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Lifestyle prescriptions for diabetes management in primary care: a narrative review

Hye Jun Lee, Jung-Ha Kim*

Department of Family Medicine, Chung-Ang University Medical Center, Chung-Ang University College of Medicine, Seoul, Korea

Diabetes mellitus is a complex chronic disease with a rapidly increasing global prevalence. For this condition, non-pharmacological lifestyle modification is as important as pharmacological treatment. This review aims to comprehensively examine lifestyle prescriptions for diabetes across multiple domains to integrate current insights and understanding. In medical nutrition therapy, which is central to diabetes treatment and management, excessive carbohydrate intake should be restricted, while individualized consumption of high-quality carbohydrates, protein, and unsaturated fatty acids is recommended. Intake of added sugars and sodium should also be limited. Physical activity should similarly be tailored to the individual, with a combination of aerobic exercise and resistance training recommended. Careful consideration of hypoglycemia risk and diabetes complications is essential. Additional strategies include limitations on uninterrupted sedentary time to less than 30 minutes, maintenance of a healthy body weight, smoking cessation, alcohol abstinence, sleep health improvements, and attention to psychosocial care. In primary care settings, patient-specific assessment, multidisciplinary lifestyle prescriptions, and education to support behavior modification are expected to play a pivotal role in the treatment and management of diabetes.

Keywords: Diabetes mellitus management; Healthy lifestyle; Nutrition therapy; Physical activity; Primary health care

Introduction

Background

Diabetes mellitus is among the chronic diseases with the most rapidly increasing global prevalence rates, with this trend driven by population aging, reduced physical activity, and rising rates of obesity [1]. According to the International Diabetes Federation, an estimated 537 million adults aged 20–70 years currently live with diabetes, and this number is projected to reach 783 million by 2045 [1]. In Korea, the Diabetes Fact Sheet 2024 reported that the prevalence of diabetes among adults aged ≥30 years increased from 11.8% in 2012 to 16.7% in 2020, corresponding to approximately 5.33 million people living with diabetes [2]. Beyond hyperglycemia, diabetes leads to a wide range of complications, including cardiovascular disease, neuropathy, and retinopathy, which substantially impair patients' quality of life [3] and impose a significant socioeconomic burden due to escalating healthcare costs. Therefore, systematic strategies for diabetes treatment and management are urgently needed.

Diabetes is a complex metabolic disorder that arises from an interaction between genetic predisposition and lifestyle-related factors [1]. Glycemic control is closely linked to behaviors such as diet and physical activity, making lifestyle modification indispensable in diabetes treatment and management. Lifestyle interventions encompass medical nutrition therapy (MNT), exercise therapy, and behavioral approaches, and evidence indicates that optimal diabetes control is achieved when pharmacological treatment is combined with dietary and exercise interventions [3]. The 2025 guidelines of both the American Diabetes Association (ADA) [4] and the Korean Diabetes Association (KDA) [5] emphasize the importance of comprehensive multidisciplinary care for patients with diabetes, involving primary and specialty care physicians, nurses, registered dietitian nutritionists, exercise specialists, pharmacists, dentists, podiatrists, behavioral health professionals, and diabetes care and education specialists.

*Corresponding email: sgirlpower219@cau.ac.kr
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Objectives

This review aims to comprehensively examine lifestyle prescriptions for the treatment of diabetes in primary care, thus integrating current insights and understanding in this field.

Ethics statement

This is a literature-based study; therefore, neither institutional review board approval nor informed consent was required.

Medical nutrition therapy

MNT plays a central role in the treatment and management of diabetes [6]. Major clinical guidelines, including the 2005 ADA recommendations, have emphasized the importance of MNT (Table 1). The 2025 KDA guidelines further underscore the need for referral to registered dietitian nutritionists, particularly for patients with diabetes who also have comorbid conditions such as hypertension, dyslipidemia, heart failure, gastrointestinal disorders, chronic kidney disease (CKD), pregnancy-related nutritional issues, pediatric growth concerns, and obesity [5].

