your risk of overnight lows. In that case, you might be more likely to stick with a morning or afternoon workout regimen instead of working out in the evening.Sometimes, increasing your amount of exercise will affect your medications. If you aim to exercise two to three hours after eating, for instance, you may need to reduce your premeal bolus of rapid-acting insulin to prevent lows.How to stay motivatedChoosing an activity you enjoy, creating a log to monitor your progress and preparing for snags—all of these can help keep you motivated.Have fun.Making exercise fun will help you stick with it—nobody wants to do 150 minutes of something they don't enjoy! Find workouts that will check off those boxes for you—whether that's a dance class, a pickleball league or a walking club.Track your progress.Logging your workouts can help you track just how many of those 150 minutes of exercise you have left to meet this week. Make sure your exercise goals are right in front of you every day to act as a visual reminder. That could mean a calendar on your wall, a day planner on your desk or an app on your phone or computer.Excuse-proof your plan.Come up with an alternative workout option for days the weather isn't great or things don't go as planned. Instead of cycling outside, you could walk laps at the local mall, use the elliptical machine at the gym or do 10 minutes of stair-climbing at home.Enlisting a friend to exercise with you is another way to ensure you won't bail on plans. It could even motivate you to go the extra mile. This consensus statement is an update of the 2010 ACSM position stand on exercise and type 2 diabetes. Since then, a substantial amount of research on select topics in exercise in individuals of various ages with type 2 diabetes has been published while diabetes prevalence has continued to expand worldwide. This consensus statement provides a brief summary of the current evidence and extends and updates the prior recommendations. The document has been expanded to include physical activity, a broader, more comprehensive definition of human movement than planned exercise, and reducing sedentary time. Various types of physical activity enhance health and glycemic management in people with type 2 diabetes, including flexibility and balance exercise, and the importance of each recommended type or mode is discussed. In general, the 2018 Physical Activity Guidelines for Americans apply to all individuals with type 2 diabetes, with a few exceptions and modifications. People with type 2 diabetes should engage in physical activity regularly and be encouraged to reduce sedentary time and break up sitting time with frequent activity breaks. Any activities undertaken with acute and chronic health complications related to diabetes may require accommodations to ensure safe and effective participation. Other topics addressed are exercise timing to maximize its glucose-lowering effects and barriers to and inequities in physical activity adoption and maintenance. Keywords: exercise, physical activity, type 2 diabetes This consensus statement is an update of the 2010 position stand on exercise and type 2 diabetes (T2D) published jointly by the American College of Sports Medicine (ACSM) and the American Diabetes Association (ADA) (1, 2). In the ensuing decade, a considerable amount of research on select topics in exercise in individuals of varying ages with T2D has been published while diabetes prevalence has continued to expand worldwide. The objective of this consensus statement is to provide readers with a summary of the current evidence and extend and update the prior recommendations from 2010. The writing group used a consensus approach to synthesize available evidence from clinical trials and case reports, narrative and systematic reviews, and meta-analyses, and the recommendations represent the consensus of the writing panel and ACSM and incorporate guidance from other professional organizations with expertise in this area, such as the ADA (1, 2). Current science, new topics for discussion, and clinical experience in making recommendations for participation by people with T2D of all ages are highlighted. In addition, the title of the consensus statement and the text itself have been expanded to include physical activity, a broader, more comprehensive definition of human movement of which structured or planned exercise is a subset. Currently diabetes affects over 463 million people worldwide (3), and its prevalence in the United States is 10.5% (4). T2D accounts for 90-95% of all cases (5). The goal of treatment for T2D is to facilitate an individualized treatment plan, one that may include education, glycemic management, reduction of cardiovascular disease (CVD) risk, and ongoing screening for microvascular complications, in order to achieve and maintain optimal blood glucose, lipid, and blood pressure levels that prevent or delay chronic complications. Lifestyle interventions and/or medications are usually prescribed for treatment of T2D, and more recently, bariatric surgery has also become part of a possible treatment plan. During any type of physical activity (PA), glucose uptake into active skeletal muscles increases via insulin-independent pathways. Blood glucose levels are maintained by glucoregulatory hormone-derived increases in hepatic glucose production and mobilization of free fatty acids (6, 7), which may be impaired by insulin resistance or diabetes (7). Improvements in systemic, and possibly hepatic, insulin sensitivity following any PA can last from 2 to 72 h, with reductions in blood glucose closely associated with PA duration and intensity (8–10). Additionally, regular PA enhances β-cell function (11), insulin sensitivity (12), vascular function (13, 14), and gut microbiota (15), all of which may lead to better diabetes and health management as well as disease risk reduction. Multiple types of PA enhance health and glycemic management in people with T2D, although structured exercise training has been studied most frequently. Many of the proven benefits result from improved insulin sensitivity, postprandial hyperglycemia, and CVD risk. Short-term aerobic exercise training improves insulin sensitivity in adults with T2D, paralleling improved mitochondrial function (16). Vigorous aerobic exercise training for 7 d may improve glycemia without lowering body weight via increased insulin-stimulated glucose disposal and suppression of hepatic glucose production (12). Short-term aerobic exercise in individuals with obesity and T2D improves whole body insulin action through gains in peripheral insulin sensitivity more so than hepatic insulin sensitivity (17). Meta-analyses and systematic reviews have confirmed that regular aerobic exercise training improves glycemia in adults with T2D, with fewer daily hyperglycemic excursions and 0.5-0.7% reductions in hemoglobin A1C (A1C) (18–22). Regular training also improves insulin sensitivity, lipids, blood pressure, other metabolic parameters, and fitness levels, even without weight loss (23, 24). Resistance exercise training in adults with T2D typically results in 10-15% improvements in strength, bone mineral density, blood pressure, lipid profiles, skeletal muscle mass, and insulin sensitivity (25). Combined with modest weight loss, resistance training may increase lean skeletal muscle mass and reduce A1C three-fold more in older adults with T2D compared to a calorie-restricted, non-exercising group that lost skeletal muscle mass (26). A recent meta-analysis of resistance exercise suggests that high-intensity training is more beneficial than low-to-moderate-intensity training for overall glucose management and attenuation of insulin levels in adults with T2D (27). Interventions with combined aerobic and resistance exercise training may be superior to either mode alone. A greater reduction in A1C has been noted in adults with T2D undertaking a combined training program compared with either type alone (28); however, combined training group participants had a greater exercise volume. In another trial, combined training significantly improved A1C levels over non-exercising controls, although neither resistance nor aerobic training alone resulted in significant changes (29). Moreover, the combined group lost more weight and improved aerobic fitness more so than controls. A meta-analysis (21) showed that all three exercise modalities favorably impact glycemia and insulin sensitivity, and combined training may produce greater reductions in A1C than either training modality alone (30). Higher intensities of aerobic training are generally considered superior to low-intensity training (31). HIIE training is a regimen that involves aerobic training done between 65-90% VO2peak or 75-95% heart rate peak (HRpeak) for 10 sec to 4 min with 12 sec to 5 min of active or passive recovery. HIIE has gained attention as a potentially time-efficient modality that can elicit significant physiological and metabolic adaptations. One session of HIIE (10 × 60 s cycling at ~90% HRmax) reduced postprandial hyperglycemia in adults with T2D (32). Two wks of afternoon HIIE training were shown to improve continuous glucose monitor (CGM)-monitored glycemia while morning training may increase glucose levels on exercise days, particularly if undertaken fasted (33). HIIE training also significantly improves fitness levels and reduces A1C and body mass index (BMI) in adults with T2D. Compared with continuous walking matched for energy expenditure, HIIE training resulted in greater fitness, better body composition, and improved CGM-monitored glycemia (34), as well as enhanced insulin sensitivity and pancreatic β-cell function in adults with T2D (35). Individuals with T2D who seek to improve glycemia with HIIE should closely monitor their responses to training, as chronic intense training may have negative effects such as transient post-exercise hyperglycemia. The maximal activity of citrate synthase and skeletal muscle mitochondrial protein content in adults with T2D are improved following just 6 sessions of low-volume HIIE (36). Further changes observed with HIIE training include greater reduction in A1C and CVD risk factors with less exercise time (37), as well as enhanced diastolic function (38), increased left ventricular wall mass, greater end-diastolic blood volume due to increased stroke volume and left ventricular ejection fraction (39), and improved endothelial function (40). Glycemia and insulin sensitivity in adults with overweight/obesity and with insulin resistance, prediabetes, or T2D are improved similarly with different modes of structured exercise training when energy expenditure is matched (41–44). Adverse events have been reported in 34% of studies included in a meta-analysis, with a majority attributable to musculoskeletal injuries during HIIE rather than moderate training (45). The benefits of other types of PA are less well established and have mixed glycemic outcomes. Yoga may improve A1C, blood lipids, and body composition in adults with T2D (46); whereas, tai chi may improve glycemic management, balance, neuropathic symptoms, and some dimensions of quality of life (47). Further studies are required to fully establish the potential benefits of yoga and tai chi in populations with T2D. Dietary restriction and increased PA are the cornerstones of intensive lifestyle (ILS) interventions that are typically used to induce weight loss. Such interventions may prevent or delay onset of T2D in at-risk populations and reduce CVD risk in individuals with T2D. In many cases PA has been shown to be as important as, if not more so than, weight loss. The U.S. Diabetes Prevention Program (DPP) multicenter trial utilized ILS with a goal of achieving modest (5-7%) weight loss and led to the important observation that for every 1 kg of body weight lost, T2D risk was reduced by 16% (48). Even among those failing to meet the weight loss goal of 7% during the first year, individuals meeting the PA goal had a 44% reduction in diabetes incidence, independent of the small weight loss (−2.9 kg) (48). The DPP outcomes study (DPPOS) has shown a higher incidence of T2D onset in those who gained weight at 10 and 15 years after participating in the original ILS arm (49, 50). More recent follow-up data from DPPOS shows that cumulative T2D incidence remained lower in the ILS group, a finding not explained by differences in body weight among groups (51); rather, PA was inversely related to incident of T2D for all participants. Importantly prevention of T2D was enhanced in active participants with lower baseline PA, and moderate-intensity walking (about 18.2 km/wk) improved oral glucose tolerance with only 2 kg of weight loss (52). Overall, individuals at high risk for developing T2D who have initially low PA levels benefit the most from moderate-intensity walking and other exercise with minimal weight loss. Most ILS interventions in adults with T2D have also led to a reduction in CVD risk factors. In the Look AHEAD trial (53), ILS participants with T2D lowered triglycerides and increased HDL-C levels. More weight loss led to greater improvements in A1C, systolic blood pressure, HDL-C, and triglyceride levels. Most ILS trials (focused primarily on dietary changes and increased PA) with weight reduction as a goal in adults with T2D have resulted in 5% appears to be necessary for beneficial effects on A1C, blood lipids, and blood pressure in most individuals (54, 55). During the first year of the trial, ILS participants experienced greater reductions in A1C, initial improvements in fitness and attenuation of all CVD risk factors except for LDL-C levels. Further, ILS did not reduce the occurrence of a composite CVD outcome score over 9.6 y despite the greater, sustained weight loss in participants (56), but the participants had fewer hospitalizations, medications, and health care costs over 10 y (57). Thus, lifestyle interventions that include PA in recommended amounts and possible weight loss remain important approaches in the management of T2D and CVD risks. Weight loss from PA alone is generally small, although possible with 1 or more hours of daily moderate-or high-intensity exercise (58–60). In men and women with obesity, 1 h of daily moderate-intensity aerobic exercise induced weight loss similar to dietary restrictions alone, with similar reductions in abdominal subcutaneous and visceral fat observed in both groups. Regular exercise without weight loss also reduced subcutaneous and visceral