

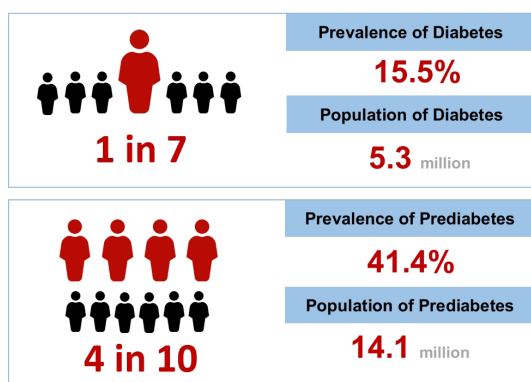
Diabetes Fact Sheets in Korea 2024

Se Eun Park, Seung-Hyun Ko, Ji Yoon Kim, Kyuho Kim, Joon Ho Moon, Nam Hoon Kim, Kyung Do Han, Sung Hee Choi, Bong Soo Cha

Diabetes Metab J 2025;49:24-33 | <https://doi.org/10.4093/dmj.2024.0818>

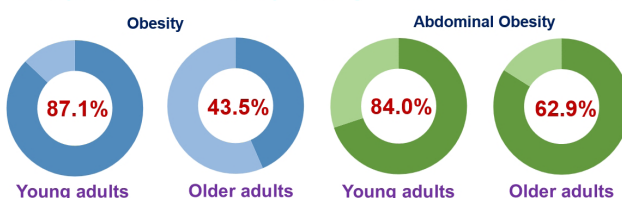
Diabetes Fact Sheets In Korea 2024

Prevalence of Diabetes and Prediabetes in Korean Adults

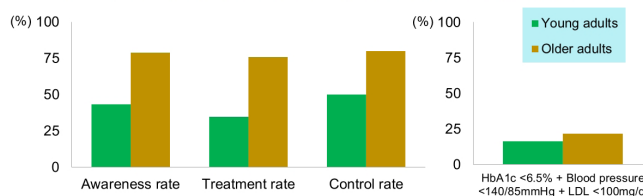


Data from the Korea National Health and Nutrition Examination Survey (2019–2022) were analyzed.

Obesity and Abdominal Obesity in Young and Older Adults with Diabetes



Management of Diabetes in Young and Older adults with Diabetes



Conclusion

- Diabetes mellitus remains highly prevalent among Korean adults.
- Older adults with diabetes show higher awareness and treatment rates but limited management outcomes, while young adults face significant obesity, comorbidities, and low awareness and treatment rates.



Highlights

- The prevalence of diabetes among Korean adults aged over 30 remains high at 15.5%.
- Only 15.9% of adults with diabetes have achieved integrated management goals.
- Older adults with diabetes show higher awareness and treatment rates than younger adults.
- Over 80% of young adults with diabetes are obese, with abdominal obesity being prevalent.

How to cite this article:

Park SE, Ko SH, Kim JY, Kim K, Moon JH, Kim NH, et al. Diabetes Fact Sheets in Korea 2024. *Diabetes Metab J* 2025;49:24-33. <https://doi.org/10.4093/dmj.2024.0818>

Diabetes Fact Sheets in Korea 2024

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Background: This study aimed to investigate the prevalence, management, and comorbidities of diabetes mellitus among Korean adults.

Methods: Data from the Korea National Health and Nutrition Examination Survey (2019–2022) were analyzed to assess the prevalence, treatment, risk factors, and comorbidities of diabetes. Comparisons between young and older adults with diabetes were emphasized.

Results: Among Korean adults aged ≥ 30 years, the prevalence of diabetes is 15.5% during 2021–2022. Of these, 74.7% were aware of their condition, 70.9% received antidiabetic treatment, and only 32.4% achieved glycosylated hemoglobin (HbA1c) $< 6.5\%$. Moreover, 15.9% met the integrated management targets, which included HbA1c $< 6.5\%$, blood pressure $< 140/85$ mm Hg, and low-density lipoprotein cholesterol < 100 mg/dL. In young adults aged 19 to 39 years, the prevalence of diabetes was 2.2%. Among them, 43.3% were aware of their condition, 34.6% received treatment, and 29.6% achieved HbA1c $< 6.5\%$. Obesity affected 87.1%, and 26.9% had both hypertension and hypercholesterolemia. Among adults aged ≥ 65 years, the prevalence of diabetes was 29.3%, with awareness, treatment, and control rates of 78.8%, 75.7%, and 31.2%, respectively. Integrated management targets (HbA1c $< 7.5\%$, hypertension, and lipids) were achieved by 40.1%.

Conclusion: Diabetes mellitus remains highly prevalent among Korean adults, with significant gaps in integrated glycemic, blood pressure, and lipid control. Older adults with diabetes show higher awareness and treatment rates but limited integrated management outcomes. Young adults with diabetes bear a significant burden of obesity and comorbidities, alongside low awareness and treatment rates. Therefore, early intervention programs, education, and strategies tailored to younger populations are urgently required.


Keywords: Aged; Comorbidity; Diabetes mellitus; Prevalence; Republic of Korea; Young adult

INTRODUCTION

Diabetes mellitus is a major global public health challenge,

contributing significantly to morbidity, disability, and mortality, with a rapidly growing incidence and prevalence over the past few decades [1]. According to the *International Diabetes*

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Received: Dec. 13, 2024; Accepted: Dec. 24, 2024

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Federation Diabetes Atlas, 10.5% of adults aged 20 to 79 years had diabetes worldwide in 2021, and this number is expected to reach 783 million by 2024 [2]. This alarming trend is attributed to various factors, including rising rates of overweight and obesity, unhealthy diets, physical inactivity, and genetic and epigenetic predispositions [3]. The increasing burden of diabetes has resulted in increased diabetes-related morbidity, which has become a socioeconomic burden. Consequently, a comprehensive assessment of the disease status, prevalence, management, and comorbidities is critical for reducing its impact.