Numerous studies have consistently shown that individualized MNT provided by registered dietitian nutritionists effectively improves a variety of health outcomes in patients with diabetes, including glycated hemoglobin (HbA1c), body weight, waist circumference, low-density lipoprotein cholesterol, blood pressure, and dietary patterns [7]. Compared to pharmacologic treatment, MNT is associated with fewer adverse effects, is cost-effective, and is reportedly more effective in the long-term prevention of diabetes-related complications [4].

Dietary patterns and meal planning

No single standardized dietary pattern can be universally applied to patients with diabetes; therefore, meal planning should always be individualized [4]. Evidence supports several dietary patterns that improve glycemic control, facilitate weight reduction, and lower cardiovascular risk, including the Mediterranean, vegetarian, low-fat, low-carbohydrate, and Dietary Approaches to Stop Hypertension (DASH) diets [7]. Current diabetes care guidelines recommend incorporating these diverse dietary approaches into

Table 1. Recommendations for medical nutrition therapy in diabetes

Items	Recommendations
Provision of medical nutrition therapy	(1) Individualized medical nutrition therapy programs are essential for achieving therapeutic goals. (2) Such programs should be delivered by registered dietitian nutritionists. (3) Recommended target groups include patients with type 1 diabetes, type 2 diabetes, and gestational diabetes mellitus.
Multicomponent intervention	(1) Medical nutrition therapy should be delivered in combination with physical activity and behavioral interventions.
Recommendation of evidence-based healthy dietary patterns	(1) Individualized meal planning is recommended for patients with diabetes. (2) Insufficient evidence is available to support a specific macronutrient distribution. (3) Guidance should emphasize non-starchy vegetables, fruits, legumes, lean protein, whole grains, nuts, and seeds, while minimizing red meat, sugar-sweetened beverages, and processed foods. (4) Reduction of carbohydrate intake may be beneficial for glycemic control in patients with diabetes and can be applied within personalized dietary patterns.
Restriction of sodium intake and high-salt diets	(1) Sodium intake should be limited to less than 2,300 mg per day, which should be achieved primarily through the reduction of processed food consumption.
Caution with micronutrient supplements, herbal medicine, and other complementary products	(1) Healthcare providers should assess supplement use and provide counseling when necessary. (2) Unless deficiencies are present, the benefits of micronutrient supplementation in patients with diabetes remain unclear; similarly, the benefits of herbal medicine and other dietary products are uncertain.
Avoidance of excessive alcohol consumption	(1) Patients with diabetes should preferably avoid alcohol consumption; if consumed, recommended limits should be followed. (2) Patients should be educated regarding the risk of hypoglycemia following alcohol intake, and blood glucose monitoring should be emphasized, particularly for those using insulin or insulin secretagogues.
Restriction of added sugars and non-nutritive sweeteners	(1) Sugar-sweetened beverages should be limited, and the consumption of water without non-nutritive sweeteners is recommended. (2) Non-nutritive sweeteners may be used in the short term to reduce calorie and carbohydrate intake; however, long-term use is not recommended.

The table summarizes and revises the medical nutrition therapy recommendations from the 2025 American Diabetes Association guidelines [4].

MNT as appropriate [4]. Despite their differences, these patterns share common features: an emphasis on non-starchy vegetables, fresh fruits, legumes, whole grains, nuts, seeds, and low-fat dairy products, alongside reduced consumption of red meat, beverages sweetened with sugar, sweets, refined grains, and processed or ultra-processed foods [4].

Meal patterns

Intermittent fasting, including time-restricted eating, has been reported to improve glycemic control and promote weight reduction in patients with type 2 diabetes [4]. Accordingly, since its 2023 guidelines, the ADA has included intermittent fasting among dietary patterns that may be used in diabetes management [4]. However, unlike the Mediterranean, vegetarian, low-fat, low-carbohydrate, and DASH diets, the long-term benefits of intermittent fasting—such as reductions in mortality—have not yet been established, and concerns persist regarding hypoglycemia from prolonged fasting and compensatory binge eating [4]. Continuous monitoring is particularly warranted for patients using glucose-lowering agents with a high risk of hypoglycemia. In addition, potential adverse effects such as eating disorders, gastrointestinal dysfunction, and alterations in sex hormone levels necessitate caution [8]. Intermittent fasting is contraindicated in children under 12 years of age, adults over 70 years, patients with a history of eating disorders, those with a body mass index <18.5 kg/m^2, and women who are pregnant or breastfeeding [8].