fat and prevented further weight gain (58). In postmenopausal women with T2D, modest weight loss with either dietary restriction alone or diet plus exercise similarly reduced total abdominal fat, subcutaneous adipose tissue, and glycemia, but the addition of exercise was necessary for visceral adipose tissue loss (61), which leads to lesser metabolic dysfunction and CVD risk. Thus, moderate-to high-intensity exercise (~500 kcal) done 4-5 d/wk appears to reduce abdominal, but particularly visceral, fat in adults with T2D and may lower their metabolic risk. Women with gestational diabetes mellitus (GDM) may have a nearly 10-fold higher risk of developing T2D at some point (62). PA is a preventative tool for GDM and subsequent development of T2D (63, 64). Prepregnancy exercise training has been consistently associated with a reduced risk of GDM (65–68). Moderate aerobic exercise performed 3 d/wk (50-55 min/session) for 8-10 wk through the third trimester reduces the prevalence of GDM (2.6% vs. 6.8% with standard care) and minimizes excessive weight gain during pregnancy (69). Cycling exercise (30 min, 3x/wk) initiated early in pregnancy has been shown to reduce the frequency of GDM in women with overweight/obesity and lowered gestational weight gain before the mid-second trimester (70). A recent meta-analysis concluded that prenatal exercise alone, including 140 min of moderate-intensity exercise weekly, results in a 25% reduction in risk of GDM, preeclampsia, and gestational hypertension (71). Regular PA of any type during pregnancy decreases the incidence of GDM and maternal weight gain without serious adverse events (72). It is widely recommended that pregnant women participate in ~20-30 min of moderate-intensity aerobic exercise most days of the week, but the total amount of PA needed to achieve these diabetes risk reductions may be greater (73, 74). Regular PA potentially has psychological and cognitive function benefits for people with T2D. Both are important for the long-term health of this population. Participation in both short-and long-term exercise training has been shown to substantially decrease symptoms of depression and anxiety in individuals across all age groups diagnosed with clinical depression (75). Exercise increases certain brain hormones that modulate hippocampal plasticity to improve both cognition and mental health (76). In the Look AHEAD trial, participants following ILS had improved health-related quality of life and reduced symptoms of depression after 12 m (77), and the benefit extended as long as 8 y (78). In the U-TURN study (79), participants with T2D who undertook ILS experienced improvements in the physical component of quality-of-life scores but with no change in the mental component at 1 y. Collectively, these studies suggest that regular exercise may improve psychological well-being, including health-related quality of life and depressive symptoms, in individuals with T2D. T2D is associated with cognitive dysfunction, including poor attention and concentration, visual and verbal memory, processing speed, and executive function (80). Young and older adults have experienced increases in basal glucose uptake in brain regions critical to cognitive function following 12 wk of aerobic interval exercise (4 × 4 min >90% VO2peak for 3 d/wk) combined with moderate-intensity treadmill walking (70% VO2peak for 2d/wk) (81). Similarly, 2 wk of sprint interval training lowered insulin-stimulated glucose uptake in the temporal cortex, cingulate gyrus, cerebellum as well as global regions when compared with other moderate-intensity continuous exercise training in sedentary, middle-aged adults with insulin resistance (82). When PA is combined with a low-fat diet, brain insulin sensitivity is increased in adults with obesity (83). Surprisingly, there is a paucity of research on the effects of exercise on memory and cognitive function in people with T2D (84–87). Although the Look AHEAD trial reported no cognitive benefit after 8-9 y of lifestyle treatment in people with T2D (88), a recent meta-analysis suggested a favorable, albeit small to moderate, effect of exercise on executive function and memory (89), similar to reported associations between exercise and cognitive function in adults with T2D (90, 91). There is a paucity of data on the physiological mechanisms related to memory, cognitive function, and cerebral blood flow. The 2018 update of the Physical Activity Guidelines for Americans (Table 1) included recommendations for youth, adults, and older adults (92, 93). In general, these recommendations apply to individuals with T2D as well, with a few exceptions and modifications (Table 2). In most instances, the recommendations for adults of all ages are the same unless comorbid health conditions or older age impact their ability to be active and modifications are needed (92). Physical Activity Guidelines for All Americans (2018) (91, 92) Adults Move more and sit less throughout the day. Some physical activity is better than none. For substantial health benefits, do at least 150 min (2 h, 30 min) to 300 min (5 h) a week of moderate-intensity, or 75 min (1 h, 15 min) to 150 min (2 h, 30 min) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity, preferably spread throughout the week. Additional health benefits are gained by engaging beyond the equivalent of 300 min (5 h) of moderate-intensity physical activity weekly. Perform muscle-strengthening activities of moderate or greater intensity and that involve all major muscle groups on 2 or more days/week. Older Adults The guidelines for healthy older adults are the same as those for all adults. In addition, as part of weekly physical activity, do multicomponent physical activity that includes balance training as well as aerobic and muscle-strengthening activities. Determine level of effort for physical activity relative to the level of fitness. With chronic conditions, understand whether and how the conditions affect the ability to do regular physical activity safely. If an individual cannot do 150 min of moderate-intensity aerobic activity a week because of chronic conditions, engage in as much physical activity as abilities and conditions allow. Children and Adolescents Preschool-aged children (ages 3 through 5 y) should be physically active throughout the day to enhance growth and development. Adult caregivers of preschool-aged children should encourage active play that includes a variety of activity types. Provide young people opportunities and encouragement to participate in physical activity appropriate for their age, that are enjoyable, and that offer variety. Children and adolescents ages 6 through 17 years should engage in 60 min (1 h) or more of moderate-to-vigorous physical activity daily: • Aerobic: Most of the 60 min or more per day should be either moderate-or vigorous-intensity aerobic physical activity and should include vigorous-intensity physical activity on at least 3 d/wk. • Muscle-strengthening: As part of 60 min or more of daily physical activity, include muscle-strengthening activities on at least 3 d/wk. • Bone-strengthening: As part of 60 min or more of daily physical activity, include weight-bearing exercise to strengthen bones at least 3 d/wk. Recommended Types of Exercise Training for All Adults with Type 2 Diabetes Type of Training Type Intensity Frequency Duration Progression Aerobic Walking, jogging, cycling, swimming, aquatic activities, rowing, dancing, interval training 40%-59% of VO2R or HRR (moderate), RPE 11-12; or 60%-89% of VO2R or HRR (vigorous), RPE 14-17 3-7 d/wk, with no more than 2 consecutive days between bouts of activity Minimum of 150 to 300 min/wk of moderate activity or 75 to 150 min of vigorous activity, or an equivalent combination thereof Rate of progression depends on baseline fitness, age, weight, health status, and individual goals; gradual progression of both intensity and volume is recommended Resistance Free weights, machines, elastic bands, or body weight as resistance; undertake 8-10 exercises involving the major muscle groups Moderate at 50%-69% of 1-RM, or vigorous at 70%-85% of 1-RM 2-3 d/wk, but never on consecutive days 10-15 repetitions per set, 1-3 sets per type of specific exercise As tolerated; increase resistance first, followed by a greater number of sets, and then increased training frequency Flexibility Static, dynamic, or PNF stretching; balance exercises; yoga and tai chi increase range of motion Stretch to the point of tightness or slight discomfort ≥2-3 d/wk or more; usually done with when muscles and joints are warmed up 10-30 s per stretch (static or dynamic)group; 2-4 repetitions of each As tolerated; may increase range of stretch as long as not painful Balance Balance exercises: lower body and core resistance exercises, yoga, and tai chi also improve balance No set intensity ≥2-3 d/wk or more No set duration As tolerated; balance training should be done carefully to minimize the risk of falls All adults with T2D should follow the same recommendations, with no more than two consecutive days between bouts due to the transient nature of exercise-induced improvements in insulin action (94, 95). Adults with comorbid health conditions and compromised older adults with T2D should aim to get as much aerobic activity as their physical and mental health allows. Resistance exercise training in older adults with T2D results in 10-15% improvement in strength, bone mineral density, lean mass, blood pressure, blood lipids, and insulin sensitivity (25, 96), along with 3-fold greater reductions in A1C (26). Notably, interventions that combine aerobic and resistance training may be superior to either one alone (21, 29, 30). Adults unable to meet current recommendations should focus on improving on functional fitness and balance. Exercises that enhance joint flexibility are highly beneficial for health and well-being in older adults with T2D. Limitations to joint mobility, resulting in part from glycation occurring with normal aging, may be accelerated by hyperglycemia (97). While stretching exercises increase range of motion and flexibility (98), they generally do not impact glycemia unless undertaken as part of another PA such as yoga (99). Flexibility exercises, alone or in combination with resistance training, has been shown to improve joint range-of-motion in individuals with T2D and facilitates participation in activities that require flexibility (98). Moreover, flexibility training is generally low-intensity and easier to perform, thereby providing one possible entry into a more physically active lifestyle for less fit and older adults (1). Many lower body and core resistance exercises double as balance training (100). Power training undertaken by adults with T2D can improve overall body balance (101). Balance exercises may reduce the risk of falls by improving balance and gait, even in adults with peripheral neuropathy (102, 103). At-home balance exercises may reduce risk of falls even without significant changes in leg strength in older adults with T2D at increased risk for falls (103). Along with traditional static and dynamic stretching, yoga, tai chi, and other types of PA may also provide health and glycemic benefits. Inclusive of basic stretching and strengthening activities, yoga may improve overall glycemia, lipid levels, and body composition in adults with T2D (46, 99, 104, 105). Tai chi training incorporates some balance, stretching, and resistance elements and may improve glycemia, reduce BMI and neuropathic symptoms, and increase balance and quality of life in adults with T2D and neuropathy (106, 107). Various forms of qigong may improve A1C levels and other health and fitness parameters including balance (106, 108, 109). Pilates may improve blood glucose management, along with functional capacity, in older adults with T2D (110). Thus, many alternate types of exercise and PA may be appropriate and beneficial for adults with T2D, especially individuals with lower initial fitness and poorer balance. Physical inactivity (i.e., sitting or lying while awake) increases the risk of T2D across all racial and ethnic groups (111). In sedentary adults with 9 h of sedentary behavior per day, 1 h extra of sedentary time daily over an 8-d period is associated with a 22% increase in the odds of developing T2D (112). Furthermore, greater sedentary time is related to hyperglycemia independent of aerobic fitness (113), although high levels of fitness can attenuate CVD risk factor clustering (114). In adults with T2D, the interruption of prolonged sitting with activity breaks, such as light-intensity walking or simple resistance activities for 3 min every 30 min over 8 h, decreases postprandial glucose, insulin, C-peptide, and triglyceride levels (115). Replacing sitting time with standing (2.5 h/d) and light-intensity walking (totaling 2.2 h/d) every 30 min may improve 24-h glucose levels and insulin sensitivity more than structured exercise (116). Bouts of stair climbing also have been effective at reducing postprandial glycemia (117, 118), but not necessarily A1C (119). Short 5-min breaks every h over 12 h more effectively lowered glucose and insulin levels than 1 h of moderate-intensity continuous exercise at the beginning of the day in people with impaired glucose tolerance (120), and short bouts of exercise (HIIE consisting of 6 × 1 min walking at 90% max HR) 30 min before meals reduces glucose levels more than a single 30-min bout of moderate walking (121). Small "doses" of PA to break up sitting moderately attenuate postprandial glucose and insulin levels, somewhat more than moderate continuous exercise, with greater effects in people with insulin resistance and a higher BMI (122). However, breaks from sitting have not been shown to lower hyperglycemia in free-living environments (123). Whether long-term use of breaks in sedentary time has clinically relevant glycemic benefits remains unclear. PA goals recommended for youth and adolescents with T2D are the same as for youth in the general population (92, 93). Childhood obesity and T2D occur in complex psychosocial and cultural environments making successful implementation of lifestyle interventions difficult (124). Youth with T2D manifest both insulin resistance and non-autoimmune β-cell failure similar to adults; however, youth-onset is associated with a more rapid decline in β-cell function and acceleration of diabetes complications. The Bright Bodies Weight Management Program for Children, a