The increasing prevalence of diabetes among older adults is well established. In Korea, over one-third of individuals aged 65 years have diabetes, and half of this population has prediabetes [4]. This number is expected to rise in the coming decades, further complicating public health challenges. Older adults with diabetes have heightened risks of functional disability, accelerated muscle loss, and coexisting illnesses, such as hypertension, chronic kidney disease, coronary heart disease, stroke, and premature death, compared to those without diabetes [5]. In contrast, the incidence of diabetes is also rising among younger adults in Korea. Between 2006 and 2015, a nationwide study reported that the incidence of diagnosed diabetes increased from 0.5 to 0.7 per 1,000 individuals in the 20–29-year age group and from 2.0 to 2.6 per 1,000 individuals in the 30–39-year age group. Notably, the proportion of obese young adults with diabetes significantly increased from 51.4% in 2006 to 72.4% in 2015 [6]. The higher burden of comorbidities in this group is driven by complex etiologies, long disease duration, aggressive clinical course, and lack of evidence-based guidelines for young patients with diabetes [7]. Therefore, understanding the current epidemiological status of diabetes in young and older adults is crucial for effective clinical and public health management.

In Korea, diabetes mellitus is the leading cause of disability-adjusted life years, as reported by the Korean National Burden of Disease study [8], which emphasizes the urgent need to halt the diabetes epidemic. Recently, the coronavirus disease 2019 (COVID-19) pandemic has compounded these challenges by disrupting diabetes management through delayed diagnosis and reduced monitoring [9]. In addition, advanced guidelines in antidiabetic medications and updates in clinical practice have significantly influenced diabetes care in recent years [10, 11]. To provide nationally representative statistics on diabetes epidemics, the Korean Diabetes Association (KDA) has published Diabetes Fact Sheets (DFS) since 2012, based on data

from the Korea National Health and Nutrition Examination Survey (KNHANES), a nationwide survey conducted by the Korean Centers for Disease Control and Prevention [12].

In this study, we aimed to investigate the prevalence, management, risk factors, and comorbidities of diabetes mellitus among Korean adults and update the Diabetes Fact Sheet for Korea [4]. We focused on data from 2019 to 2022 to emphasize comparisons between young and older adults with diabetes, using information from the KNHANES and the Korean National Health Insurance Service (NHIS) to provide comprehensive national estimates of the current diabetes burden.

METHODS

Study design and data collection

This study analyzed data from the KNHANES (2019 to 2020), a nationally representative cross-sectional survey designed to evaluate the health and nutritional status of the Korean population [13]. Data were collected through health interviews, examinations, and nutritional surveys. The response rate for health interviews and health examinations was 93.8%, and for nutritional surveys was 86.5% in 2020.

We also used the KNHANES (2021 to 2022) data to evaluate the prevalence of diabetes mellitus among adults aged ≥ 19 years, as well as risk-factor control, comorbidities, and self-management behaviors among adults aged ≥ 30 years. The Korean NHIS is a compulsory health insurance system managed by the Korean government that provides healthcare coverage to nearly the entire Korean population. The NHIS database covers almost all South Korean citizens, and provide a longitudinal data set that includes demographic information, disease diagnoses based on the International Classification of Diseases, Tenth Revision (ICD-10), prescription records, hospital admissions, procedure details, and health examination results including laboratory tests and anthropometric measurements [14,15].

We constructed three datasets from KNHANES and NHIS as follows: (1) KNHANES 2021 to 2022, (2) KNHANES 2019 to 2022 (merged 3 years of data), and (3) NHIS data. Data from KNHANES 2021 to 2022 were used to evaluate the overall prevalence of diabetes and prediabetes, the management status of diabetes and comorbidities in diabetes and energy intake in Korean. Data for KNHANES 2019 to 2022 were used to analyze and compare the diabetes status in young and older adults. In addition, we examined the use of antidiabetic medications

among adults with diabetes mellitus using the Korean NHIS data. This study was approved by the Institutional Review Board of Sungkyunkwan University Kangbuk Samsung Hospital (IRB no. 2024-12-005). The board waived the requirement for informed consent.

Definition of diabetes mellitus and comorbidities

In analyses using the KNHANES database, diabetes mellitus was defined as fasting plasma glucose (FPG) ≥ 126 mg/dL, glycosylated hemoglobin (HbA1c) $\geq 6.5\%$, a previous diagnosis of diabetes mellitus, or current use of antidiabetic medications [16]. Prediabetes was defined as an FPG of 100–125 mg/dL or HbA1c of 5.7%–6.4% [11]. Hypertension was defined as systolic blood pressure (SBP) ≥ 140 mm Hg, diastolic blood pressure (DBP) ≥ 90 mm Hg, or the use of antihypertensive medications. Hyper low-density lipoprotein (LDL) cholesterolemia was defined as low-density lipoprotein cholesterol (LDL-C) ≥ 100 mg/dL or the use of lipid-lowering medications [17]. Overweight and obesity were defined as a body mass index of 23.0–24.9 and ≥ 25.0 kg/m², respectively. Abdominal obesity was defined as a waist circumference ≥ 90 cm in men and ≥ 85 cm in women [18].

In the NHIS Korean data, diabetes mellitus was defined according to the tenth revision of the ICD codes E11–E14, and at least one prescription for antidiabetic medications.

Management of diabetes, its risk factors, and health behaviors

The awareness of diabetes mellitus was defined as the percentage of individuals previously diagnosed with diabetes mellitus among those with the condition [4]. The treatment rate of diabetes mellitus was referred to as the percentage of individuals with diabetes mellitus receiving antidiabetic medications among people with diabetes [4]. The control rate was defined as the percentage of individuals with HbA1c $< 6.5\%$ among those with diabetes mellitus [11]. According to the KDA clinical practice guideline for diabetes [11], blood pressure (BP) control was defined as SBP < 140 mm Hg and DBP < 85 mm Hg, and lipid control was defined as an LDL-C level of < 100 mg/dL. Current smoking was defined as having smoked ≥ 100 cigarettes in a lifetime and currently smoking [4]. High-risk alcohol consumption was defined as > 7 drinks twice per week for men and > 5 drinks for women [4]. Regular walking was defined as walking ≥ 30 min/day for ≥ 5 days/week [4]. Excess energy intake was defined as $\geq 125\%$ of the estimated energy

requirement recommended by the dietary reference intakes for Koreans 2015 [19]. We calculated the percentage of energy intake from macronutrients (carbohydrates, proteins, and fats), as previously reported [4]. We evaluated the management of diabetes mellitus as insulin, oral glucose-lowering medications, non-pharmacologic treatment, and no treatment using a health interview survey of the KNHANES.