Macronutrients

There is no ideal ratio of calories from carbohydrates, protein, and fat for patients with diabetes. Rather, macronutrient distribution should be determined through an individualized assessment of the patient's current dietary habits, preferences, and metabolic goals [4].

Carbohydrates

For glycemic control and management, excessive carbohydrate intake should be restricted, while dietary strategies must be individualized to therapeutic goals and patient preferences. A 2022 meta-analysis showed that reducing carbohydrate intake improves glycemic outcomes in patients with diabetes, with low-carbohydrate diets (26%–45% of total energy from carbohydrates) benefiting both glycemic control and weight reduction [9]. However, very low-carbohydrate diets (<10% of total energy from carbohydrates) may increase the risk of essential nutrient deficiencies, hypoglycemia, and ketoacidosis [10]. Caution is required in patients receiving sodium–glucose cotransporter-2 (SGLT-2) inhibitors due to the elevated risk of ketoacidosis [11]. Moreover, restricting carbohydrates without reducing total energy intake often increases consumption of protein or fat. When these macronutrients are derived primarily from animal sources, a higher intake of saturated fatty acids may elevate cardiovascular risk [11]. Therefore, while reducing total carbohydrate intake can be beneficial for glycemic improvement, extreme restriction is not recommended for patients at risk of malnutrition, older adults, pregnant or lactating women, or those taking SGLT-2 inhibitors. Equally important is replacing reduced carbohydrates with appropriate sources of protein and fat.

In addition to the amount of carbohydrate intake, it is important to select carbohydrate sources that are high-quality, minimally processed, nutrient dense, and rich in dietary fiber [4]. Adequate qualitative intake of carbohydrates should be achieved through consumption of fiber-rich whole grains, legumes, vegetables, fresh fruits, and dairy products such as milk and yogurt. In its 2023 recommendations for carbohydrate intake, the World Health Organization (WHO) emphasized not only the proportion but also the quality of carbohydrates, recommending fiber-rich whole grains, legumes, vegetables, and fresh fruits instead of refined carbohydrates [12]. For patients with kidney disease, plant-based diets rich in such foods generally do not need to be restricted, as their phosphorus bioavailability is lower than that of animal-based foods; these diets also improve the sodium-to-potassium ratio while reducing cardiovascular risk. However, in cases of severely impaired renal function or when specific medications are used, caution is warranted due to a risk of electrolyte disturbances such as hyperkalemia [12].

The glycemic index (GI) classifies carbohydrates based on the glycemic response following food consumption, whereas the glycemic load accounts for both the GI and the amount of carbohydrate consumed. Studies in patients with diabetes have shown heterogeneous results due to variability in definitions; however, a recent large-scale meta-analysis of cohort studies reported that higher intake of high-GI foods was associated with increased incidence of type 2 diabetes (hazard ratio [HR], 1.27; 95% confidence interval [CI], 1.21–1.34), overall cardiovascular disease (HR, 1.15; 95% CI, 1.11–1.19), diabetes-related cancers (HR, 1.05; 95% CI, 1.02–1.08), and all-cause mortality (HR, 1.08; 95% CI, 1.05–1.12) [13]. For patients with type 1 or type 2 diabetes who administer insulin at mealtimes, ongoing and comprehensive education on nutritional composition and carbohydrate intake is essential. Regular education should emphasize the relationship between carbohydrate consumption and insulin requirements, particularly when meal timing or carbohydrate quantity is inconsistent. In addition, fat and protein intake can influence postprandial glycemic responses—both early and delayed—in a dose-de-

pendent manner [14]. Therefore, when adjusting insulin doses for high-fat, high-protein mixed meals, clinicians should exercise caution to mitigate the risk of delayed hyperglycemia [7].

