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The Diabetes Epidemic in Korea

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Diabetes is one of the foremost public health issues worldwide that can lead to complications in many organ systems, and has become a significant cause of morbidity and mortality in Korea. According to data from the National Health Insurance Service (NHIS), about 2.7 million Koreans (8.0%) aged 30 years or older had type 2 diabetes mellitus (T2DM) in 2013. The prevalence of T2DM increased with age and rose from 5.6% in 2006 to 8.0% in 2013. Using data based on The Health Screening Service of the NHIS, 25% of Korean adults were reported to have prediabetes in 2013. The prevalence of an impaired fasting glucose tended to increase over time from 21.5% in 2006 to 25.0% in 2013. Even though nationwide health screening has been regularly conducted as a public service, the proportion of undiagnosed cases of diabetes was still reported to be on the higher side in the latest study. Based on the results of these epidemic studies, further actions will be needed to effectively implement lifestyle changes on a social level and increase measures for the early detection of diabetes to stem the tide of the epidemic.

Keywords: Epidemiology; Diabetes; Prediabetic state

INTRODUCTION

Diabetes is one of the foremost public health issues worldwide and is anticipated to increase in global predominance by 51% from 366 million in 2011 to 552 million in 2030 [1]. Diabetes leads to complications in many organ systems, which have become a significant cause of morbidity and mortality in Korea [2]. Type 2 diabetes mellitus (T2DM) has experienced an explosive increase in prevalence during the last three decades in the Asian population. In China, the rate of diabetes has risen from 2.6% to 9.7% over the past decade [3]. In Taiwan, the prevalence rate of diabetes from 1985 to 2007 was between 4.9% and 8.3% [4]. The prevalence of probable diabetes in Japan has increased from 6.9 million to 8.9 million during the decade from 1997 to 2007 [5]. The prevalence of T2DM in Korea is also increasing, as evidenced by several cohort studies and national surveys [6,7]. The rapidly rising prevalence rates of diabetes in Asia may be related to increasing urbanization, a decrease in physical activity and a rising obese population [8]. The aim of this review is to provide insight on the diabetes epidemic in Korea based upon the published literature.

LITERATURE SEARCH STRATEGY

Websites including PubMed, Google, and KoreaMed were searched using the following key words: “diabetes in Korea,” “diabetes epidemic in Korea,” and “diabetes prevalence in Korea.” Reports published by the Korea Centers for Disease Control and Prevention and the Korean Diabetes Association (KDA) on the above topics were also used. The articles and reviews

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were selected from peer-reviewed journals and identified based on the search for preparing the present review article.

PREVALENCE OF DIABETES

Cohort studies

The cross-sectional cohort studies in various areas included Yeoncheon county in 1993 with a sample size of 2,520 [9], Jeong-eup district (1997) with a sample size of 1,108 [10], and Mok-dong in Seoul (1998) with a sample size of 774 [11]; the diabetes prevalence rates were 7.2%, 7.1%, and 8.5%, respectively. In a prospective cohort study conducted in Anseong and Ansan counties from 2000 to 2002, 12.6% of residents had been diagnosed with diabetes, including 6.0% established cases of diabetes and 6.6% newly diagnosed cases [12,13]. These cohort studies revealed a rapid increase with respect to the prevalence of diabetes, although the studies were conducted in restricted areas involving participants who might have had widely varied characteristics (Table 1).

The Korean National Health and Nutrition Examination Surveys

The Korean National Health and Nutrition Examination Survey (KNHANES) is a cross-sectional health surveillance system that is randomly sampled throughout South Korea and is conducted by the Korea Institute for Health and Social Affairs. Since its initiation in 1998, surveys for the KNHANES I (1998), KNHANES II (2001), KNHANES III (2005), KNHANES IV (2007 to 2009), and KNHANES V (2010 to 2012) have been executed, and the investigation for the KNHANES VI (2013 to 2015) is still in progress [14]. In this analysis, diabetes was defined as a fasting plasma glucose value ≥126 mg/dL or a previous diagnosis of diabetes. According to the KNHANES, the age-standardized prevalence rates of diabetes among adults aged ≥30 years were 8.6%, 9.1%, 9.6%, 9.6%, 9.8%, and 11.1% in 2001, 2005, 2007, 2009, 2011, and 2013, respectively (Fig. 1A). The prevalence of T2DM was 1.4 times higher in men than in women (Fig. 1A) and increased with age by 2.5% in the group from 30 to 39, 7.3% in people from 40 to 49, 12.6% in those from 50 to 59, 25.2% in the group from 60 to 69, and 27.6% in people 70 years of age and older in 2013 (Fig. 2A).