Young and older adults with diabetes

To compare the diabetes status in young and older adults, data from the 8th (2019 to 2021) and 9th (2022) KNHANES cycles were analyzed. We assessed the prevalence, awareness, treatment, control rates, lifestyle behaviors related to diabetes, and comorbidities for these two age groups. In the NHIS, trends in antidiabetic medication use were evaluated. For the analysis of antidiabetic medication, older adults consisted of individuals selected using a 60% simple random sampling method due to data capacity regulations of NHIS. For young adults with diabetes, all individuals were included in the analysis of the NHIS dataset.

Statistical analysis

Statistical analyses utilized the KNHANES database to account for its complex sampling design and sampling weights [13], ensuring nationally representative prevalence estimates. The estimated prevalence of diabetes mellitus was presented as mean and standard error, while proportions of comorbidities, risk-factor control, and self-management behaviors were presented as percentages. Independent *t*-tests were used to compare the means of continuous variables, and chi-square tests were used to compare the proportions of categorical variables. All analyses were performed using SAS software version 9.4 (SAS Institute, Cary, NC, USA).

RESULTS

Prevalence of diabetes mellitus

Among Korean adults aged ≥ 30 years, approximately 5.3 million individuals or 15.5% (18.1% in men and 13.0% in women) had diabetes mellitus in 2021 to 2022 (Table 1). The estimated prevalence among adults aged ≥ 19 and ≥ 65 years was 13.1% (15.2% in men and 11.0% in women) and 29.3% (30.4% in men and 28.5% in women), respectively, indicating an increasing prevalence with age. Among adults aged ≥ 30 years, approximately 14.09 million, or 41.1% (43.8% in men and 38.5%

Table 1. Estimated prevalence of diabetes mellitus and prediabetes, KNHANES 2021 to 2022

Variable	Diabetes			Prediabetes		
	Total	Men	Women	Total	Men	Women
By age group, yr						
19–29	13.1 (5,405,519)	15.2 (3,130,510)	11.0 (2,275,009)	36.1 (14,949,509)	38.3 (7,896,298)	34.0 (7,053,211)
30–64	15.5 (5,333,837)	18.1 (3,072,080)	13.0 (2,261,758)	41.1 (14,099,002)	43.8 (7,409,019)	38.5 (6,689,984)
≥65	29.3 (2,340,268)	30.4 (1,062,135)	28.5 (1,278,133)	47.7 (3,804,141)	45.6 (1,595,558)	49.3 (2,208,584)
30–39	3.3 (213,466)	4.0 (139,258)	2.4 (74,208)	29.3 (1,902,723)	36.6 (1,263,531)	21.0 (639,192)
40–49	8.4 (659,606)	11.6 (465,533)	5.1 (194,074)	36.0 (2,824,476)	42.8 (1,715,741)	28.9 (1,108,735)
50–59	16.7 (1,355,027)	22.9 (923,534)	10.6 (431,492)	44.6 (3,614,117)	45.8 (1,850,896)	43.4 (1,763,221)
60–69	22.7 (1,514,503)	27.0 (883,499)	18.6 (631,004)	49.6 (3,307,805)	48.6 (1,593,147)	50.5 (1,714,659)
≥70	30.6 (1,591,235)	30.7 (660,255)	30.5 (930,980)	47.1 (2,449,881)	45.8 (985,704)	48.0 (1,464,177)

Values are presented as percentage (number).

KNHANES, Korea National Health and Nutrition Examination Survey.

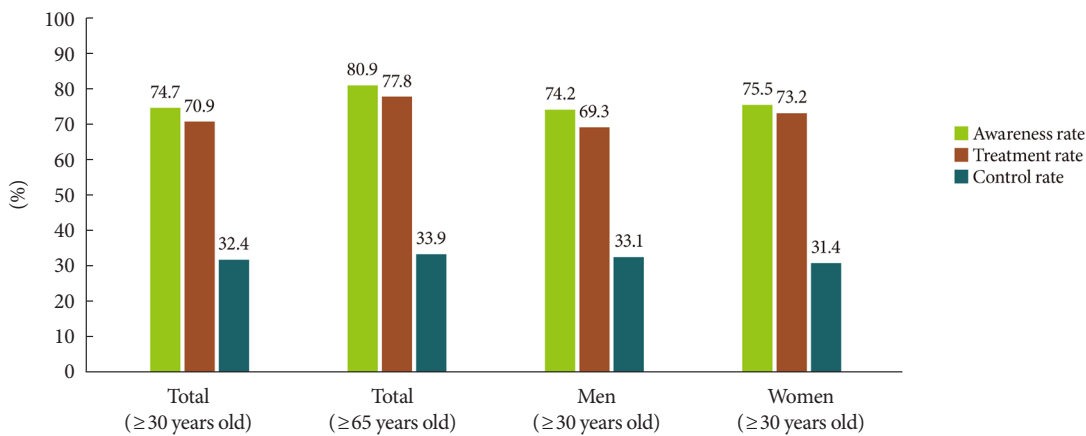


Fig. 1. Estimated proportion of awareness, treatment, and control within target glycosylated hemoglobin.

in women), had prediabetes during the same period. The estimated prevalence of prediabetes among adults aged ≥19 and ≥65 years was 36.1% (38.3% in men and 34.0% in women) and 47.7% (45.6% in men and 49.3% in women), respectively.