Added sugars and free sugars are primarily consumed via sugar-sweetened beverages (SSBs), which have been consistently associated with increased diabetes risk. A recent meta-analysis reported that each additional daily serving of SSBs was associated with a 20% higher relative risk of type 2 diabetes and an 8% increase in all-cause mortality [15]. Accordingly, major diabetes care guidelines recommend limiting SSB intake as much as possible to minimize added sugar consumption [10]. As the detrimental effects of SSBs have become increasingly recognized, consumption of artificially sweetened beverages (ASBs) has risen. While some studies have shown significant benefits for weight reduction, no improvement in glycemic outcomes has been observed [16]. Current evidence regarding the metabolic effects and potential risks of ASBs is still insufficient. The American Heart Association permits temporary substitution of ASBs for individuals with high SSB consumption but ultimately recommends reducing intake of both SSBs and ASBs [17]. Excessive consumption of artificial sweeteners should therefore be approached with caution. Additionally, even natural sources such as fruit-derived concentrates are classified as added sugars. When consumed in liquid form, these products provide limited satiety, making portion control difficult and potentially leading to excessive intake with marked increases in postprandial glucose levels [18].

Protein

Protein restriction is generally not necessary in patients with diabetes, although both excessive intake and overly strict restriction should be avoided in those with kidney disease. Historically, protein restriction was suggested for patients with diabetes-related albuminuria or CKD to delay disease progression; however, many studies have reported insufficient evidence to support this recommendation. Current major diabetes care guidelines advise that patients with diabetic kidney disease (DKD) who are not on dialysis should consume protein at levels similar to the general population while avoiding excessive intake (>20% of total energy or >1.3 g/kg/day), as this may exacerbate albuminuria and accelerate renal function decline. Conversely, in patients with DKD receiving dialysis, protein restriction may worsen malnutrition due to energy loss; thus, a higher protein intake (1.0–1.2 g/kg/day) is recommended [4]. Although evidence remains limited, an increasing number of studies suggest that substituting plant-based for animal-based protein may improve HbA1c, fasting glucose, and serum cholesterol levels. A prospective observational study also demonstrated that individuals with higher consumption of plant-based foods and lower consumption of animal-based foods had a lower risk of developing diabetes [19].

A recent meta-analysis reported that 18% of patients with type 2 diabetes have concomitant sarcopenia, with higher HbA1c identified as a risk factor (odds ratio [OR], 1.16; 95% CI, 1.09–1.24) [20]. Concerns have been raised that weight reduction strategies such as glucagon-like peptide 1 (GLP-1) receptor agonists, dual agonists (glucose-dependent insulinotropic polypeptide/GLP-1 receptor agonists), and bariatric surgery may increase the risk of malnutrition and sarcopenia in certain patients with diabetes. This risk is particularly elevated in patients with comorbid cardiovascular, renal, or hepatic disease and in those with obesity [21]. Therefore, in primary care, patients with diabetes who experience rapid or significant weight loss should be advised to engage in resistance training, ensure adequate protein intake, and undergo screening for sarcopenia [4].

Fat

Patients with diabetes are advised to follow general population guidelines regarding saturated fat, cholesterol, and trans fat intake [4]. Foods high in saturated and trans fatty acids should be replaced with those rich in unsaturated fatty acids. A systematic review showed that replacing saturated or trans fats with unsaturated fatty acids improves glycemic outcomes and reduces cardiovascular risk [22]. According to the 2022 Korean Society of Lipid and Atherosclerosis dyslipidemia guidelines [23], saturated fat intake should be limited to <7% of total energy and replaced with unsaturated fats whenever possible, while trans fat intake should be avoided. In patients with hypercholesterolemia, dietary cholesterol should be restricted to <300 mg/day.

Evidence is insufficient to support the benefit of unsaturated fatty acid supplementation for glycemic control or cardiovascular prevention, and the safety of excessive supplementation remains unclear [7].