year-long 2x/wk exercise and nutrition/behavior modification program in youth with obesity without diabetes, reduced insulin resistance and T2D risk (125). In a multicenter study in youth with T2D (the TODAY Study), metformin therapy managed glycemia in half of participants, and the addition of rosiglitazone, but not lifestyle changes including PA, was superior to metformin alone (126, 127). A 12-wk gym-based, supervised program in adolescents with T2D improved endothelial function and health, independent of changes in insulin sensitivity (14). Thus, home-based and gym-based exercise and weight management programs should be encouraged for youth with T2D to enhance insulin sensitivity and cardiometabolic function and manage overweight and obesity. For most individuals planning to participate in a low- to moderate-intensity PA like brisk walking, no pre-exercise medical evaluation is needed unless symptoms of CVD or microvascular complications are present (1, 96). In adults who are currently sedentary, medical clearance is recommended prior to participation in moderate-to high-intensity PA. Although suggested by practice guidelines (Table 3), pre-exercise stress testing in asymptomatic adults with T2D remains controversial. One study reported that all participants with T2D had lower rates of major CVD outcomes (< 1%), with no differences between those who underwent stress testing (sedentary with 1 or more cardiac risk factors) and those who did not over 3.4 y, and pre-exercise stress testing did not reduce CVD events (128). In the Look AHEAD trial, only older age was associated with increased prevalence of all abnormalities during maximal exercise stress testing (129), and in the DIAD trial, more intensive testing did not alter event rates (130). Moreover, no evidence is available to determine whether pre-exercise evaluation involving stress testing is necessary or beneficial before participation in anaerobic or resistance training. Coronary ischemia is less likely to occur during resistance compared with aerobic exercise eliciting the same heart rate, and some doubt exists that resistance exercise induces ischemia (131–133). Indications for Pre-Participation Exercise Stress Testing In general, maximal graded exercise stress testing may be indicated for adults matching one or more of these criteria: • Age > 40 y, with or without cardiovascular disease risk factors other than diabetes • Age > 30 y and ○ Type 1 or type 2 diabetes >10 y duration ○ Hypertension ○ Cigarette smoking ○ Dyslipidemia ○ Proliferative or preproliferative retinopathy ○ Nephropathy including microalbuminuria • Any of the following, regardless of age ○ Known of suspected cardiovascular, coronary artery, or peripheral artery disease ○Autonomic neuropathy ○ Advanced nephropathy with renal failure Numerous acute and chronic health issues may arise around PA initiated by individuals with T2D. Of primary concern are exercise-related hypoglycemia and hyperglycemia. In addition, exercising with chronic health complications related to diabetes may require accommodations to ensure safe and effective PA participation. Individuals managing glycemia with lifestyle improvement alone have minimal risk for hypoglycemia (134). Use of select medications for T2D may increase the risk of exercise-related hypoglycemia, including insulin and insulin secretagogues (i.e., sulfonylureas and meglitinides) (7, 135–137). For example, pre-exercise insulin administration increases the risk of hypoglycemia during exercise, and both insulin dosing and timing must be considered. Carbohydrates may be needed if pre-exercise blood glucose levels are likely to lead to hypoglycemia during or following activities and medication doses are not lowered to compensate. No medication dose adjustments or carbohydrate intake is necessary for other oral diabetes medications or non-insulin injectables, such as GLP-1 agonists (96). Later-onset hypoglycemia is a greater concern when carbohydrate stores (i.e., skeletal muscle and liver glycogen) are depleted, but usually is not an issue for most recreational exercisers who are non-insulin users. While high-intensity exercise may be problematic for those taking insulin, finishing an exercise session with a short, high-intensity bout has been shown to be beneficial in preventing hypoglycemia in those not on insulin. Longer duration, high-intensity PA increases the risk for post-exercise hypoglycemia with use of insulin or its secretagogues (138). Clinical consensus recommendations state that if blood glucose is >300 mg/dL−1 (16.7 mmol/L−1), caution should be advised when exercising without or with minimal levels of blood or urinary ketones, but ketones are seldom measured or excessively elevated in individuals with T2D. Regardless, if blood glucose is elevated, individuals are advised to only begin light activity if they are asymptomatic and properly hydrated (96, 139). Activities that are short and intense (such as HIIE) may cause a transient increase in blood glucose that remains elevated afterward for a period of time (140, 141). Extra insulin (in users) and/or a lower intensity cool-down following intense activities may be used to reduce post-exercise glucose elevations, although no treatment is needed in most cases (140). Importantly, diabetic ketoacidosis, which normally is the result of hyperglycemia and elevated ketones, may occur with euglycemia or only moderate hyperglycemia in adults with T2D taking oral SGLT-2 inhibitors to manage blood glucose (142). Given these potential confounders, PA should only be undertaken when individuals with elevated blood glucose, even without overt ketosis, are feeling well. Aging alone negatively affects heat loss in both dry and humid environments (143), but T2D also appears to increase the risk of heat stress during PA, but not during passive rest (144). Impairments in whole-body heat loss are related to abnormal cutaneous vasodilation and decreased sweating (145), which can lead to increases in body temperature and heart rate. Consequently, many adults with T2D have a reduced ability to do PA, especially in warm environments, due to an impaired ability to thermoregulate, and with dehydration, their risk of chronic hyperglycemia increases (146). Moreover, certain diabetes-related comorbidities and medications may increase the risk of heat-related illness (147). Heat acclimation has been shown to be possible in adults with T2D engaging in aerobic or resistance training, though, with some improvements in exercise-generated heat dissipation and other factors after adaptation (148, 149). Nevertheless, individuals with T2D should be cautious when exercising in hot environments, although they may acclimatize to hotter conditions with regular PA. Recurrent hyperglycemia increases the risk for chronic complications of diabetes, including macrovascular complications (CVD, PVD and lower limb amputations) and microvascular complications (e.g. retinopathy, nephropathy, and peripheral and autonomic neuropathy (150–152). Prolonged daily sedentary time also increases the risk of T2D, CVD, and premature mortality, even when adjusted for PA levels (153, 154). Most individuals can engage in various types of PA safely and effectively despite having health complications. With regular training, they can anticipate significant and meaningful improvements when following general exercise training precautions (Table 4). Certain activities may be contraindicated due to existing health conditions, and special testing or pre-exercise preparation may be required (Table 5). In individuals with macrovascular diseases or cardiac autonomic neuropathy, pre-exercise screening should follow the guidelines set by ACSM (155) and ADA (96). General Exercise Training Considerations and Precautions Medical clearance (and exercise testing) prior to starting activities more vigorous than brisk walking is recommended for adults with signs or symptoms of cardiovascular disease, longer diabetes duration, older age, or other diabetes-related complications (95). Individuals should not begin exercise with a blood glucose >250 mg · dL−1 (13.9 mmol · L−1) if moderate or high levels of blood or urinary ketones are present. Use caution during PA with a blood glucose >300 mg · dL−1 (16.7 mmol · L-1) without excessive ketones, stay hydrated, and only begin if feeling well (95, 139). Individuals are advised to hydrate properly by drinking adequate fluids before, during, and after exercise, as well as avoid exercising during the peak heat of the day or in direct sunlight to prevent overheating. Particularly for anyone using insulin or taking sulfonylureas (and possibly meglitinides within 2-3 h of physical activity), it is important to carry rapid-acting carbohydrate sources during PA to treat hypoglycemia and have glucagon available to treat severe hypoglycemia (if prone to developing it). Physical Activity Precautions for Common Comorbid Health Complications Health Complication Precaution Autonomic Neuropathy • Be aware of an increased likelihood of hypoglycemia, abnormal blood pressure responses, and impaired thermoregulation, as well as elevated resting and blunted maximal heart rate. • Use of ratings of perceived exertion (RPE) is suggested to monitor exercise intensity. • Take steps to prevent dehydration and hyperthermia or hypothermia. Peripheral Neuropathy • Limit exercise participation that may cause foot trauma, such as prolonged hiking, jogging, or walking on uneven surfaces. • Non-weight-bearing exercises (e.g., cycling, chair exercises, swimming) may be more appropriate, but avoid aquatic exercise with unhealed plantar surface ulcers. • Check feet daily for signs of trauma and redness. • Choose shoes and socks carefully for proper fit and wear socks that keep feet dry. • Avoid activities requiring excessive balance ability. Diabetic Retinopathy • With unstable proliferative and severe retinopathy, avoid vigorous, high-intensity activities that involve breath holding (e.g., weight lifting and isometrics) or overhead lifting. • Avoid activities that lower the head (e.g., yoga, gymnastics) or that jar the head. • In the absence of a stress test measured maximal heart rate, use RPE to monitor exercise intensity (10 to 12 on a 6-20 scale). • Exercise is contraindicated for anyone with unstable or untreated proliferative retinopathy, recent panretinal photocoagulation, or other recent surgical eye treatment. • Consult an ophthalmologist for specific restrictions and limitations. Diabetic Kidney Disease • Avoid exercise that causes excessive increases in blood pressure (e.g., weight lifting, high-intensity aerobic exercise) and refrain from breath holding during activities. • High blood pressure is common, and lower intensity exercise may be necessary to manage blood pressure responses and fatigue. • Light to moderate exercise is possible during dialysis treatments if electrolytes are managed. Hypertension • Avoid heavy weight lifting or breath holding. • Perform dynamic exercises using large muscle groups, such as walking and cycling at a low to moderate intensity. • Follow blood pressure guidelines for activity levels. • In the absence of a measured maximal heart rate, use of RPE is recommended (10 to 12 on a 6-20 scale). Some studies have addressed optimal timing of exercise around meals and in general to maximize blood glucose management and other health benefits in T2D. In addition, while dietary eating patterns may be used to enhance blood glucose management, their impact on exercise remains equivocal. Most acute exercise studies have examined effects on glycemia around breakfast, demonstrating better management with light-or moderate-intensity aerobic exercise undertaken postprandially in individuals with T2D (156–158), but this glycemic benefit does not necessarily carry over to lunch (156, 157). Only one study found better glycemic management with exercise prior to breakfast (159). A comparison of 2 wks of morning or afternoon HIIE (3x/wk) training in men with T2D showed that afternoon sessions reduced blood glucose more than morning sessions, which actually increased glycemia (33). A 12-wk multimodal exercise training program found that either morning and afternoon sessions in men and women with T2D improved A1C, fasting glucose, and HOMA2-IR but not fructosamine, and postprandial glucose and insulin levels were similarly lowered following a mixed meal (160). When exercise was undertaken around dinner, better blood glucose responses occurred with self-selected-pace walking post-meal (161), and blood glucose and triglyceride levels were attenuated by post-meal resistance exercise (162). Overall, most studies have shown that postprandial exercise provides better glucose control by attenuating acute glycemic spikes, and greater energy expenditure postprandially reduces glycemia regardless of exercise intensity or type, with a longer duration (≥45 min) providing the most consistent benefits (61). Prevention or delay of T2D can be achieved with regular PA and maintenance of a healthy body weight, and individuals with T2D should focus on sustainable eating plans that consider the amount and timing of carbohydrate intake in combination with an active lifestyle to manage glycemia, insulin sensitivity, body weight, and CVD risk. According to the 2020-2025 US Dietary Guidelines for Americans (163), a healthy eating plan provides appropriate daily calories; highlights fruits, vegetables, and whole grains; includes reduced or non-fat dairy products, lean meats, poultry, fish, beans, eggs, and nuts; and is low in saturated and trans fats, cholesterol, salt, and added sugar. Whole foods-based eating is micronutrient dense, antioxidant rich, and beneficial in preventing and managing T2D (164). Carbohydrate restriction reduces body weight and improves glycemia (165–168), and use of popular diet options (i.e., low carbohydrate, ketogenic diet) and other eating patterns (i.e., Mediterranean, vegan) are frequently followed for T2D management (169, 170). Time-restricted feeding and intermittent fasting which have multiple definitions have become popular in recent years, but there are limited studies to date in individuals with T2D and the benefits to glycemic management are unknown. Caution is recommended when implementing a ketogenic diet that chronically restricts carbohydrate to ≤50 g/d to induce ketosis (170) as insufficient trials in individuals with T2D support this approach (165, 169, 170) and its impact on PA participation and exercise