Management of glycemic status

In 2021 to 2022, 74.7% of adults with diabetes were aware of their condition, and 70.9% were undergoing treatment. Compared with previous reports, the proportion of awareness, treatment, and control within the target HbA1c levels significantly improved [4]. The glycemic control rate among individuals with diabetes was 32.4% for a target goal of HbA1c <6.5% (Fig. 1). The average HbA1c levels decreased with age among Korean adults with diabetes (Fig. 2). Most adults with previously diagnosed diabetes were being treated with oral hypogly-

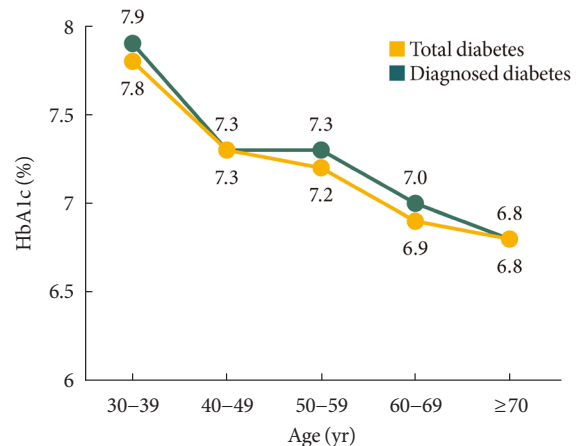


Fig. 2. Average glycosylated hemoglobin (HbA1c) levels by age group among adult Korea National Health and Nutrition Examination Survey (KNHANES) participants, 2021 to 2022.

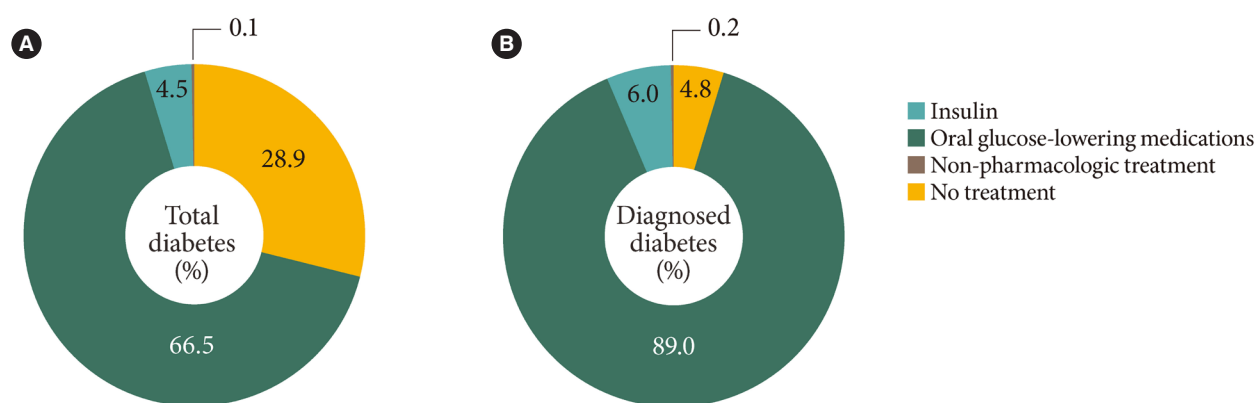


Fig. 3. Diabetes treatment among adult Korea National Health and Nutrition Examination Survey (KNHANES) participants with (A) diabetes mellitus and (B) previously diagnosed diabetes mellitus, 2021 to 2022.

cemic agents (89.0%), while 6.0% were treated with insulin with or without an oral hypoglycemic agent, and 4.8% were not receiving any treatment for their disease (Fig. 3).

Control of risk factors and comorbidities in diabetes

The percentages of adults with diabetes mellitus who achieved HbA1c levels of <6.5%, <7.0%, and <8.0% were 32.4%, 60.6%, and 84.2%, respectively (Table 2). The prevalence of hypertension among adults with diabetes mellitus was 59.6% (57.7% in men and 62.1% in women), with 60.8% achieving BP control (<140/85 mm Hg). The prevalence of hyper-LDL cholesterol-emia was 74.2% (69.7% in men and 80.4% in women), and 65.3% achieved lipid control (LDL-C level <100 mg/dL). However, only 15.9% of adults with diabetes mellitus achieved all three integrated management targets: HbA1c <6.5%, BP <140/85 mm Hg, and LDL-C <100 mg/dL for diabetes care in patients without cardiovascular disease, based on the recent KDA Clinical Practice Guidelines [11].

The prevalence of obesity among adults with diabetes mellitus was 53.8% (56.0% in men and 50.9% in women), with class I obesity accounting for 42.2% (Table 2). The overweight prevalence was 19.7%, and abdominal obesity was reported in 61.2%, with slightly higher percentages in women (62.4%) than in men (60.3%). Regarding health behaviors, current smoking and high-risk alcohol consumption were observed in 20.8% (32.9% in men and 4.1% in women) and 22.3% (28.5% in men and 7.8% in women) of adults with diabetes mellitus, respectively. Those who walked regularly accounted for 40.2% (38.4% in men and 42.7% in women) (Table 2).

Table 2. Prevalence of risk-factor control and comorbidities among adults aged ≥ 30 years, KNHANES 2021 to 2022

Variable	Total	Men	Women
HbA1c			
<6.5%	32.4	33.1	31.4
<7.0%	60.6	60.5	60.9
<8.0%	84.2	82.6	86.5
<9.0%	91.8	90.9	92.9
Hypertension	59.6	57.7	62.1
BP <140/85 mm Hg	60.8	58.7	63.5
Hyper-LDL cholesterol-emia	74.2	69.7	80.4
LDL level <100 mg/dL	65.3	64.1	66.8
HbA1c <6.5%+BP <140/85 mm Hg+LDL-C level <100 mg/dL	15.9	16.1	15.7
Weight status (BMI), kg/m ²			
Underweight (<18.5)	1.5	1.1	2.1
Normal weight (18.5–22.9)	24.9	22.4	28.4
Overweight (23.0–24.9)	19.7	20.5	18.7
Class I obesity (25.0–29.9)	42.2	45.0	38.3
Class II obesity (30.0–34.9)	9.4	9.0	10.0
Class III obesity (≥ 35.0)	2.2	2.0	2.6
Abdominal obesity (WC), cm			
Yes (≥ 90 in men, ≥ 85 in women)	61.2	60.3	62.4
Current smoking	20.8	32.9	4.1
High-risk alcohol consumption	22.3	28.5	7.8
Regular walking	40.2	38.4	42.7

Values are presented as percentage.