Sodium restriction

The 2025 ADA guidelines and the 2020 Korean Dietary Reference Intakes recommend limiting sodium intake to ≤2,300 mg per day [4,24]. Numerous studies have reported that sodium intake affects glucose metabolism and glomerular filtration rate; therefore, sodium restriction is suggested as a useful strategy for patients with diabetes, regardless of the presence of kidney disease [25]. Given that hypertension and cardiovascular disease are major comorbidities of diabetes, reducing sodium intake may help lower blood pressure and decrease the risk of cardiovascular disease and diabetes-related complications. A meta-analysis of randomized controlled trials (RCTs) in patients with type 1 and type

2 diabetes demonstrated that sodium reduction effectively improved blood pressure [26]. Furthermore, an RCT in patients with type 2 diabetes showed that reducing sodium intake to an average of 2,310 mg/day in conjunction with the DASH diet improved blood pressure and other cardiovascular risk factors [27]. The most effective strategies for sodium restriction include reducing consumption of processed and ultra-processed foods—the main sources of dietary sodium—and avoiding the addition of salt during cooking or at the table [4].

Micronutrients

Vitamins and minerals are essential nutrients required for bodily structure and the regulation of various physiological processes; however, supplementation is generally not recommended for glycemic improvement in patients with diabetes [4]. A meta-analysis suggested that vitamin D supplementation, compared with other supplements, may provide some benefit in improving HbA1c, fasting glucose, and homeostatic model assessment for insulin resistance; however, this evidence remains insufficient [28]. Unless deficiencies are present, the benefits of micronutrient supplementation in diabetes are unclear [7]. Similarly, evidence supporting the use of herbal products and food-derived agents—such as aloe vera, cinnamon, turmeric, Jerusalem artichoke, and bitter melon—for glycemic control remains inadequate [7]. Nonetheless, supplementation may be considered when deficiencies are identified or highly likely, such as in pregnant or lactating women, older adults, vegetarians, or individuals on very-low-calorie or low-carbohydrate diets. Furthermore, long-term use of metformin has been associated with vitamin B12 deficiency; therefore, in patients receiving prolonged metformin therapy who present with unexplained anemia or peripheral neuropathy, measurement of vitamin B12 levels is recommended [29].

Non-nutritive sweeteners

The U.S. Food and Drug Administration has approved several non-nutritive sweeteners (NNS) for consumption by both the general population and patients with diabetes [7]. For patients with diabetes who regularly consume sugar-sweetened foods or beverages (e.g., regular soft drinks, juice drinks, or foods sweetened with cane sugar or high-fructose corn syrup), NNS can serve as appropriate substitutes for nutritive sweeteners such as sugar, honey, or agave syrup [30]. Non-nutritive sweeteners appear to have no significant impact on glycemic control and, when not offset by increased caloric intake from other sources, may help reduce total energy and carbohydrate intake [7].

Physical activity

Physical activity plays a pivotal role in glycemic management and the prevention of complications, particularly in patients with type 2 diabetes [4]. Mechanistically, exercise acutely increases glucose uptake by skeletal muscle; over the long term, it improves glucose metabolism and alters body composition to enhance whole-body insulin sensitivity. These improvements are not only attributable to weight reduction but also relate to reduced visceral adiposity, increased muscle mass, improved lipid metabolism, reduced systemic inflammation, and enhanced endothelial function [31]. Consequently, regular physical activity improves glycemic control, reduces cardiovascular risk, and contributes to weight loss [31].

According to the 2025 KDA guidelines, the type, frequency, duration, and intensity of exercise should be individualized based on age, physical capacity, and comorbidities (including microvascular complications), and referral to exercise specialists for exercise prescription is recommended [5]. Before initiating an exercise program, patients should be evaluated for the presence of cardiovascular disease and microvascular complications, and potential contraindications should be identified. More detailed assessments may be required for patients with established diabetes-related complications. In high-risk patients, it is advisable to begin with short sessions of low-intensity exercise and gradually increase the duration and intensity.

Additionally, clinicians should assess for conditions that may contraindicate certain types of exercise or increase the risk of injury. These include uncontrolled hypertension, untreated proliferative retinopathy, autonomic neuropathy, orthostatic hypotension, peripheral neuropathy, balance disorders, diabetic foot ulcers, and a history of Charcot foot [5].