Table 1. Prevalence of Diabetes in Korea Based on Cohort Data

Region	Year	Diagnosis method	Criteria	Sample size, *n*	Prevalence, %	Reference
Yonchon, rural	1993	75 g OGTT	WHO 1985	2,520	7.2	[9]
Jeong-eup, rural	1997	75 g OGTT	WHO 1985	1,108	7.1	[10]
Mok-dong, urban	1998	75 g OGTT	ADA 1997	774	8.5	[11]
Ansan and Anseong, rural and urban	2000–2002	75 g OGTT	ADA 1997	10,038	12.6	[12]

OGTT, oral glucose tolerance test; WHO, World Health Organization; ADA, American Diabetes Association.

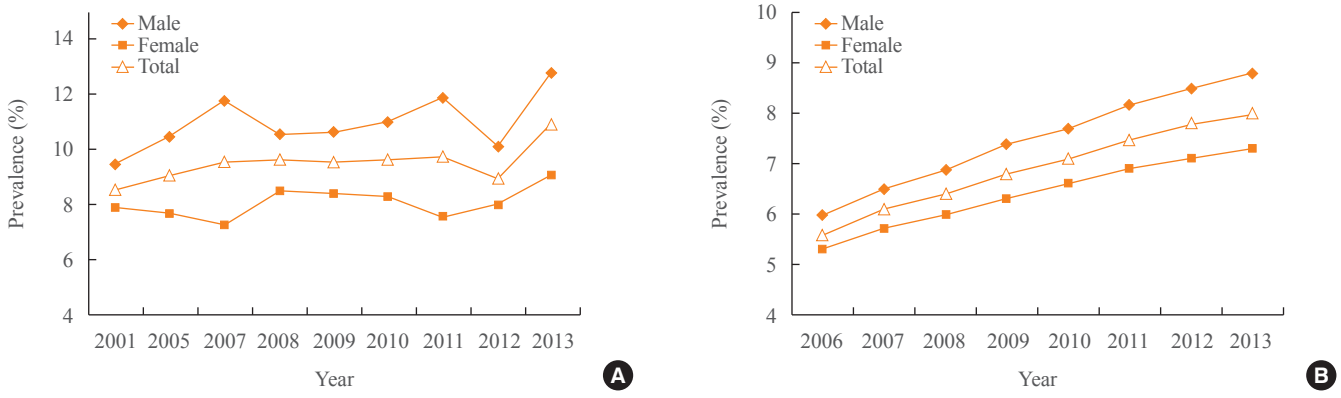

Fig. 1. Trends in the prevalence of diabetes in Korea. (A) The age-standardized prevalence of diabetes based on the Korea National Health and Nutrition Examination Surveys from 2001 to 2013. Diabetes was defined as a fasting plasma glucose value ≥126 mg/dL or a previous diagnosis of diabetes. (B) The prevalence of type 2 diabetes was determined based on data from the National Health Insurance Service. Type 2 diabetes was defined as the presence of ICD-10 code (E11–E14) and the prescription of anti-diabetic medications.

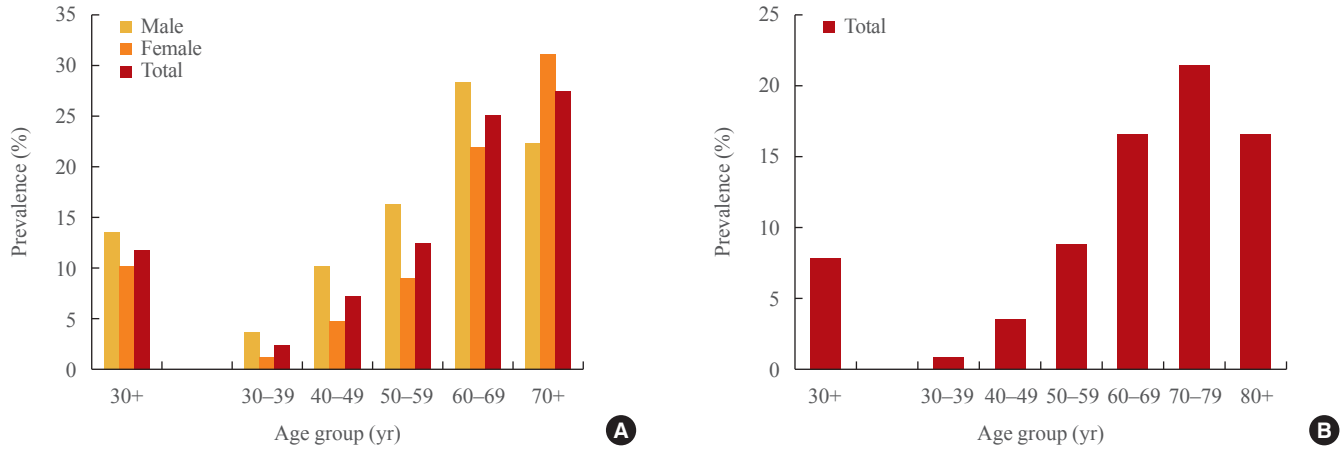

Fig. 2. The prevalence of diabetes according to age group in 2013. (A) The age-standardized prevalence of diabetes based on the 2013 Korea National Health and Nutrition Examination Survey. Diabetes was defined as a fasting plasma glucose value ≥126 mg/dL or a previous diagnosis of diabetes. (B) The prevalence of type 2 diabetes was based on data from the National Health Insurance Service. Type 2 diabetes was defined when an ICD-10 code (E11–E14) and the prescription of anti-diabetic medications were present.