KNHANES, Korea National Health and Nutrition Examination Survey; HbA1c, glycosylated hemoglobin; BP, blood pressure; LDL-C, low-density lipoprotein cholesterol; BMI, body mass index; WC, waist circumference.

Dietary intake in adults with diabetes from 2021 to 2022

The total daily energy intake, excess energy intake, and percentage of energy intake from macronutrients were evaluated in individuals with diabetes, those previously diagnosed with diabetes, and those without diabetes. The total energy intake and excess energy intake were higher in participants without diabetes than in those with diabetes (total or previously diagnosed). The percentage of energy intake from carbohydrates was higher in adults with diabetes mellitus, whereas that from protein and fat was higher in adults without diabetes mellitus (Supplementary Table 1).

Characteristics of young and older adults with diabetes

The prevalence of diabetes was 2.2% (307,000) among young adults aged 19–39 years. The prevalence of prediabetes in young adults was 26.5% (3.03 million). Prediabetes was more prevalent in men than in women (26.5% vs. 16.7%). In addition, the prevalence in individuals aged 30–39 years (3.4%) was 3-fold higher than that observed in those aged 19–29 years (1.1%). The prevalence of diabetes in adults aged ≥ 65 years was 29.4%. Among those aged ≥ 75 years, 31.4% were estimated to have diabetes, with 30.0% in men and 32.3% in women (Supplementary Table 2).

Among young adults with diabetes, 26.9% had both hypertension and hypercholesterolemia. Only 9.2% of these young adults met all three integrated target levels. Among older adults with diabetes, hypertension coexisted with diabetes in 72.6%, while hypercholesterolemia was present in 70.5%, and the rate of integrated management of all three targets was 40.1% (HbA1c $< 7.5\%$) (Supplementary Table 3). Most young adults with diabetes were obese, with obesity and abdominal obesity rates of 87.1% and 84.0%, respectively. Among older adults with diabetes, the percentages of obesity and abdominal obesity were 43.5% and 62.9%, respectively (Fig. 4A and Supplementary Table 3).

Among young adults with diabetes, 43.3% were aware of their condition, 34.6% were treated with antidiabetic drugs, and 29.6% achieved HbA1c levels $< 6.5\%$. Compared with adults aged 30–39 years, individuals aged 19–29 years showed lower rates of disease awareness and treatment (Supplementary Table 4). Among older adults with diabetes, the awareness, treatment, and control rates for diabetes were 78.8%, 75.7%, and 31.2% based on HbA1c level of 6.5% or 79.8% based on HbA1c level of 7.5% [11], respectively (Fig. 4B and Supplementary Table 5).

In both young and older adults with diabetes, metformin was the most commonly prescribed antidiabetic medications. There was a steady decrease in the use of sulfonylureas/glinides and α -glucosidase inhibitors, and an increase in the use of dipeptidyl peptidase 4 inhibitors. Among young adults with diabetes, the use of sodium glucose cotransporter 2 inhibitors has steadily increased since 2015; however, this increase has been slower among older adults than younger adults.

DISCUSSION

The prevalence of diabetes among Korean adults aged ≥ 30 years is 15.5%, affecting an estimated 5.3 million individuals in 2021–2022. Compared to 2019–2020, the proportion of adults aware of (74.7%) and treated for (70.9%) diabetes mellitus notably increased in 2021–2022 [4]. However, only 15.9% of adults aged ≥ 30 years with diabetes mellitus achieved the integrated management targets, including all glycemic, BP, and lipid control measures. Although the prevalence of obesity among adults with diabetes is higher in men, abdominal obesity is more common in women. Most young adults (aged 19 to 39) with diabetes (87.1% obese and 84.0% with abdominal obesity) represent important intervention targets at the national health-care level.

This study updated the findings of the Diabetes Fact Sheet in Korea 2022 [4] using the 2021–2022 data from the KNHANES. Although there was an increase in the prevalence of diabetes mellitus among adults aged ≥ 30 years in 2020 (16.7%), the prevalence of diabetes in 2021 to 2022 remained stable. The exact cause of this stabilization is difficult to evaluate, but the COVID-19 pandemic may have contributed to the increased prevalence of diabetes mellitus in 2020 [4,20]. Additionally, the collection and analysis of data, which might have affected the diagnosis and monitoring of diabetes mellitus, was impacted during the COVID-19 pandemic. In Korea, the prevalence of diabetes has increased owing to population aging and increasing obesity [21,22]. Improvements in diabetes survival and the aging of the population may elevate the prevalence, while the stabilization of the incidence and national screening programs to identify undiagnosed diabetes may counterbalance these trends. Future data from 2023 onward will clarify the long-term impacts of these factors.

The most notable change was the improvement in the rate of awareness, treatment, and control of diabetes compared to previous reports [4]. Improved awareness of diabetes through ear-