Frequency and type of physical activity

According to the 2025 ADA guidelines, patients with diabetes are recommended to engage in at least 150 minutes per week of aerobic exercise at moderate or higher intensity, spread over a minimum of 3 days per week, with no more than 2 consecutive days without activity, given that the effects of aerobic exercise on insulin sensitivity persist for 24–72 hours [4]. The goal should be a gradual increase in exercise intensity, frequency, and duration over time.

High-intensity interval training (HIIT)—defined as performing aerobic exercise at 65%–90% of peak oxygen consumption (VO_2peak) or 75%–95% of maximal heart rate for intervals lasting 10 seconds to 4 minutes, interspersed with 12 seconds to 5 minutes of active or passive recovery—has been shown to induce sig-

nificant physiological and metabolic adaptations in both type 1 and type 2 diabetes [32]. However, HIIT may cause transient post-exercise hyperglycemia, necessitating bolus insulin correction in patients with type 1 diabetes, while blood glucose monitoring is recommended when initiating HIIT in patients with type 2 diabetes [32].

Resistance exercise is recommended at least twice per week. High-load resistance exercise (e.g., dumbbells, weight machines) may be particularly effective for improving glycemic control and muscle strength; however, resistance exercise of all intensities has been shown to benefit the maintenance of muscle strength, balance, and functional capacity [4]. Notably, resistance exercise is not associated with an increased risk of cardiac ischemia or stroke compared with aerobic exercise and is therefore recommended even in middle-aged and older adults with diabetes [4].

Combining aerobic and resistance exercise provides additional benefits for glycemic control and is therefore strongly recommended [33]. In older adults with diabetes, flexibility and balance exercises are also important for maintaining joint mobility, muscle strength, and postural stability. Activities such as yoga and tai chi can be valuable adjuncts in this regard [34].

Hypoglycemia and hyperglycemia

In patients treated with insulin and/or insulin secretagogues, exercise-induced hypoglycemia can occur if medication dosages or carbohydrate intake are not adjusted before, during, and after physical activity. For such patients, carbohydrate supplementation may be necessary when pre-exercise blood glucose is <90 mg/dL [35]. In contrast, hypoglycemia is uncommon in patients not using insulin or secretagogues, and routine preventive measures are generally unnecessary.

High-intensity exercise should be avoided in the presence of diabetic ketoacidosis. However, in the absence of ketoacidosis and when overall clinical status is stable, exercise does not need to be postponed or contraindicated even in the setting of hyperglycemia [36]. Therefore, patients with diabetes should be trained either in self-monitoring of blood glucose before and after exercise or in the use of continuous glucose monitoring. They also should understand the impact of exercise on glycemia, including both immediate and delayed effects according to exercise intensity and duration [36].

Exercise in the presence of microvascular complications

A meta-analysis reported that higher levels of physical activity were associated with reduced risks of cardiovascular disease, mortality, and microvascular complications compared with lower activity levels [37]. Furthermore, a dose–response meta-analysis showed that even relatively low levels of physical activity can help reduce the risk of diabetes-related complications [37].

Diabetic retinopathy

In patients with proliferative diabetic retinopathy or severe nonproliferative diabetic retinopathy, vigorous aerobic or resistance exercise is not recommended because of the risk of vitreous hemorrhage and retinal detachment [36]. Consultation with an ophthalmologist may be appropriate before initiating high-intensity exercise.

Diabetic peripheral neuropathy

Reduced pain sensation and elevated pain thresholds in peripheral neuropathy may increase the risk of skin injury, infection, and Charcot joint destruction during certain activities. Careful assessment of motor and proprioceptive function is therefore essential, particularly in patients with advanced neuropathy. When appropriate footwear is used, moderate-intensity walking does not appear to increase the risk of foot ulceration or recurrent ulcers in patients with diabetic peripheral neuropathy [38]. Moreover, 150 minutes per week of moderate-intensity exercise has been shown to improve clinical outcomes in patients with prediabetic neuropathy [39]. Accordingly, all patients with peripheral neuropathy should wear protective footwear and perform daily foot inspections for early detection of lesions. If foot injury or open wounds are present, weight-bearing exercise should be limited and replaced with non–weight-bearing activities.