Despite the fact that there are fluctuations in the annual prevalence, the prevalence of diabetes has increased during the last few decades. This rise has been particularly evident in older groups (≥70 years age) and almost doubled from 15.1% in 2001 to 27.6% in 2013.

Furthermore, according to the KNHANES, undiagnosed diabetes was defined as a fasting plasma glucose ≥126 mg/dL without a previous diagnosis of diabetes; the prevalence was 30.9% in men and 22.0% in women out of the total diabetic population in 2013 [14]. The rate of unawareness was highest in people from 30 to 39 years of age and was 65.4% in men and 35.1% in women. Interestingly, according to the 2011 to 2012 KNHANES, it is evident that men with a low income had lower odds for diabetes compared to those with the highest incomes; in contrast, women with a low income had an increased likelihood of developing diabetes compared with women with the highest income [15]. However, according to data from the 2013 KNHANES, the gender-specific economic discrepancy has since disappeared, and diabetes has become more prevalent in individuals in lower income groups in both genders; this finding was similar to that observed in developed Western countries [14].

The National Health Insurance Service database

Recently, the National Health Insurance Service (NHIS), which is a single-payer program for all residents in Korea, signed an agreement with the KDA to provide open access to its databases. As a result, the current epidemic of diabetes was evaluated and reported using the information from the National Health Information Database of the NHIS as a Korean Diabetes Fact Sheet (DFS) in 2015 by the KDA. The data from the NHIS has distinctive characteristics compared to the KNHANES. First, it is not a sampling inventory but instead a complete enumeration survey for all residents in Korea. Second, it is possible to set type limits for diabetes using operational definitions with ICD-10 codes. In practice, patients with type 1 diabetes who had claims under ICD-10 code E10 were excluded from the evaluation of the prevalence of T2DM. According to Korean DFS 2015 [16], about 2.7 million Korean people (8.0%) aged 30 years or older had T2DM in 2013. In this analysis, T2DM was defined based on ICD-10 code (E11–E14) and the concurrent prescription of anti-diabetic medications. The prevalence of T2DM increased with age as follows: 0.9% in the 30 to 39, 3.5% in people 40 to 49, 8.9% in people 50 to 59, 16.6% in the group from 60 to 69, and 21.5% in the 70 to 79 years group; there was a slight decrease in the group ≥80 years to 16.7% in 2013 (Fig. 2B). The overall increase in the annual prevalence of T2DM rose from 5.6% in 2006 to 8.0% in 2013 (Fig. 1B).

When the database of the Health Screening Service was used, which included 10,610,669 participants aged ≥30 years from the national Health Screening Service, the prevalence of diabetes in 2013 was found to be 10.9%; diabetes was defined as a fasting glucose value ≥126 mg/dL or an ICD-10 code (E11–E14) with a prescription of anti-diabetic medications. The prevalence from the database of the Health Screening Service was 2.9% higher than that of the National Health Information Database. This discrepancy suggests that around 3% of the adult population have undiagnosed diabetes according to a fasting glucose ≥126 mg/dL without an ICD-10 code (E11–E14) or the

prescription of antidiabetic medications.

PREVALENCE OF PREDIABETES

The prevalence of prediabetes was also reported by the Korean DFS 2015 using the database of the Health Screening Service of the NHIS [16]. Prevalent case of prediabetes was defined as a fasting plasma glucose between 100 to 125 mg/dL without a claim under ICD-10 codes E11–E14 or the prescription of antidiabetic medication. Based on the fasting glucose level, 25.0% of adults were reported to have prediabetes in 2013. The prevalence of an impaired fasting glucose tended to increase over time from 21.5% in 2006 to 25.0% in 2013. An analysis of prediabetes based on data from the KNHANES also defined the condition as a fasting glucose between 100 to 125 mg/dL without a prior history of diabetes. In these analyses, the prevalence of prediabetes increased as well from 17.4% in 2005 to 20.4% in 2007 to 2009 [17]. Based on the fact that only the fasting glucose level was considered for the definition of prediabetes, an impaired glucose tolerance was not included when defining prediabetes. It is therefore hypothesized that this operational definition of prediabetes may underestimate its true prevalence.

CONCLUSIONS

Numerous epidemiologic studies, including regional cohorts, the KNHANES and the National Health Information Database, have revealed a high rate of existence and a gradual increase in the prevalence of diabetes in Korea. Even though nationwide health screening is regularly offered as a public service, the proportion of undiagnosed cases was still reported to be high in the latest study. Estimates of the diabetes burden have important implications for future public health planning. Based on the results of these epidemic studies, we anticipate that further actions will be needed to effectively implement lifestyle changes on a social level and increase measures for the early detection of diabetes to stem the tide of the epidemic.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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