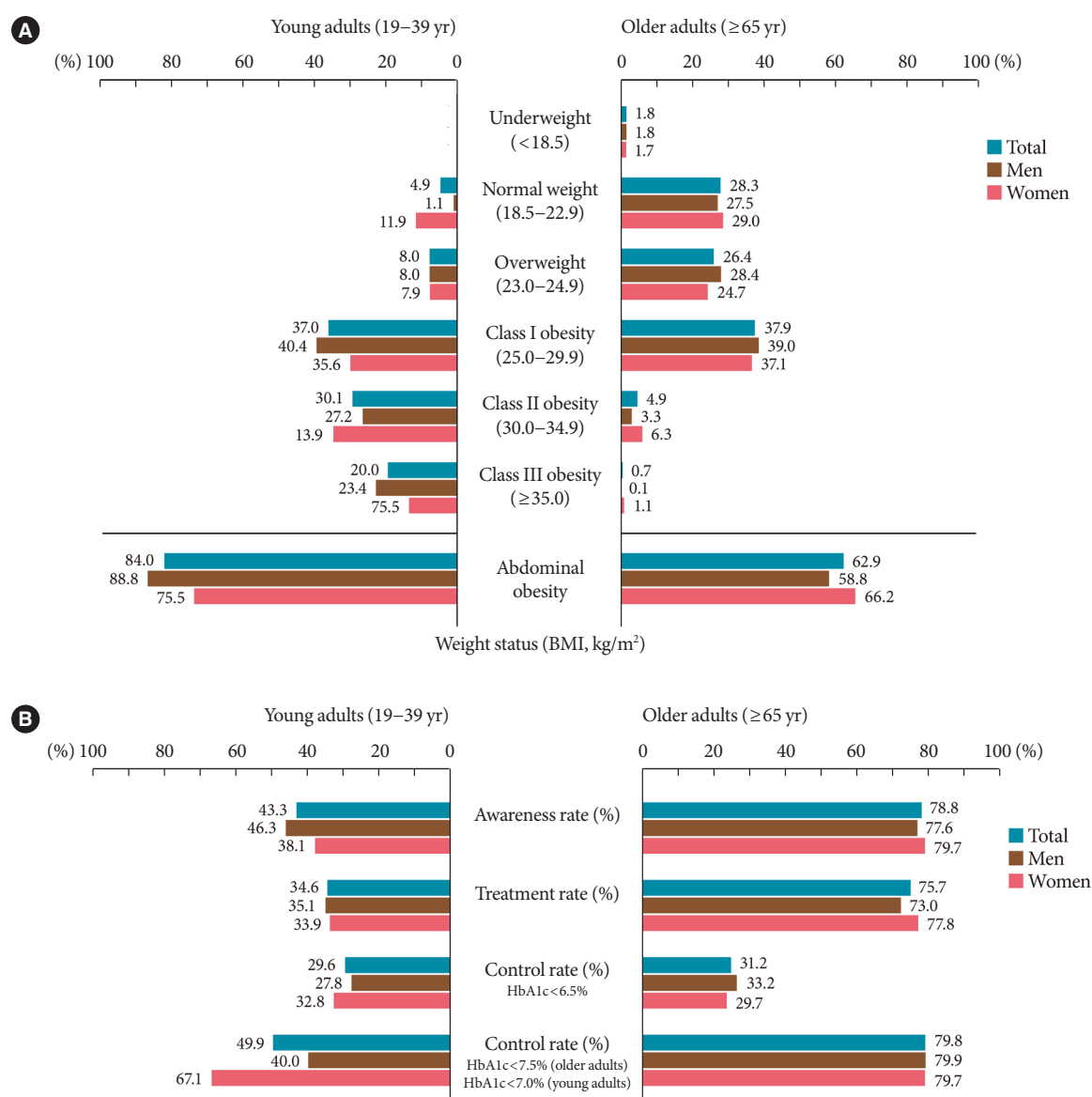


Fig. 4. (A) Obesity and abdominal obesity, (B) management of diabetes in young and older adults with diabetes among adult Korea National Health and Nutrition Examination Survey (KNHANES) participants, 2019 to 2022. BMI, body mass index; HbA1c, glycosylated hemoglobin.

ly detection should be prioritized for diabetes management. Health behaviors, such as smoking cessation, reduced alcohol intake, and increased regular exercise among adults with diabetes mellitus, also improved in 2021–2022 compared with 2019–2020. The integrated management of diabetes through achievement of clinical targets for glucose, BP, and lipid is important to prevent and delay diabetes-related complications [23]. The prevalence of hypertension and hypercholesterolemia among adults with diabetes mellitus was similar between

2019–2020 [4] and 2021–2022. However, the control of BP and lipids significantly improved in 2021–2022 (60.3% and 65.8%, respectively) compared to 2019–2020 (55.8% and 53.5%, respectively) [4]. In line with these findings, a larger proportion of adults with diabetes mellitus have achieved the goals for all three risk factors (15.9%) from 2021 to 2022, compared with 9.9% from 2019 to 2020 [17].

Despite improvements in the management of diabetes, the prevalence of obesity and abdominal obesity among adults

with diabetes mellitus has remained stable from 2019–2020 [4] to 2021–2022. Unique dietary patterns in Korea, characterized by a high carbohydrate intake, may contribute to this trend [24,25], although the food sources of energy intake are changing [26]. A total of 64.5% of energy intake came from carbohydrates among adults with diabetes in Korea, and they showed higher carbohydrate but lower overall energy intake than their counterparts without diabetes. Maintaining healthy behaviors is essential for achieving diabetes management goals [27].

Although diabetes is a highly prevalent health condition in the aging population, the increasing number of young individuals with type 2 diabetes is a growing public health concern [28]. In the present factsheet 2024, there are several differences in the characteristics and management of diabetes between young and older adults in Korea. The earlier onset of diabetes leads to longer lifetime exposure to hyperglycemia and, consequently, a greater propensity for long-term complications [29]. The course of type 2 diabetes in young individuals can be more rapid and disruptive than that in patients who develop the disease later in life, leading to early morbidity and poor quality of life [30]. This study highlights that the prevalence of diabetes is three times higher in individuals aged 30–39 years than in those aged 20–29 years. Moreover, a significant proportion of young adults with diabetes were overweight and obese (95.1%), with only 4.9% maintaining a normal body weight, and they exhibited the lowest awareness and treatment rates. These findings underscore the severe societal and health implications of young-onset diabetes, which require urgent attention.

Among older adults in Korea, we identified a significantly high prevalence of diabetes, prediabetes, and other comorbidities. This may be attributed to age-related changes. Age-related decline in pancreatic function results in decreased insulin secretion, whereas reduced muscle mass, increased visceral fat, mitochondrial dysfunction in muscles, and increased inflammation may contribute to decreased insulin sensitivity, thereby increasing the risk of diabetes in the older population [31]. Glycemic goals for older adults should be individualized, considering risk of hypoglycemia, coexisting chronic illnesses, cognitive function, functional status and life expectancy [5]. Currently, HbA1c targets are <7.5% for relatively healthy older adults according to guidelines [5,11]. The awareness, treatment, and glycemic control rates (HbA1c <7.5%) were >70%, and management rates of lifestyle habits were higher in older adults with diabetes than in young adults with the condition.