Diabetic autonomic neuropathy

Autonomic neuropathy can increase the risk of exercise-related adverse events through mechanisms such as impaired cardiovascular responses, orthostatic hypotension, impaired thermoregulation, night vision deficits from pupillary dysfunction, and heightened susceptibility to hypoglycemia [40]. Cardiovascular autonomic neuropathy, in particular, is an independent risk factor for cardiovascular mortality and silent myocardial ischemia [40]. Therefore, a cardiac evaluation is recommended before patients with diabetic autonomic neuropathy initiate exercise beyond habitual intensity.

Chronic kidney disease

Physical activity can acutely increase urinary albumin excretion [4]; however, no evidence suggests that vigorous exercise accelerates CKD progression, and no specific exercise restrictions are generally required for patients with CKD [36].

Sedentary behavior

Prolonged sedentary behavior is associated with adverse health outcomes, including increased risk of diabetes, higher cardiovascular risk, and elevated mortality [41]. It is therefore recommended to interrupt sitting time at least every 30 minutes by standing, walking, or engaging in light activity. Participation in leisure-time physical activities and avoidance of prolonged sedentary behavior can help prevent type 2 diabetes and improve glycemic control in patients with diabetes [4]. Recent studies have shown that, in patients with type 2 diabetes and low habitual activity levels, interrupting sedentary time with 3 minutes of light walking or resistance exercise every 30 minutes improves glycemic and insulin-related markers [42]. Furthermore, a meta-analysis demonstrated that interventions targeting interruptions of sedentary behavior contribute to improvements in 24-hour glucose levels and postprandial glycemia [42].

Weight control

Weight management is a critical component of care for patients with diabetes who have overweight or obesity. In patients with type 2 diabetes and concomitant overweight or obesity, at least a 5% reduction in body weight is required to achieve benefits in glycemic, lipid, and blood pressure control [4]. The 2025 KDA guidelines recommend that patients with diabetes who have overweight or obesity reduce their weight by ≥5% and maintain this reduction through MNT (including caloric restriction) and appropriate physical activity [5]. Greater weight loss has been associated with further improvements in glycemia, blood pressure, and lipid profiles, as well as reductions in cardiovascular disease incidence and mortality [43]. In addition, for patients with type 2 diabetes and obesity, the guidelines recommend considering anti-obesity pharmacotherapy as an adjunct to lifestyle modification for weight reduction [5].

Alcohol abstinence

In patients with diabetes, alcohol intake should be limited to the same daily amounts recommended for the general population; however, because alcohol reduces hepatic gluconeogenesis and glucose output, the risk of hypoglycemia is increased [44]. Accordingly, the 2025 KDA guidelines recommend abstinence whenever possible [5]. For patients without diabetes-related complications or liver disease and with well-controlled glycemia, complete abstinence may not be necessary, and the intake limits used for the general population may be applied. The WHO recommends restricting alcohol consumption to no more than 1 drink per day for women and 2 drinks per day for men (based on standard drink sizes for each beverage) and abstaining from alcohol on at least 2 days per week [44]. Systematic reviews have suggested that, compared with abstainers, moderate alcohol consumption (up to 2 drinks per day for men and 1–1.5 drinks per day for women) is associated with a reduced risk of coronary artery disease and type 2 diabetes [45]. In contrast, a meta-analysis reported that excessive alcohol intake—≥50 g/day in women and ≥60 g/day in men—increases the risk of type 2 diabetes [46]. For patients treated with insulin or insulin secretagogues, alcohol consumption without adequate food intake may precipitate hypoglycemia [4]. To prevent this, alcohol should always be consumed with meals, and patients should monitor blood glucose frequently before and after drinking to minimize the risk of hypoglycemia [4].