performance remains equivocal (167, 168, 171–173). Anti-diabetes medications are often co-prescribed with exercise for management of T2D. Some of these, as well as others taken for comorbid conditions, may impact the effectiveness of exercise participation. In addition, adults undergoing bariatric surgery to manage obesity and T2D may also be impacted by pre- and post-surgery exercise participation. Somewhat surprisingly, pilot studies on adults with insulin resistance have found that metformin, the most commonly prescribed medication for pre-diabetes and diabetes, may attenuate exercise-enhanced peripheral insulin sensitivity benefits following acute (174) and chronic exercise (175) training. In adults with T2D, the normal reduction in postprandial glycemia with metformin use also may be somewhat attenuated by exercise (176). Although it augments skeletal muscle glucose uptake during any PA (177) and improves glycemia in individuals with T2D (178), metformin has been found to potentially blunt AMP-activated protein kinase activity (174) and mitochondrial adaptations to aerobic exercise (179) and attenuate skeletal muscle hypertrophy after weight lifting (180) in healthy adults. Thus, metformin may be contributing to the inter-individual variability observed in exercise-induced improvements in insulin sensitivity and cardiometabolic health (181), but more research is needed in this area. As for other medications, both GLP-1 agonists and SGLT-2 inhibitors have glucose-lowering mechanisms and downstream metabolic impacts that may impact exercise-induced adaptations. GLP-1 agonists may improve A1C levels and fasting glycemia following aerobic exercise training in adults with T2D, but these findings have been confounded by significant weight loss (182). More research is needed on the interaction of all these medications and exercise. Insulin therapy is often a last option in T2D, but in men with T2D, similar reductions in time spent in hyperglycemia and reduced glycemic variations over 24 h were observed following a 45-60 min bout of exercise with and without insulin use (183). Individuals with T2D using insulin or insulin secretagogues are advised to supplement with carbohydrate (or reduce insulin, if possible) as needed to prevent hypoglycemia before and/or after exercise. β-blockers blunt the heart rate responses to exercise and lower maximal aerobic exercise capacity to ~87% of expected via negative inotropic and chronotropic effects (184). While their use may increase risk of hypoglycemia unawareness with PA by blunting adrenergic responses, β-blockers can increase exercise capacity in people with T2D and CVD by reducing ischemia during PA (185). In adults using β-blockers, ratings of perceived exertion (RPE) should be utilized to monitor exercise intensity rather than heart rate (186). In a small number of individuals, statin use has been associated with an elevated risk of myopathies (myalgia and myositis), particularly when combined with fibrates and niacin and hyperglycemia (187). Bariatric surgery is now considered the most effective way to improve glycemic management and achieve diabetes remission over the long term (188, 189); however, less than 10% of adults undergoing bariatric procedures meet PA recommendations pre-surgery, despite the nearly 40% of adults saying they feel ready to exercise 14 d before surgery (190). Preoperative exercise may benefit these individuals by lowering surgical risk and enhancing recovery, as well as reducing the length of hospital stays (191). Increases in VO2peak are also associated with reduced operating time and improved quality of life despite no additional effect on blood glucose levels or insulin sensitivity (192, 193). Others have suggested increased exercise pre-surgery increases the propensity for being active afterward (194). Aerobic exercise training following surgery may further enhance weight maintenance, glycemic management, and insulin sensitivity (195–197), lower risk of CVD, enhance endothelial function (198), and improve cardiac autonomic regulation (199). Resistance exercise training may reverse muscle strength deficits frequently observed after bariatric surgery (200). Exercise training is also effective in ameliorating surgery-related bone loss (201, 202), which is common following bariatric surgery (203–205). Barriers to PA participation are similar among people with and without diabetes and include lower self-efficacy (206), inappropriate goal-setting (207), lack of access to facilities (208), lack of supervision or social support (209–211), and inattention to cultural nuances (212). Health issues like obesity and knee and hip osteoarthritis may also be barriers as they negatively impact self-efficacy related to PA participation (213). The built environment, or human-made surroundings, may also impact the ability and willingness to be regularly active (208), and may include availability of facilities, having pleasant and safe places to walk, and access to green spaces (214, 215). Focusing on creating more exercise-friendly environments is likely to promote greater participation. Setting realistic goals with appropriate activities, slower progression, and supportive feedback can increase success and confidence (216–218). Counseling by health care professionals may also be a meaningful and effective source of support (219). Likewise, supervision of exercise sessions improves compliance and glycemia (220). The prevalence of physical inactivity, obesity, and T2D are significantly higher among non-Hispanic Blacks, American Indian/Alaskan Natives, and Hispanics than among non-Hispanic Whites (4, 221–224). The disproportionate burden of these conditions is likely more attributable to social and environmental determinants in these racial and ethnic minorities than biological differences (225, 226). Physical education in schools, limited open spaces for outdoor activities, inadequate infrastructure for active transportation, unsafe environments, and hypercaloric diets are dominant environmental factors that contribute to T2D development (225–232). Community environments that promote PA are associated with a lower incidence of T2D (227, 233–235); therefore, efforts that promote long-term health outcomes and target environmental factors may reduce T2D (235, 236). Neighborhood walkability, PA resources, and access to green spaces may reduce T2D risk (215, 235), while living in urban settings may raise it. Large scale clinical trials in T2D are needed to understand optimal treatment regimens and importance of PA and exercise, other lifestyle changes, and medications on glycemia. Further work is warranted to elucidate the cognitive domains that are most responsive to PA and dietary improvements in adults with T2D, as well as exercise effects on memory and cognitive function related to glycemic management. More research on the effect of exercise training on vascular function and the microbiome needs to be conducted in individuals with obesity and with and without T2D. Longer duration training is needed to establish whether exercise timing modifies the glycemic response to meals as well as overnight levels and if specific time of day of planned exercise should be prescribed. While prolonged sitting has been found deleterious in research settings, studies on PA breaks in daily life are necessary to determine whether long-term use has clinically relevant glycemic benefits in populations with T2D. Potential interactions between diabetes medications like metformin and exercise training need to be further investigated with respect to their impact on glycemic management. Social and environmental factors have also been associated with physical inactivity and the incidence of T2D and these factors need to be explored further. Targeted research is needed to better define the health disparities that exist across racial, ethnic, and potentially socioeconomic populations and how their impact on PA participation for T2D and prediabetes prevention and management can be mitigated. Larger clinical trials examining the impact of chronic high-intensity exercise on mitochondrial function and glucose tolerance in a population with obesity and with and without T2D are needed. Various types of physical activity, inclusive of but not limited to planned exercise, can greatly enhance the health and glycemic management of individuals of all ages with T2D, including flexibility and balance exercise in adults. The latest Physical Activity Guidelines for Americans are applicable to most individuals with diabetes, including youth, with a few exceptions and modifications. All individuals should engage in regular physical activity, reduce sedentary time, and break up sitting time with frequent activity breaks. Physical activity undertaken with health complications can be made safe and efficacious, and exercise training undertaken before and after bariatric surgery is warranted and may enhances its health benefits. Finally, barriers to, and inequities in, physical activity and exercise adoption and maintenance need to be addressed to maximize participation. Supplemental Data File (.doc, .tif, pdf, etc.) Consensus Statements and Recommendations • Regular aerobic exercise training improves glycemic management in adults with type 2 diabetes, with less daily time in hyperglycemia and 0.5–0.7% reductions in overall glycemia (as measured by A1C). • High-intensity resistance exercise training has greater beneficial effects than low-to-moderate-intensity resistance training in terms of overall glucose management and attenuation of insulin levels. • Greater energy expenditure postprandially reduces glucose levels regardless of exercise intensity or type, and durations ≥45 min provide the most consistent benefits. • Small "doses" of physical activity throughout the day to break up sitting modestly attenuate postprandial glucose and insulin levels, particularly in individuals with insulin resistance and a higher body mass index. • Weight loss (accomplished through lifestyle changes in diet and PA) of >5% appears to be necessary for beneficial effects on A1C, blood lipids, and blood pressure. • For reductions in visceral fat in individuals with type 2 diabetes, a moderately high volume of exercise (~500 kcal) done 4–5 days a week is needed. • In youth with type 2 diabetes, intensive lifestyle interventions plus metformin have not been superior to metformin alone in managing glycemia. • Despite the limited data, it is still recommended that youth and adolescents with type 2 diabetes meet the same physical activity goals set for youth in the general population. • Pregnant women with and without diabetes should participate in at least 20–30 minutes of moderate-intensity exercise most days of the week. • Individuals with type 2 diabetes using insulin or insulin secretagogues are advised to supplement with carbohydrate (or reduce insulin, if possible) as needed to prevent hypoglycemia during and after exercise. • Participation in an exercise program prior to bariatric surgery may enhance surgical outcomes, and after surgery participation confers additional benefits. 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[DOI] [PMC free article] [PubMed] [Google Scholar] 236.Diabetes Canada. The Built Environment and Diabetes: A Position Statement. Ottawa, 2020. [Google Scholar] This section collects any data citations, data availability statements, or supplementary materials included in this article. Supplemental Data File (.doc, .tif, pdf, etc.) Begin by moving more throughout your day, like taking short walks or stretching every 30 minutes. Doing a variety of activities also helps you avoid injuries and get a range of health benefits. The current exercise guidelines for people with type 2 diabetes are largely consistent with the general population's exercise guidelines, with some specific considerations. When prescribing exercise, we look to use "FITT Principles". FITT (frequency, intensity, time and type) principles provide a structured approach to designing an effective exercise program. By using FITT principles, programs can be tailored to meet the unique needs and goals of an individual. The Commonwealth Department of Health provides physical activity guidelines for adults, including those with type 2 diabetes. Here are the guidelines for adults: Frequency: Aim for at least 150 to 300 minutes (2.5 to 5 hours) of moderate intensity physical activity or 75 to 150 minutes (1.25 to 2.5 hours) of vigorous intensity physical activity. You can also aim for a combination of both per week. It is recommended to be active on most, preferably all, days every week. Intensity: Moderate intensity physical activity should make you breathe harder than normal, but you should still be able to speak in full sentences. Vigorous intensity physical activity should make you breathe hard and fast, and you should only be able to say a few words without pausing for breath. Time: Physical activity should be accumulated in bouts of at least 10 minutes duration. Type: A combination of aerobic and muscle-strengthening activities is recommended. Aerobic activities can include brisk walking, jogging, cycling, swimming and dancing, while muscle-strengthening activities can include lifting weights, resistance band exercises and bodyweight exercises. Example programs The following are some general examples of how these principles may be implemented in an exercise program. However, it's important to note that every person's needs and abilities are unique, so it's important to find an exercise routine that works for you and to always consult with your healthcare provider before starting a new exercise program. Please do not use this information as individual advice. *** Please note that these are just examples of weekly exercise routines that are designed not for an individual’s use but an example of how these guidelines may be implemented. Introductory program example: Monday Tuesday Wednesday Thursday Friday Saturday Sunday 30 minutes of moderate intensity walking 30 minutes walking 30 minutes of body weight exercises 30 minutes walking 30 minutes walking 30 minutes of body weight exercises 30 minutes walking Intermediate program example: Monday Tuesday Wednesday Thursday Friday Saturday Sunday 20 minutes weight based training program + 20 minutes moderate walking Rest day or 30 minutes Yoga exercise 45 minutes walking moderate intensity 20 minutes weight based training program + 20 minutes moderate walking Rest day or 30 minutes