Excellent healthcare accessibility in Korea may lead to the early detection of diabetes, improvements in health literacy, and appropriate metabolic management in the older population [32–34]. The health and functional statuses of older adults with diabetes vary, which means that treatment goals should be individualized [35]. Diabetes in older adults is distinct from that in young adults, and the therapeutic approach should differ for each population.

This study had some limitations. First, as this study was based on cross-sectional data, we could not assess causality, and the results may not reflect changes in the variables over time. Second, the data should be interpreted with caution, as self-reported information was used for medical history. Third, we evaluated the use of antidiabetic medications using the Korean NHIS data for young and older adults with diabetes, which may differ from other analyses in terms of study participants.

In conclusion, the prevalence of diabetes mellitus among Korean adults remains high. Although the management of diabetes has improved, only 15.9% of adults with diabetes mellitus have achieved integrated management control of all glycemic, BP, and lipid levels between 2021 and 2022. The increasing prevalence of diabetes among young and older adults in Korea necessitates strong public health messaging and individualized therapy to mitigate diabetes-related complications. It is necessary to evaluate the national diabetes statistics to support and advocate public health policies to reduce the burden of diabetes mellitus. National efforts to improve prevention, early detection, and comprehensive management are essential to address the diabetes epidemic and reduce the socioeconomic burden in Korea.

SUPPLEMENTARY MATERIALS

Supplementary materials related to this article can be found online at <https://doi.org/10.4093/dmj.2024.0818>.

CONFLICTS OF INTEREST

Bong Soo Cha has been publisher of the *Diabetes & Metabolism Journal* since 2024. Seung-Hyun Ko has been executive editor of the *Diabetes & Metabolism Journal* since 2022. Sung Hee Choi has been associate editors of the *Diabetes & Metabolism Journal* since 2022. They were not involved in the review process of this article. Otherwise, there was no conflict of interest.

AUTHOR CONTRIBUTIONS

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Acquisition, analysis, or interpretation of data: S.E.P., S.H.K., J.Y.K., K.K., J.H.M., N.H.K., K.D.H., S.H.C.

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FUNDING

This study was supported by the Korean Diabetes Association.

ACKNOWLEDGMENTS

None

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Supplementary Table 1. Total energy intake, excess energy intake, and percentages of energy intake from macronutrients among adults aged ≥ 30 years, KNHANES 2021 to 2022

Variable	Total diabetes mellitus	Diagnosed diabetes mellitus	Non-diabetes mellitus	P value ^a
Total energy intake, kcal	1,791.1	1,747.0	1,829.2	0.1855
Men	2,040.7	1,985.9	2,142.4	0.0175
Women	1,454.0	1,430.4	1,542.0	0.0019
Excess energy intake, % ^b	12.6	11.8	11.9	0.5246
Men	14.2	13.5	14.6	0.8067
Women	10.5	9.4	9.5	0.4135
Percentages of energy intake from macronutrients				
Carbohydrates, %	64.5	65.0	60.8	<0.0001
Men	63.5	64.4	60.4	<0.0001
Women	65.9	65.7	61.3	<0.0001
Protein, %	15.3	15.2	15.9	0.0003
Men	15.6	15.4	16.3	0.0014
Women	14.9	15.1	15.5	0.0057
Fat, %	20.2	19.8	23.3	<0.0001
Men	21.0	20.2	23.4	<0.0001
Women	19.2	19.2	23.2	<0.0001

KNHANES, Korea National Health and Nutrition Examination Survey.

^aP values are for comparing total diabetes mellitus and non-diabetes mellitus, ^bExcess energy intake was defined as $\geq 125\%$ of the estimated energy requirement recommended by the dietary reference intakes for Koreans 2015.

Supplementary Table 2. Estimated prevalence of diabetes mellitus and prediabetes among young and older adults, KNHANES 2019 to 2022

Age, yr	Diabetes, %			Prediabetes, %		
	Total	Men	Women	Total	Men	Women
Young adults						
19–39	2.2±0.2	2.7±0.3	1.7±0.3	21.8±0.7	26.5±1.0	16.7±0.8
19–29	1.1±0.2	1.2±0.3	1.0±0.3	14.3±0.8	16.4±1.2	12.0±1.1
30–39	3.4±0.4	4.3±0.6	2.4±0.4	29.8±1.0	37.2±1.5	21.7±1.2
Older adults						
≥65	29.4±0.6	30.2±1.0	28.9±0.8	49.0±0.7	48.2±1.1	49.6±0.9
65–74	28.1±0.8	30.3±1.3	26.0±1.1	49.8±1.0	48.2±1.5	51.3±1.2
≥75	31.4±1.0	30.0±1.6	32.3±1.3	47.8±1.2	48.1±1.7	47.5±1.5

Values are presented as mean±standard error.
KNHANES, Korea National Health and Nutrition Examination Survey.

Supplementary Table 3. Prevalence of risk-factor control and comorbidities among young and older adults with diabetes, KNHANES 2019 to 2022