Smoking cessation

The causal relationship between smoking and diabetes is well established [4]. Smoking contributes to the development of type 2 diabetes, whereas smoking cessation significantly reduces this risk over the long term [47]. Among patients with diabetes, both active smoking and exposure to secondhand smoke are associated with increased risks of macrovascular complications (including cardiovascular and peripheral vascular disease), microvascular complications (such as nephropathy and retinopathy), poor glycemic control, and premature mortality compared with nonsmokers [47]. Accordingly, the 2025 ADA guidelines recommend that all patients with diabetes abstain from tobacco use, including cigarettes, other tobacco products, and electronic cigarettes [4]. Systematic assessment of smoking status at every clinical encounter is a key strategy for prevention and cessation. In adults with diabetes, counseling combined with pharmacotherapy constitutes the standard of care, and the 2020 American Thoracic Society guidelines recommend varenicline as first-line pharmacologic therapy [48].

Sleep health

The relationship between sleep disturbances and diabetes is complex. Sleep disorders are recognized risk factors for the development of type 2 diabetes, and many patients with diabetes experience poor sleep quality or sleep disruption [49]. Common sleep disorders include obstructive sleep apnea, insomnia, and restless legs syndrome, all of which have been linked to microvascular and macrovascular complications [49]. Therefore, screening for sleep health should be considered in patients with diabetes, encompass-

ing symptoms of sleep disorders, sleep disruption related to diabetes symptoms or management, and sleep-related concerns [4]. Patients with severe sleep disturbances should be referred to sleep medicine specialists and behavioral health professionals, with a collaborative approach involving the diabetes care team [4]. In addition, patient education on healthy sleep practices and routines is essential [4]. Recommended strategies for improving sleep hygiene include maintaining consistent bedtimes and wake times; ensuring a dark, quiet environment; optimizing bedroom temperature and humidity; establishing a bedtime routine; silencing or turning off electronic devices (excluding diabetes management devices); engaging in daytime physical activity; limiting daytime naps; restricting caffeine and nicotine in the evening; and avoiding stimulating foods (e.g., spicy meals) and alcohol at night [4].

Psychosocial care

Studies indicate that clinically significant behavioral health disorders, such as depression and anxiety, are substantially more prevalent among patients with diabetes than among those without the disease. These conditions negatively affect self-management, contribute to glycemic instability, and are associated with increased complications and mortality [50]. Accordingly, the 2025 ADA guidelines recommend that all patients with diabetes receive psychosocial care, which should be integrated into routine medical care and delivered by trained health professionals using collaborative, patient-centered, and culturally appropriate approaches [4]. Screening protocols for psychosocial issues—including diabetes distress, depression, anxiety, fear of hypoglycemia, and disordered eating behaviors—should be implemented at least annually as well as when changes occur in disease status, treatment, or life circumstances. These include times such as diagnosis, routine follow-up visits, hospitalization, the onset of new complications, the transition from pediatric to adult care, treatment changes, poor glycemic control, reduced quality of life, or difficulties with self-management [4].

Referral to behavioral health specialists experienced in diabetes care, or to other trained healthcare professionals, should be made when necessary for further assessment and treatment of diabetes distress, depression, suicidal ideation, anxiety, fear of hypoglycemia, disordered eating, and cognitive dysfunction [4]. Evidence-based interventions include cognitive behavioral therapy and mindfulness-based therapies, and ongoing monitoring with individualized management is essential even after intervention [4]. Behavioral interventions may be delivered through multiple modalities, including face-to-face visits, digital health platforms, and group-based diabetes education or care programs [4].

Conclusion

Diabetes is a heterogeneous condition that requires individualized management strategies. Given its variability in pathophysiology and clinical presentation, lifestyle interventions should be tailored through multidisciplinary care, with clear goals and structured follow-up to support long-term adherence. Accordingly, lifestyle prescription in primary care represents a cornerstone of effective diabetes management.

ORCID

Hye Jun Lee: https://orcid.org/0000-0001-5810-9787
Jung-Ha Kim: https://orcid.org/0000-0002-7630-9501

Authors' contribution

Conceptualization: HJL, JHK. Data curation: HJL. Methodology/formal analysis/validation: HJL. Project administration: JHK. Writing–original draft: HJL. Writing–review & editing: HJL, JHK.

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Supplementary materials

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