Yoga exercise 20 minutes weight based training program + 20 minutes moderate walking 45 minutes walking moderate intensity Advanced program example: Monday Tuesday Wednesday Thursday Friday Saturday Sunday 30 minutes vigorous running Rest day 30 minutes high level strength gym session Rest day 30 minutes spin class 30 minutes high level strength gym session 1 hour swimming moderate intensity or 1 hour dance class moderate intensity Some considerations for high intensity activity If you're living with diabetes and looking to start high-intensity exercise or if you have other health complications that put you at a higher risk for cardiovascular disease, it's important to take some extra precautions to ensure that you're exercising safely. Current recommendations are that you seek individual healthcare assessment and advice from a suitable healthcare provider before starting a new exercise regimen. This is especially important if you have elevated blood pressure or cholesterol or if you smoke. To get the most personalised and effective exercise plan, consider consulting with an accredited exercise physiologist who specialises in working with individuals living with diabetes. They can help you assess, prescribe and review your exercise routine to make sure it's safe and effective for you. With the right guidance, you can enjoy the many benefits of high-intensity exercise while keeping your health in check. For a personalised program, reach out to us at Exercise for Rehabilitation & Health or find an exercise professional near you. Disclaimer: The opinions expressed in this article are those of the authors and not necessarily endorsed by Diabetes Victoria. Please consult your healthcare professional before making changes to your diabetes management. Please note: If you take insulin or a sulphonylurea medicine, you are at risk of hypoglycaemia or hypo – a glucose level of less than 4mmol/L. Any type of activity or exercise increases your risk of hypoglycaemia. These can occur during your activity and for many hours afterwards. It is important to carry hypo treatment with you when you exercise. When you have type 1 diabetes, you are also at risk of developing ketones with exercise if you do not have enough insulin in your body. If your glucose level is 15mmol/L or more, you need to check for blood ketones. If your blood ketones are 0.6mmol/L or more, you should not exercise until these are cleared. Please speak to your diabetes team for further information and guidance. Physical activity is one of the essential parts of type 2 diabetes management. It helps us prevent complications and reduces the risk factors of diabetes complications by strengthening the circulatory system. When performed regularly, exercise helps to prevent or delay a type 2 diagnosis in people diagnosed with pre-diabetes. Dedicating time to perform moderate-intensity exercises can help reduce your A1c. If you’re at risk or are living with type 2 diabetes and want to become more active, this guide serves to help you break from the sedentary lifestyle and help you move more. Before Beginning a New Workout Regimen It’s great that you’re excited to get moving—we’re excited for you! But before you start a new exercise regimen, see your doctor for a thorough physical exam to identify and address any cardiovascular, kidney, vision and orthopedic issues. To assess the risk of diabetes complications and other health risk factors, your doctor may conduct lab work to test your A1c and lipids, such as cholesterol and triglycerides, to ensure they’re within normal range. Also, when you’re at the doctor’s office, consider taking a stress test, which measures how your heart works during physical activity, how healthy your heart is, and if there are any irregularities. If you have diabetes, a stress test may be conducted to check for coronary heart disease. You should consider taking a stress test if: Have a family history of heart disease and other cardiovascular health issues Have experienced chest pain Experiencing shortness of breath Have a history of diabetes complications How Exercise Helps Control Diabetes Physical activity uses stored glucose, called glycogen, from your muscles. Once glycogen has been used, your liver uses fat to cover the increased energy demand. When a person with diabetes exercises, their glucose tolerance and insulin sensitivity improve due to the muscles’ improved reception of insulin. After exercise, glycogen in the muscles has to be replaced. Depending on the intensity of the workout, the energy requirements may change, which can cause blood sugar to lower for as long as 12 to 24 hours as the body replaces glycogen. Building Your Workout Plan There are different ways to start working out today. You can become more active by daily activities such as chores or going for a walk each day. Track how often you’re moving by using a pedometer to measure your daily steps. Aim for workouts for a mix of resistance and aerobic training that use large muscle groups like your legs, back and core. However, we know not everyone wants to lift weights, so maybe walking or learning how to train as a runner may be more your style. Certain exercises can also impact your glucose levels in different ways. Aerobic exercise, such as jogging, tends to drive blood glucose down. However, certain high-intensity or anaerobic exercises, such as weight lifting, can increase blood glucose. It’s important to listen to your body, check your blood glucose often and look for patterns to help you adjust routines. Drink Water During workouts, your body attempts to cool itself by sweating as your muscles generate a large amount of heat. As water leaves your body, replace it with more water. The lack of hydration can cause an increase in core body temperature will occur increasing the risk of heat exhaustion and heat stroke. Here’s when you should drink water before, during and after physical activity according to the American Council on Exercise: Drink 17 to 20 ounces of water two to three hours before exercise. Drink 8 ounces of water 20 to 30 minutes before you start exercising or during your warm-up. Drink 7 to 10 ounces of water every 10 to 20 minutes during exercise. Drink 8 ounces of water no more than 30 minutes after exercise. Before Your Workout Allowing yourself time to fuel up with enough carbohydrates is hugely important to avoid hypoglycemia. You may find yourself increasing the number of finger pricks before

exercising to ensure you're in an optimal range. If you need, blood glucose can then be raised in the 30 minutes before exercise by eating carbohydrates, like fruit. During Your Workout It's important to pay close attention to your body so you can manage blood glucose changes quickly. Always have the following on hand: Diabetes supplies (glucose meter, insulin, syringes and spare pump supplies) Fast-acting sugar (sports drink/glucose tablets) Water Food After Your Workout It's important to replenish glycogen stores post-activity. The effects of exercise can be felt for upwards of 24 hours. Hydration is crucial. Consuming "slow" carbohydrates, those with fat and/or protein is also key. How to Monitor Your Progress It is important that you monitor your blood glucose and blood pressure for the first few days when you start a workout session. It is recommended that you test your levels before, during and after exercise, to keep a record so your doctor and nutritionist can make the relevant changes in your medications and your nutritional program. Tracking your progress can help you stay motivated and make any changes to your workout plan. You can do this with a smartwatch, smartphone and various apps to keep monitoring your progress. If you need extra help, consider asking your doctor to help you start a log or find a workout and accountability partner. You should also look into footwear and sportswear. Shoe stores can help you get fitted for the correct size and may have orthopedic shoes specifically for people with diabetes. However, if you're looking for a more personalized fit, especially if you're at high-risk or experiencing foot complications and neuropathy, consider seeing a podiatrist or a perdorthist. For athletic clothes, wear breathable fabrics to prevent chafing and fungal infections. Another component of exercise is to be aware of hypoglycemia and how to treat it. Monitor your blood glucose during your workout and carry a source of simple carbohydrates with you, such as a juice box, gel, or candy containing between 15-20 grams of carbs. When You Shouldn't Exercise If you suffer from acute infections or fever because can increase the risks of hyperglycemia. If there are ketones in your urine. If the baseline heart rate is above 100 beats per minute. If your blood glucose is equal to or greater than 13.9 mmol/L250 mg/dL. Why? Insulin is the hormone that is responsible for transporting glucose where it is needed. If you are insulin deficient and exercise, other hormones called counterregulatory (epinephrine, norepinephrine, glucagon, growth hormone and cortisol) will release more glucose to meet the requirements of physical activity. This leads to higher blood sugar which could lead to metabolic ketoacidosis and diabetic coma. Therefore, you should wait until you're within your target blood sugar range before exercising. However, consult with your diabetes care team for personalized advice on how to adjust any medication and exercise regimen in the event of high blood sugar levels. Working Out with Diabetes Complications Neuropathy The pain from neuropathy can interfere with one's willingness to exercise. But, luckily, there are ways to get in a good workout that minimizes that pain. People diagnosed with neuropathy should avoid weight-bearing exercises that are heavy on the feet, this includes jogging and walking and opt for exercises such as stationary biking and swimming. Other exercises include flexibility, balance and strength training exercises such as calf raises, hip extensions and calf extensions. If you experience pain from neuropathy during your workout, do not push through the pain because it further damages and increases inflammation of your nerves. Check for blisters, sores and cuts on your feet and legs after each workout and treat accordingly. For more assistance, you may want to work with a physical therapist to manage the effects of neuropathy. Retinopathy Exercises by people diagnosed with retinopathy depend on its severity. People with advanced or severe retinopathy should avoid exercises such as heavy lifting, boxing, and the Valsalva maneuver during weightlifting. Nephropathy People with nephropathy should avoid exercises that are strenuous and other high-intensity workouts. At the end of the day, choose the best workout plan that best suits your diabetes and health goals, will be fun for you and will keep you motivated. Also, as your needs change, your physical activity goals will as well. Remain adaptable and change your workout plan as necessary or as directed by your physician. Join the Beyond Type 2 Community! 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How much exercise should I do? Benefits of exercise Exercising safely with diabetes Exercise programs for people with diabetes A guide to BGLs and exercise Steps to get started with exercise Exercise advice for people with type 1 diabetes For good health, Australian's should aim for at least 30 minutes of moderate intensity physical activity every day. You may choose to do this all at once or you can split it up into shorter bouts of 10-15 minutes. Moderate intensity physical activity is being active enough that your heart is beating a little bit faster and you are "lightly puffing" but can still hold a conversation. If you can sing or whistle a tune, you need to work a little bit harder. Keep in mind that the above recommendations are for general health – if your goal is to lose weight you may need to do more than 30 minutes. Finding the motivation to exercise is often more challenging than exercising itself. It's important to find your own source of motivation, in order to achieve your exercise goals and keep you moving long term. Our top five tips to keeping motivated: Join a friend – You'll be more motivated to keep up your exercise schedule if you know someone else is relying on you. Plan ahead – Dedicate time each day to exercise, it will be easier to keep to a schedule and you will start to form a routine. Keep a diary – Track your progress and set goals, if you can see how well you're tracking you're more likely to keep up the good work. Motivation – Surround yourself with positive role models to remind you why exercise is important and encourage you to continue. Reward yourself – Treat yourself to new exercise gear or a massage to keep you motivated and celebrate your achievements. Physical activity is one of the best things you can do for your overall health. Being physically active every day is important for people of all ages and has a positive impact on physical and mental wellbeing. For a person with diabetes, exercise can help: Insulin to work better, which will improve your diabetes management Reduce insulin resistance and reduce blood glucose levels Improve joint and muscle movement, and strengthen bones Maintain a healthy weight Lower your blood pressure Reduce your risk of heart disease Reduce stress and anxiety Improve your sleep. Warning – Don't take part in strenuous physical activity if you are feeling unwell or have ketones present in your blood or urine. Exercise is important but before you start, make sure you assess safety first by considering the following: See your GP for exercise clearance, especially if your BGLs are consistently out of your target range. Consider seeking advice from an Accredited Exercise Physiologist for an exercise program tailored to your individual needs. You can get advice from your podiatrist or GP to choose appropriate footwear. It is a good idea to wear enclosed shoes and to check your feet before and after exercise for any changes or concerns. Plan to do your physical activity at regular times on set days to reduce the chance of hypoglycaemia. Plan what exercise you'll do, how often, for how long and at what intensity. Talk to your diabetes educator particularly if you're balancing medication. Read more about BGLs and exercise. If you wear medical alert identification, such as a bracelet or chain, ensure you have this on. Apply sunscreen and protect your head and body against the sun. Drink plenty of water before, during and after exercising to avoid dehydration. Ask yourself: Am I feeling well? It is not recommended that you exercise when you are feeling unwell. Take time out to rest and start exercising again when you are feeling better. Have I checked my BGL? When you are starting a new exercise routine or changing your current routine, it is important to check your BGLs more regularly. For people who require blood glucose lowering medication or insulin you should check your BGLs before, during and after exercise to avoid hypoglycaemia. Check your BGLs every 20-30 minutes if the intensity, type or duration is new to you, or you experience symptoms of hypoglycaemia or hyperglycaemia. Check your BGL and monitor it for up to 24 hours. Have a carbohydrate snack or meal, if required. Be aware of overnight hypoglycaemia. Have a low GI snack before bed if you think your BGLs might drop during the night. If you require blood glucose lowering medication or insulin you may need to adjust your dose as your BGL reduces as a result of the exercise. This is particularly important if you are exercising at a high intensity or for longer than 30 minutes at a time. Speak to your health care team before making any changes to your medication dose. To find out more about our exercise programs, such as Beat It and Ready Set Go – Let's Move, visit our education and events section. Discover the effects of your blood glucose levels and exercise. < 4mmol/L: A BGL less than 4mmol/L is usually referred to as hypoglycaemia. Exercise should be postponed until you have treated your hypoglycaemia. 