Variable	Older adults, %			Young adults, %		
	Total	Men	Women	Total	Men	Women
HbA1c						
<6.5%	31.2±1.3	33.2±2.0	29.7±1.6	29.6±4.7	27.8±6.0	32.8±7.0
Hypertension ^a	72.6±1.2	68.2±1.8	76.1±1.5	34.7±5.1	43.9±6.7	18.8±6.1
BP <140/85 mm Hg	61.8±1.6	65.8±2.5	58.8±2.2	46.4±9.0	45.4±10.4	50.5±18.3
Hyper-LDL cholesterolemia ^b	70.5±1.3	64.3±2.0	75.6±1.6	74.4±4.9	67.8±6.7	85.7±5.7
LDL level <100 mg/dL	67.5±1.3	66.0±1.9	68.7±1.6	41.8±5.3	48.8±6.9	29.8±7.3
Hypertension+hyper LDL cholesterolemia	52.0±1.4	45.7±2.0	57.1±1.9	26.9±4.7	31.6±6.4	18.8±6.1
HbA1c <6.5%+BP <140/85 mm Hg+ LDL-C level <100 mg/dL	15.2±1.0	16.4±1.5	14.3±1.2	9.2±3.2	10.0±4.4	7.8±4.1
HbA1c <7.0% or <7.5%+BP <140/85 mm Hg+LDL-C level <100 mg/dL ^c	40.1±1.3	42.5±2.0	38.1±1.7	26.8±4.7	29.9±6.4	21.4±6.7
Weight status (BMI), kg/m ²						
Underweight (<18.5)	1.8±0.4	1.8±0.6	1.7±0.5	-	-	-
Normal weight (18.5–22.9)	28.3±1.3	27.5±1.8	29.0±1.7	4.9±2.1	1.1±1.1	11.9±5.5
Overweight (23.0–24.9)	26.4±1.3	28.4±1.9	24.7±1.6	8.0±2.4	8.0±2.9	7.9±4.1
Class I obesity (25.0–29.9)	37.9±1.3	39.0±1.9	37.1±1.9	37.0±4.9	40.4±6.5	30.7±6.9
Class II obesity (30.0–34.9)	4.9±0.6	3.3±0.6	6.3±0.8	30.1±4.8	27.2±6.2	35.6±7.2
Class III obesity (≥35.0)	0.7±0.2	0.1±0.1	1.1±0.4	20.0±4.4	23.4±5.9	13.9±5.6
Abdominal obesity (WC), cm						
Yes (≥90 in men, ≥85 in women)	62.9±1.3	58.8±2.0	66.2±1.8	84.0±3.7	88.8±4.0	75.5±7.1
Current smoking ^d	10.4±0.8	19.7±1.7	2.7±0.5	34.2±5.2	44.8±6.9	15.7±5.3
High-risk alcohol consumption ^e	6.3±0.7	13.4±1.4	0.4±0.2	16.1±3.6	17.6±4.9	13.5±5.1
Regular walking ^f	41.7±1.4	46.8±2.0	37.3±1.9	41.8±5.2	35.4±6.3	53.1±8.0

Values are presented as mean ± standard error.

KNHANES, Korea National Health and Nutrition Examination Survey; HbA1c, glycosylated hemoglobin; BP, blood pressure; LDL-C, low-density lipoprotein cholesterol; BMI, body mass index; WC, waist circumference.

^aHypertension was defined as systolic BP ≥140 mm Hg or diastolic BP ≥90 mm Hg or taking antihypertensive medications, ^bHyper-LDL-cholesterolemia was defined as LDL-C ≥100 mg/dL or taking lipid-lowering medications, ^cHbA1c <7.0% for young adults and <7.5% for older adults with diabetes, ^dCurrent smoking was defined as having smoked ≥100 cigarettes in a lifetime and currently smoking, ^eHigh-risk alcohol consumption was defined as >7 drinks twice per week for men and >5 drinks for women, ^fRegular walking was defined as walking ≥30 min per day, and ≥5 days per week.

Supplementary Table 4. Estimated proportion of awareness, treatment, and control within targeted glycosylated hemoglobin in young adults with diabetes

Variable	Awareness ^a , %	Treatment rate ^b , %	Control rate ^c , %	
			HbA1c <6.5 %	HbA1c <7.0 %
19–39 years				
Total	43.3±5.0	34.6±4.3	29.6±4.7	49.9±4.9
Men	46.3±6.4	35.1±5.9	27.8±6.0	40.0±6.3
Women	38.1±6.3	33.9±6.0	32.8±7.0	67.1±7.1
19–29 years				
Total	27.1±7.5	16.5±5.3	26.2±8.3	51.6±9.5
Men	36.6±11.5	17.6±8.6	35.1±11.2	49.6±11.7
Women	15.0±4.6	15.0±4.6	14.8±10.9	54.1±15.5
30–39 years				
Total	49.0±5.8	41.0±5.2	30.8±5.7	49.4±5.8
Men	49.1±7.5	40.3±6.9	25.6±7.0	37.2±7.3
Women	48.6±7.5	42.5±7.4	41.0±7.9	73.0±6.7

Values are presented as mean ± standard error.

HbA1c, glycosylated hemoglobin.

^aAwareness of diabetes mellitus was defined as the percentage of individuals previously diagnosed with diabetes mellitus among individuals with diabetes mellitus, ^bTreatment rate of diabetes mellitus was defined as the percentage of individuals receiving antidiabetic medications among individuals with diabetes mellitus, ^cControl rate of diabetes mellitus was defined as the percentage of individuals with glycosylated hemoglobin <6.5% or <7.0% among individuals with diabetes mellitus.

Supplementary Table 5. Estimated proportion of awareness, treatment, and control within targeted glycosylated hemoglobin in older adults with diabetes

Variable	Awareness ^a , %	Treatment rate ^b , %	Contral rate ^c , %	
			HbA1c <6.5 %	HbA1c <7.5 %
≥65 years				
Total	78.8±1.1	75.7±1.1	31.2±1.3	79.8±1.1
Men	77.6±1.7	73.0±1.8	33.2±2.0	79.9±1.6
Women	79.7±1.4	77.8±1.4	29.7±1.6	79.7±1.5
65–74 years				
Total	77.5±1.4	74.4±1.4	30.0±1.6	78.4±1.5
Men	78.5±2.0	74.5±2.1	31.3±2.3	78.2±2.1
Women	76.6±2.0	74.3±2.0	28.7±2.1	78.6±2.0
≥75 years				
Total	80.3±1.7	77.3±1.8	32.8±1.9	81.6±1.6
Men	76.1±3.0	70.4±3.2	36.6±3.2	83.2±2.3
Women	82.7±2.0	81.3±2.0	30.6±2.4	80.7±2.1

Values are presented as mean ± standard error.

HbA1c, glycosylated hemoglobin.

^aAwareness of diabetes mellitus was defined as the percentage of individuals previously diagnosed with diabetes mellitus among individuals with diabetes mellitus, ^bTreatment rate of diabetes mellitus was defined as the percentage of individuals receiving antidiabetic medications among individuals with diabetes mellitus, ^cControl rate of diabetes mellitus was defined as the percentage of individuals with glycosylated hemoglobin <6.5% or <7.5% among individuals with diabetes mellitus.