4mmol/L – 5mmol/L: Have a small amount of carbohydrate. I.e. piece of fruit or small glass of milk before you start exercising. 5mmol/L – 10mmol/L: This is the ideal BGL range to exercise. Let's get moving! 10mmol/L – 14mmol/L: Caution needs to be taken with BGLs consistently over 10mmol/L, consider gentle exercise and see your GP to discuss ongoing treatment. 15mmol/L: If your BGL is more than 15mmol/L postpone strenuous exercise. This is considered 'hyperglycaemia' and can cause BGLs to rise further and lead to dehydration. Exercising when BGLs are above 15mmol/L can also lead to the production of ketones for people with type 1 diabetes. While exercise is generally a safe activity, there are some warning signs to look out for. These signs let you know that you may have overdone it, or your body is having an abnormal reaction to exercise. If you experience any of the following during exercise, stop and rest. Chest, abdominal, neck, jaw or arm pain or tightness Palpitations, irregular or racing heart beat Feeling faint, light headed or dizzy Leg cramps or pain Symptoms of hypoglycaemia (stop immediately and treat!) If the pain/symptom does not go away within five minutes, seek urgent medical attention – dial 000. If the symptom subsides see your GP before starting exercise again. Remember to always discuss your exercise plans with your GP or an Accredited Exercise Physiologist especially if you have been inactive for a long time, have any medical conditions or injuries. Being active can help you manage your diabetes by keeping your blood glucose levels (BGLs) within your target range and helping you to achieve and maintain a healthy weight. It also helps you to relieve stress, sleep better, feel fitter, have stronger bones and is an opportunity to interact with your family and friends and meet new people. The National Physical Activity Guidelines for Australian Adults recommend: Think of movement as an opportunity, not an inconvenience. Be active every day in as many ways as you can. Engage in at least 30 minutes of moderate-intensity physical activity on most, preferably all, days of the week. Do muscle strengthening activities on at least 2 days per week Break up long periods of sitting as often as possible, and If possible, also enjoy some regular, vigorous activity for extra health and fitness. Doing any physical activity is better than doing none. If you are new to exercise, start off by doing small sessions of your chosen activity – just 10-minute bouts are enough to gain benefit. Gradually, as your fitness improves, increase this to 30-60 minutes. Adults are recommended to be active on most, preferably all, days of the week. Exercise done consistently throughout the week helps to improve the body's ability to use glucose for energy. Research shows this effect only lasts for 24-72 hours though, so we need to do it regularly! How 'intense' your exercise is impacts upon how often it is recommended you do that activity. Which is your preferred exercise intensity level? Moderate intensity exercise – If you are "lightly puffing" and you can hold a short conversation – you're exercising at a moderate intensity. The guidelines recommend you do between 150-300 minutes of moderate intensity exercise each week. Vigorous intensity exercise – You would be short of breath but able to speak up to one sentence if you're doing vigorous intensity exercise, which is a little more difficult to sustain than moderate intensity exercise. The guidelines recommend you undertake between 75-150 minutes of vigorous intensity exercise each week, if you are able. Why not mix it up? Try doing both moderate and vigorous activity each week to make up the recommended amount and to keep it interesting! Remember, it's not just what exercise we do – but how we do it that will help improve our health. Exercise that is too light may not give you the recommended health benefits while exercise that is too hard can place you at risk of over-training and injury. Undertake muscle strengthening activities on at least 2 days each week. Strengthening activities include anything that requires your body to move against a weight or gravity. This would include activities such as lifting tins of food, repeated sitting and standing from a chair or seated leg raises. Minimise the amount of time spent in prolonged sitting. Break up long periods of sitting as often as possible. Meet a friend for a walking date rather than a coffee, stand on public transport rather than sit or ask whether your workplace can provide standing workstations. Here are some suggestions for you to discuss with your doctor: Walking Swimming Cycling/ exercise bike Dancing Gardening Golfing Weight training Tai Chi Water aerobics Increasing your general physical activity is also helpful, e.g. taking the stairs instead of the lift, moving during the ad breaks of your favourite TV program, completing housework, and gardening. Avoid watching too much TV or sitting at the computer for a long time. Regular exercise is an important part of your diabetes management. It will help your insulin to work more efficiently and assist with your blood glucose management. However, if you have fluctuating or high blood glucose levels (i.e. fasting blood glucose levels greater than 14 mmol/L and urinary ketones), it is best to avoid exercise until your blood glucose has settled. Exercise in these circumstances can actually elevate blood glucose and increase ketone production. It may be necessary to reduce your insulin dose prior to exercise, depending on the intensity and duration. Insulin adjustment will vary with each individual so it is important to discuss appropriate adjustments with your doctor or Credentialled Diabetes Educator. You may also require extra carbohydrate before, during and after exercise. Discuss adjusting carbohydrate intake with your doctor or dietitian. Exercise has many benefits for people with diabetes, especially when combined with healthy eating.Before you start exercising, make sure you have an individualised diabetes management plan, and a health check with your GP.An exercise physiologist can develop a personalised exercise plan for you.Check your blood glucose levels (BGLs) before, during and after exercise to see how the exercise you are doing affects them.If your BGLs are above the normal range before exercise refer to your diabetes management plan. If you are unwell and your BGLs are high, avoid exercising until your BGLs have returned to the normal range and you are feeling better.If you have type 1 diabetes and you are unwell, avoid exercise until you feel better as you may be at risk of ketoacidosis.Always carry portable hypoglycaemia treatment with you if you take insulin or sulphonylurea medication.If you have existing diabetes complications such as eye or kidney problems, check with your diabetes specialist if it is safe to do certain types of activity. Exercise has benefits for everyone, including people with diabetes, especially when combined with healthy eating. Benefits of exercise According to Australia's Physical Activity and Exercise Guidelines (2021) it's important to exercise regularly. The exact type and amount of exercise is dependent on your age and other circumstances, such as pregnancy. These guidelines are applicable to people with diabetes as well, but speak with your doctor before commencing any new activity. The guidelines recommend the following physical activity: Children – 3 hours of various physical activities each day, including energetic play such as crawling, walking, jumping, dancing. Adults (17 – 64 years) – 2.5 to 5 hours of moderate intensity physical activity per week such as a brisk walking, golf, mowing the lawn or swimming and 1.25 to 2.5 hours of vigorous intensity physical activity per week such as jogging, aerobics, fast cycling, soccer or netball. Older adults (64 years and over) – 30 minutes of moderate intensity physical activity on most days such as walking, shopping, gardening. None of these activities need to be done all at once. Several shorter sessions can add up over the day. Exercise helps to: If you are at risk of type 2 diabetes, exercise can be part of a healthy lifestyle that can help to reduce this risk. Diabetes – precautions to take before starting an exercise program While exercise has many benefits it is also important to know about some guidelines for diabetes and exercise. This makes exercise safer and more enjoyable. People with diabetes are at increased risk of heart and blood vessel disease and foot problems, so it's important that your exercise is right for you. People with type 1 diabetes and people with type 2 diabetes using insulin or some glucose-lowering medications called sulphonylureas are at risk of hypoglycaemia, and their risk increases during and after exercise. Speak with your doctor if you are unsure of the type of medication you are taking. Make sure you have an individualised diabetes management plan – your diabetes health professional can help you with this. If you have never exercised before, start with low impact exercise such as walking and go slowly. This will help build exercise tolerance. You will also be more likely to continue doing regular exercise and prevent injuries. Consider seeing an exercise physiologist for an individualised exercise program. This is especially helpful if you have pain or limited movement. Discuss with your doctor or diabetes educator the most appropriate areas of the body to inject your insulin, especially during exercise. People who have had diabetes for a long time or those who have consistently high BGLs are at higher risk of developing foot problems. If you have nerve damage to your feet (called peripheral neuropathy) this makes you more prone to injury and to problems such as foot ulcers. The health of your feet should be checked regularly by a podiatrist to make sure you are safe to do the exercise you are planning. You can prevent foot injuries and infections by: wearing well-fitting socks and shoes – check that shoes are long enough, wide enough and deep enough wearing the right shoe for the activity you are doing inspecting your feet daily having annual foot checks by a podiatrist reporting to your doctor any changes to your feet, such as redness, swelling or cuts or wounds, as soon as you detect them. Diabetes, exercise and blood glucose levels Exercise causes your muscles to use more glucose, so it can lower your BGLs. It is important for people with diabetes to keep track of their BGLs before, during and after exercise. Hypoglycaemia Hypoglycaemia or a low BGL (4.0 mmol/L or less) can occur in people who inject insulin or take a type of glucose lowering medication (sulphonylurea). Exercise causes your muscles to use more glucose. This lowers your BGLs. For people taking insulin or diabetes tablets (which make you produce more insulin) there is a risk of your BGLs going too low. Check your BGLs before during and after exercise to see how the particular exercise you are doing affects your BGLs. The type, length of time (duration), your fitness level and intensity of exercise can all have an effect. You can reduce your risk of hypoglycaemia during and after exercise by: checking your BGLs before exercise – make sure your BGL is at least 7.0 mmol/L before exercise checking your BGL regularly during and after exercise increasing your carbohydrate intake as necessary according to intensity, duration and type of exercise decreasing medication or insulin as necessary, after talking to your doctor. Your risk of hypoglycaemia during exercise is increased if: you have type 1 diabetes you inject insulin or take a sulphonylurea you have had recurring episodes of hypoglycaemia you are unable to detect the early warning signs and symptoms of hypoglycaemia you have an episode of hypoglycaemia before exercise (as both exercise and hypoglycaemia reduce your ability to detect further hypoglycaemia) you have drunk alcohol before exercise (alcohol reduces your ability to detect hypoglycaemia). Always take easy to carry hypoglycaemia treatments with you if you are at risk of hypos, such as jelly beans or glucose gel and wear a medic alert bracelet. Hyperglycaemia Hyperglycaemia is another way of saying that BGLs are too high (over 11 mmol/L). Exercising when your blood glucose is higher than normal can lower your levels. However, if you are unwell and your BGLs are very high it is best to avoid exercising until your BGLs have returned to the normal range. People with diabetes who have BGLs above the normal range are more at risk of dehydration so increase your fluids to stay hydrated when you exercise. If you have type 1 diabetes refer to the 'Diabetes, exercise and ketoacidosis' section below. Diabetes, exercise and ketoacidosis People with type 1 diabetes are at risk of developing a build-up of ketones (ketoacidosis) if they are unwell or have forgotten to take their insulin. If you have type 1 diabetes and you are unwell, avoid exercise until you feel better. If your BGL is above 15 mmol/L and you have positive blood or urine ketones, you need to clear the ketones from your blood before beginning exercise. Extra insulin is needed to clear ketones. Ask your diabetes health professional for an individual management plan. People with type 2 diabetes are generally not at risk of developing dangerous levels of ketones (unless taking a SGLT-2 inhibitor) and therefore do not need to check for them. Diabetes complications and exercise If you have existing diabetes complications such as heart, eye or kidney problems, check with your diabetes specialist if it is safe to do certain types of activity. They can advise you about which types of exercise to avoid in order to prevent worsening complications. Where to get help This page has been produced in consultation with and approved by: This page has been produced in consultation with and approved by: This page has been produced in consultation with and approved by: Content on this website is provided for information purposes only. Information about a therapy, service, product or treatment does not in any way endorse or support such therapy, service, product or treatment and is not intended to replace advice from your doctor or other registered health professional. The information and materials contained on this website are not intended to constitute a comprehensive guide concerning all aspects of the therapy, product or treatment described on the website. All users are urged to always seek advice from a registered health care professional for diagnosis and answers to their medical questions and to ascertain whether the particular therapy, service, product or treatment described on the website is suitable in their circumstances. The State of Victoria and the Department of Health shall not bear any liability for reliance by any user on the materials contained on this website. Type 2 diabetes is a chronic condition that occurs when your body isn't able to properly use insulin. Insulin is a hormone made by the pancreas. People with type 2 diabetes either can't produce enough insulin, have cells that are resistant to the insulin they make, or have a combination of both. Your blood glucose (blood sugar) rises when your body lacks insulin. The way your body uses insulin can seem complicated. Your body converts the nutrients from your food into glucose. The glucose enters your bloodstream, and then your pancreas is able to release insulin into your bloodstream. Insulin uses glucose as energy to fuel your body or store it for later use. That process doesn't work as it usually does if you have type 2 diabetes. Your cells may be resistant to the insulin your pancreas produces, or your pancreas might not produce enough insulin. The glucose remains in your bloodstream instead of your body using it as energy. High glucose levels in the blood can affect your organs and tissues over time. Getting treatment for type 2 diabetes is important. Complications like heart disease, kidney disease, nerve damage, and vision loss can happen if left untreated. Type 2 diabetes is a common disease that you can manage with the right treatment and lifestyle changes. Type 2 diabetes is the most common type of diabetes mellitus (diabetes), accounting for 95% of all cases. There are subtypes of type 2 diabetes, which include: Mild age-related diabetes (MARD): This is the most common subtype of type 2 diabetes and represents 39% of cases. People with MARD have some difficulty controlling their blood sugar levels. They generally have few complications. The risk of MARD usually increases with age.Mild obesity-related diabetes (MOD): MOD usually affects people who have obesity, representing nearly 22% of cases. People with MOD do not resist insulin. MOD is generally a mild form of type 2 diabetes and causes very few complications.Severe insulin-deficient diabetes (SIDD): This subtype represents about 18% of cases. People with SIDD generally are young and have a healthy weight. They produce little insulin and may have a poor metabolism. Common complications of SIDD are blindness and nerve damage. Severe insulin-resistant diabetes (SIRD): SIRD accounts for about 15% of cases. People with SIRD may have obesity and can have insulin resistance. Kidney and liver issues are common. Some people may have prediabetes. This health condition occurs when your blood sugar is slightly higher than normal but not yet in the range for type 2 diabetes. Prediabetes affects one in three adults in the United States. You can reverse prediabetes through lifestyle changes, such as managing weight, eating nutritious foods, and exercising regularly. You may experience a wide range of type 2 diabetes symptoms. These include: Blurry visionDry skinFatigue and weaknessFeeling very hungry or thirstyFrequent urinationIrritabilityPain, tingling, or numbness in your hands and feetSores, cuts, and bruises that are slow to healUnintentional weight loss Symptoms can sometimes be so mild that you don't even notice any changes in your health. Approximately half of all Americans with type 2 diabetes are unaware of their health condition. The primary cause of type 2 diabetes is insulin resistance. Other factors can also increase your risk of type 2 diabetes—unlike type 1 diabetes, which is not preventable. Risk factors include: Age: Type 2 diabetes affects all ages. People older than 45 are more likely to develop the disease.Family history: Type 2 diabetes is genetic. You are at a higher risk of type 2 diabetes if your family members have the disease.Gestational diabetes: This type of diabetes occurs when you have high blood sugar levels when you are pregnant. Blood sugar levels usually return to normal after giving birth. Gestational diabetes may increase your risk of type 2 diabetes later in life.High blood pressure: Some medications that treat high blood pressure can increase your risk.Low HDL cholesterol: Having low HDL ("good") cholesterol can increase your risk.Physical activity: A lack of exercise puts you at risk of type 2 diabetes. Getting regular exercise can keep your blood sugar low and help your body convert glucose into energy.Polycystic ovary syndrome (PCOS): This hormonal disorder that affects the ovaries. People with PCOS may also have insulin resistance. About half of people with PCOS older than 40 have type 2 diabetes.Smoking: People who smoke are 30% to 40% more likely to have type 2 diabetes than non-smokers.Weight: Obesity has been linked to type 2 diabetes. A healthcare provider can use a few tests that measure your blood sugar levels. They may repeat their testing measures or order multiple tests to confirm or rule out a type 2 diabetes diagnosis. It's best to only receive a diagnosis from a healthcare provider using one of the following tests. Don't diagnose yourself with type 2 diabetes using over-the-counter (OTC) blood testing equipment, like a blood glucose meter. A healthcare provider may ask you to take a fasting plasma glucose (FPG) test. This test requires you to fast for at least eight hours. It's usually best to schedule an FPG test early in the morning so you can fast overnight. You will have to skip breakfast, but you are able to sip on water. A healthcare provider will draw your blood. They will test the blood sample to check your blood glucose levels. Two FPG tests that show a blood glucose level of 126 milligrams (mg) or higher of glucose per deciliter (dL) of blood indicate diabetes. An A1C test measures your average blood sugar levels over the last three months from whenever you take it. You do not need to fast before receiving an A1C test, in contrast to the FPG test. You will give a blood sample, which is usually drawn from a vein in your arm. Your test results will indicate what percentage of your blood proteins are coated with sugar. Normal A1C levels are less than 5.7%, prediabetes is 5.7% to 6.4%, and diabetes is 6.5% or higher. A healthcare provider may sometimes choose to do a random plasma glucose (RPG) test to measure blood sugar levels. This test does not require fasting. A healthcare provider may ask you to take it at any point in the day. They can determine an official diabetes diagnosis if you have 200 mg or higher of glucose per dL of blood. An oral glucose tolerance test (OGTT) diagnoses prediabetes and diabetes. This test requires you to fast overnight before your blood is drawn. A healthcare provider will take a blood sample and ask you to consume a sugary drink. They will repeatedly draw your blood over two to three hours. An OGTT measures how your blood sugar levels respond to the sugary drink. If you have 200 mg or more of glucose per dL of blood after two hours, it is considered diabetes. Urine tests were historically more common to use than blood tests. However, the results are now less accurate than blood test results and are not often used to diagnose diabetes. A healthcare provider may still use a urine test to measure blood sugar if there is any difficulty drawing your blood. They might also use a urine test as an alternative to a diabetes screening. The goal of treatment is to bring your blood sugar levels down and keep them in a healthy range. Type 2 diabetes treatments can vary based on the severity of your condition, your lifestyle, and your overall health. Some people with type 2 diabetes take oral medications to keep their blood sugar in control. Insulin injections are more common for people with type 1 diabetes. A healthcare provider may offer insulin injections if other treatments aren't working for you. You can often manage your blood sugar by making healthy lifestyle changes, such as: Eating a nutritious diet: A heart-healthy diet helps manage diabetes. Focus on fruits, vegetables, whole grains, lean proteins, and non- or low-fat dairy to keep your blood sugar in check. The American Diabetes Association (ADA) advises following their Diabetes Plate Method. This method involves filling half your plate with non-starchy vegetables, a quarter with lean proteins (e.g., chicken or fish), and a quarter with carbs (e.g., beans and whole grains). Getting regular exercise: Staying active can keep your blood sugar low. Walking, bike riding, and strength training are good options. What's most important is finding exercise that is enjoyable and accessible. Losing weight, if needed: In some cases, obesity can be linked to high blood sugar levels. A healthcare provider may suggest losing a small amount of weight through a healthy diet and moderate exercise. Nearly 90 million adults in the United States have prediabetes. About 84% of these people have no idea their blood sugar is higher than average. It's possible to stop prediabetes and prevent it from progressing into type 2 diabetes. The best way to prevent type 2 diabetes is to shift toward a healthier lifestyle. You can try taking some steps to lower your risk, such as: Building a support system to hold you accountable to your goals Eating a low-fat diet that is high in fruits, vegetables, whole grains, and lean proteins Exercising regularly Keeping track of your health goals Limiting tobacco and alcohol use The National Diabetes Prevention Program offers a Lifestyle Change Program. This program pairs you with a health coach who helps you change your lifestyle. The coaches can counsel you on adopting a heart-healthy diet, fitting daily physical activity into your schedule, and reducing stress. Some programs are free. Other programs may have a fee, but some insurance plans can help you cover the cost. People with type 2 diabetes may be at risk for other health conditions that can affect their blood sugar levels and overall health. Some of these related conditions include: Chronic kidney disease (CKD): This occurs when your kidneys gradually lose function. CKD can lead to kidney failure if untreated. The disease affects nearly 25% of people with type 2 diabetes. Heart disease: Heart disease may occur in people with type 2 diabetes, affecting about 32.2% of people with the disease. Hyperlipidemia: This refers to a high amount of fat in your blood. Hyperlipidemia impacts more than 75% of people with type 2 diabetes. Diabetes may lower your HDL cholesterol and raise your LDL ("bad") cholesterol and triglycerides. Keeping your blood sugar level within a healthy range can help. Hypertension: Some evidence suggests that hypertension (high blood pressure) affects more than 80% of people with type 2 diabetes. Hypertension also increases your risk of heart disease. Obesity: Obesity is a common risk factor for type 2 diabetes. About 78% of people with type 2 diabetes are overweight or obese. Managing your weight can sometimes help prevent or treat type 2 diabetes. Type 2 diabetes can impact your physical and emotional health. Getting early treatment can improve your symptoms and overall quality of life. You may experience sadness or frustration from time to time if you have a chronic disease. It's OK to feel this way, and it's important to know these feelings are normal. You don't have to deal with type 2 diabetes alone. There are ways to cope with your emotions. Some ways to manage your overall health include: Cooking healthy meals with your loved onesEngaging in your favorite hobbies and spending time with family and friendsFinding a friend to exercise withKeeping in contact with a healthcare provider to ensure you are keeping your blood sugar in controlListening to comforting music and practicing meditation or deep breathingReaching out to a mental healthcare provider if you need additional support Type 2 diabetes can be a life-changing diagnosis. Making healthy changes can help you live a fulfilling life. People with type 2 diabetes do not produce enough or resist insulin. Your blood sugar rises as a result and leaves you at risk for serious complications if untreated. Getting a diagnosis and receiving proper treatment can help you manage type 2 diabetes. You cannot reverse type 2 diabetes, but medication and lifestyle changes can lower your blood sugar. Thanks for your feedback! There are a number of major risk factors for type 2 diabetes. Although some diabetic risks come from our genetics, many are preventable. Unfortunately, many people do not know what these are or clearly understand the signs of them. For this reason, below is a list of top type 2 diabetes risk factors. Also see: the symptoms of diabetes Obesity Obesity is the major type 2 diabetes risk, with millions of people throughout the world facing obesity. Almost a quarter of adults in the UK are recorded as being obese. Furthermore, the numbers continue to climb, both amongst adults and children. The number of children being diagnosed with type 2 diabetes caused by obesity is climbing everywhere. In the UK, about one in three children are classed as obese. Read more on diabetes and obesity Lack of exercise and sedentary way of life Living a sedentary lifestyle without sufficient exercise is seriously damaging to health. Being inactive often leads to being overweight, which can lead to pre-diabetes and type 2 diabetes. Staying active decreases insulin resistance and helps bodily insulin to be more effective. Read more on diabetes and obesity Eating a 'Western' diet Eating unhealthily is a major cause of type 2 diabetes, as over 90 per cent of type 2 diabetics are overweight. A so called Western diet, with a reliance on processed foods, poor quality fats and little fibre content, is thought to be a major contributor to diabetes and metabolic syndrome Eating well, in conjunction with exercise, can prevent or reverse the development of type 2 diabetes. Picking a healthy diet can sometimes be confusing, with so many mixed messages, and its often not helped by so-called diabetic food which are not necessarily a healthier option. High blood pressure High cholesterol and blood pressure levels are risks for many diseases, one of which is type 2 diabetes. Both are also major symptoms of pre-diabetes Gestational diabetes Gestational diabetes is another major risk, and affects about 2 to 5 per cent of women who fall pregnant. Those women who suffer from it face greater later-life risks of developing type 2 diabetes, as do their children. Family history Having a close family member with type 2 diabetes can raise your own risk of developing the condition. Unfortunately, you cannot do much about your genetic history, but you can be ready by being aware of the symptoms of type 2 diabetes Also, many ethnic minorities are more prone to suffer from diabetes. For more on this, please read diabetes and ethnicity Aging As the population of the world ages, diabetes rates are soaring. Unfortunately, the older we are, the greater the risk of developing type 2 diabetes is. The pancreas, according to some scientists, begins to produce insulin less effectively as we age. Furthermore, bodily resistance to insulin increases with age. That's because being physically active helps insulin work better in your body – either the insulin you take or the insulin your body makes. This helps keep your blood sugar levels within target and helps prevent other health problems linked to diabetes, known as complications. Find out the other benefits of being more physically active and our advice on where to start. Think of it simply as 'activity'. You don't have to join a gym or wear Lycra to do that. Benefits of exercise There are many benefits of being active when you have type 1, type 2 or other types of diabetes. Moving more can: Help your body use insulin better. If you take insulin, regular activity may reduce how much you need to take by reducing insulin resistance. Help you keep your blood sugar levels within target range and improve your HbA1c Help some people with type 2 diabetes put it into remission Help reduce blood pressure and improve cholesterol which helps protect against other health problems caused by diabetes like heart disease. Help you lose weight if you need to and keep the weight off after you've lost it. Give you energy and help you sleep Help your joints and flexibility Help your mind as well as your body - exercise releases endorphins, which you could think of as happy hormones. Being active is shown to reduce stress levels and improve low mood. Best exercise for diabetes There isn't one type of physical activity that's best for everyone with diabetes. What's important is that it gets your body moving more, that you enjoy it and that it fits into your life at a time that works for you. And that it's appropriate for any pain or other health problems you have including diabetes complications. Starting small is sensible if you are new to exercise and have pain or haven't been active for a while. It means you won't overdo it and can stop if something hurts. If you use insulin or other medication that lowers your blood sugar levels, it's important to check your blood sugar levels before and after exercise. See our page on exercise and blood sugar levels. Walking, if you can, is often a good place to start. You don't need to join a fitness class or a gym, unless that's something you'd enjoy. Exercise can be as simple as kicking a ball round the park with your grandchild or having a paddle if you're on holiday. Sports popular with people becoming more active include bowls, dancing, walking football and walking netball. Nearly any activity can be adapted to suit your own needs. For example, you might want to try seated stretches instead of standing ones or try walking in a swimming pool rather than on land so you can avoid putting weight on your joints. Setting targets If you haven't been active for a while, setting yourself realistic targets can help such as a 10-minute walk after a meal, rather than expecting yourself to meet NHS physical activity targets overnight. Each step you take to move more can help with managing your diabetes. The small victories count. To help you start this journey we've created Your guide to Moving More (PDF, 2.9MB) to help you start this journey. There's space for you to plan your activity and track your progress, as well as lots of information to support you along the way. Don't be hard on yourself if there are days you feel tired and unmotivated. You could try resting in the morning, and then introducing some movement into your afternoon. However, sometimes you need a break or time to relax, and it's okay to do that. Breaking up periods of inactivity Breaking up long periods of sitting or lying down regularly can help lower your blood sugar levels. So, for example, you might stand up for a while every 30 to 45 minutes or make phone calls standing up. Standing uses up more than twice as much energy (calories) as sitting as well as being better for your body. on-the-spot walking during TV ad breaks stretches for your arms and legs whilst sat in a chair vacuuming your home or washing your car gardening - if you have a garden. If you don't, do you have any house plants you can water, prune and re-pot while standing up. put some music on and have a dance stand up for work meetings or phone calls and consider a standing desk. It's surprising how a slight change of routine can increase your physical activity levels and help you feel better when you're living with diabetes. This could include: getting off the bus or tube one stop earlier, or parking further away from your destination taking the stairs instead of the lift or escalator carrying your shopping home. The bags will act as weights. walking or cycling for small journeys, rather than using a car or public transport. When you have diabetes, it's important to keep active at work particularly if you're sitting in front of a computer for a long time. You could try: walking meetings, using hands free equipment to chat whilst moving around in a safe environment standing when you're on the phone or trying to use a standing desk chair-exercises like sitting and lifting your arms up putting set break times in your work diary every day and using the time to be more active - eg going for a walk and getting some fresh air stretching for 5 minutes after every meeting; this can also be a great way to relieve stress. If you're more motivated by following a routine, you may find video workouts helpful. There are lots to choose from. Try one of our free video workouts with Celene and other fitness instructors suitable for people with diabetes — from 4 minutes to 30 minutes, on our YouTube channel. Staying connected with others can also help with both your physical and mental health. So think about getting moving with family, friends or neighbours. Or even doing one of our fundraising events that helps you get active and raise money so we can keep working towards a world where diabetes can do no harm. If you have type 1 diabetes, type 2 diabetes or other types of diabetes, you're able to take part in almost every type of physical activity. You may need to meet certain criteria and have a medical assessment for extreme activities such as scuba diving, sky diving and mountaineering. For diving guidance, see more information on the diabetes page of the UK Diving Medical Committee website. It's good to be active but you also need to take care of your body. Before trying any new exercises it's important you check with your GP first. They can help you decide what's safe and consider any complications you have. You can still exercise if you have diabetes complications such as problems with your eyes or heart, but you'll need to think a bit more about the activity you choose. And talk it through with your healthcare team. For example, you should avoid high-intensity activity such as High intensity interval training (HIIT) and heavy lifting. But there are other gentler, low-impact exercises you can try such as swimming, cycling or walking. Do mostly activities where you aren't putting weight on your feet, for example, swimming or chair-based exercises, especially if your gait – the way that you walk – has changed or if you have a foot deformity. If you have regular appointments with a foot care specialist or team, always talk to them about whether an activity is suitable for you before starting something new. If you have foot ulcers, avoid weight bearing activity, including jogging. If you have postural hypotension , avoid activities with rapid changes in direction, such as squash and tennis to avoid falling or fainting. If you have moderate or severe non-proliferative retinopathy , avoid activities that dramatically raise your blood pressure, such as sprinting and lifting weights. If microalbuminuria is present, most activities are safe, but avoid vigorous exercise the day before urine protein tests With overt nephropathy, also called macroalbuminuria, (and if on dialysis), it's best to avoid high-intensity and strenuous exercise. Foot problems If you have problems with your feet, such as neuropathy or foot ulcers, you might need to avoid certain types of weight-bearing activity like jogging. Chair-based exercises might be better for you, like raising your legs one after the other or lifting cans of food while you're sitting down. It's also important to use suitable footwear when exercising, and make sure to regularly check your feet for any changes in the way they look or feel. Tips to help with fear of hypos People who use insulin or medications that can lower blood sugar levels often say that the biggest barrier to being more physically active is a fear of hypos. But the benefits of physical activity on your diabetes and overall health far outweigh the risks. So we've put together some tips to help you: Keep plenty of fast-acting hypo-friendly carbohydrates, like sugary drinks and glucose tablets, to hand just in case you need them can help build your confidence. And reassure you that you will be safe while being more active. Reduce hypo anxiety by making sure you check your blood sugar levels regularly so you get to learn how your body reacts to certain movements. And starting with just a few minutes of activity and building up gradually over days and weeks. Some people also find using a continuous glucose monitor (CGM) a quick and reassuring way to keep an eye on how activity is affecting their blood sugar levels. You can also review the effect of activity on your blood sugar levels afterwards. But tech isn't suitable for everyone and not everyone is eligible. Everyone with type 1 diabetes, some people with type 2 diabetes and gestational diabetes should be considered for one of these devices. For more information, see the Who qualifes for a CGM page. Being physically active can affect your blood sugar levels in different ways. So we've also put together some guidance on how to manage blood sugar levels when exercising including snacking. Everyone is different but in general, gentle activity where you don't get out of breath quickly, such as walking, swimming and cycling, tends to lower blood sugar levels. However, activities that have short, fast, powerful movements where you get out of breath quickly, such as sprinting, punching and weight-lifting, tend to make your blood sugar levels go up. Other factors such as stress and the weather may also have an impact. "Being able to see my blood glucose readings with my Freestyle Libre2 gave me the confidence to become more active again which helped lower my HbA1c." Read Holly's experience. To help promote people to move more across the UK, we've teamed up with Sport England and other charity partners in the We Are Undefeatable campaign. "It's never too late. There are so many different activity groups you can go to now," Simon, who has type 1 diabetes and has had both lower legs amputated. Hear his experience in the video. Health's team of medical experts, writers, and editors are committed to ensuring our content is evidence-based, up-to-date, and comprehensive. I hope to use my expertise to help support those who often might feel left out of healthcare to begin their wellness journey. I am passionate about relaying medical information to the public in a way that they can understand, utilize, and feel empowered in doing so. Many of our relationships with food are harmed by misinformation. Having accurate nutrition information helps empower us. I love using my background as a research scientist to write about complex health and science topics in a manner that is accessible to all. The internet abounds with health content, and I aim to bring thoughtful and accessible information on health and wellness to all readers. Knowledge is power. Everyone deserves access to health information that can educate and empower them to make informed decisions about their care. Our Integrity Promise Health's editorial process follows these key steps to create accurate health content you can trust. Written and edited by health experts and journalists Backed by science-based evidence and research Medically reviewed by board-certified healthcare providers Updated to reflect the latest health and wellness information Learn about our process