Changes in the Prevalence of Diabetes Mellitus in Bulgaria (2006–2012)

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ABSTRACT

AIM: The aim of this study was to compare two nationwide cross-sectional studies of diabetes prevalence in Bulgaria (2006 and 2012) and to assess its dynamics.

MATERIAL AND METHODS: The two studies included 2396 and 2033 subjects, respectively. The International Diabetes Federation (IDF) diagnostic criteria were applied, and the data were weighed for type of settlement and age.

RESULTS: Diabetes prevalence was found to be 7.9% in 2006 and 9.55% in 2012, $P = 0.06$, showing an increase of 20.9%. The absolute increase was 0.9% in the females and 2.3% in the males ($P < 0.09$). The increase was the largest in those aged 50–59: [9.4%, 2006 vs. 15.7%, 2012, $P < 0.01$]. Diabetes prevalence increased in the 20–60-year olds by 6.8% and decreased in the elderly by 6.1%. Obesity increased from 26.7 to 32.7%, $P < 0.02$.

CONCLUSIONS: A significant increase in diabetes prevalence was found that necessitates healthcare measures and resources for community-based awareness and prevention programs.

KEYWORDS: diabetes prevalence, diabetes dynamic, obesity, diabetes epidemic

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Introduction

Diabetes is one of the most common chronic disorders worldwide. Its prevalence increases steadily and reaches epidemic magnitude.[1] The International Diabetes Federation (IDF) has been assessing diabetes prevalence in 216 countries and regions every 3 years since the year 2000, thus regularly updating the information and extrapolating its trends. These data help to predict the disease's magnitude and strategically plan its management: risk assessment, diagnostic and therapeutic approaches, and, above all, the devising of prevention programs.[1]

Data on the regional prevalence of diabetes mellitus and impaired glucose tolerance (IGT) were published in 2003 in the second edition of the IDF Diabetes Atlas. In Europe, there were 48 million diabetic subjects (prevalence 7.8%) and 63 million subjects with prediabetes (prevalence 10.2%).[2] The data in the latest IDF Diabetes Atlas published in 2011 and the Diabetes at a Glance of November 2012 showed that in Europe there were currently 55 million diabetics, ie, the prevalence had risen to 8.4%. The number of undiagnosed diabetic subjects in Europe was 21 million or 38% of all subjects with the disease.[3]

Authors from Germany reported in 2013 a 7.2% prevalence of the known diabetes (7.0% for the males and 7.4% for the females). The prevalence increases with the age and reaches 20% in the 70–79-year olds. The results from the last health population status screening in Germany in 2011 demonstrated a 38% increase in the prevalence of the known diabetes as compared to 1998: from 5.2 to 7.2%. The authors explain the phenomenon with the changing demographic structure of the population, the obesity pandemic, and other diabetogenic risk factors, as well as earlier diagnosis.[4]

The diabetes prevalence in the US is 8.3% or 25.8 million Americans (18.8 million diagnosed or known disease and 7 million with undiagnosed diabetes). The prevalence of the diagnosed diabetes in the adults demonstrated a significant increase from 5.1% in 1988–1994 to 7.1% in 2005–2006, ie, a 39% increase.[5]

According to the study group of the Ministry of Health, Labour and Welfare of Japan, the National epidemiological studies of diabetes in Japan (1997 and 2007) have shown an increase in the disease prevalence by 61% (1370/10,000–2210/10,000).[6] The prevalence of diabetes varies among different countries depending on their economic development. The majority of diabetics in the most economically developed countries are over the age of 60, while in the developing countries, the majority of the diabetic patients are in the age group of 40–60 years. It has been predicted that the difference will persist in 2030, though the mean age of the population in the developing countries will increase more than that in the developed ones. The United Nations Organization predicts that the number of diabetic subjects will increase till 2030

because of population aging and urbanization, which brings about profound lifestyle changes.[7] Global diabetes prevalence is expected to continue to increase as a result of a number of factors: population increase and aging, urbanization, obesity, unhealthy diet, and decreasing physical activity.[8] The IDF predicts an increase in the number of diabetics worldwide between 2003 and 2025 by 72%, to reach 333 million. No country can evade this trend.[2]

The Bulgarian Society of Endocrinology has carried out two population-based screening studies for the most common endocrine disorders, cardiovascular risk factors (arterial hypertension, obesity, dyslipidemia) and diabetes as well—in 2006 and 2012.[9,10]

The aim of the current study was to compare the data from the two nationwide cross-sectional studies of diabetes prevalence in Bulgaria (2006 and 2012) and to assess its dynamics and the relationship with certain risk factors: age, gender, obesity, abdominal obesity, and arterial hypertension.

Material and Methods

The first nationwide epidemiological study of diabetes prevalence was carried out in January–February 2006. Twenty-eight nests were selected in six regions, and 3813 subjects were randomly appointed from the national population registry. A total of 2396 subjects (62.8%) agreed to participate, signed an informed consent, and were included in the study. Of them, 1348 were females (55.8%) and 1068 were males (44.2%). The mean age of the participants was 47.7 ± 14.8 years (20–80). The standardized diabetes prevalence data, as per the WHO recommendations,[11,12] have been published in the IDF Diabetes Atlas на IDF in 2009 as total and weighed by age and gender prevalence.[13,14]

The second study was carried out in January–February 2012. Thirty-six nests were selected in 12 regions, and 3450 adult subjects were randomly appointed from the national population registry. A total of 2033 subjects (58.8%) agreed to participate, signed an informed consent, and were included in the study. Of them, 1076 were females (52.9%) and 957 were males (47.1%). The mean age of the participants was 49.3 ± 14.7 years (20–80). The age structure of the samples in both the studies was planned according to the IDF methodology for diabetes prevalence assessment in adults.[15] The participants in both were further divided in age groups by decades (20–29; 30–39; 40–49; 50–59; 60–69; 70+ years). The comparison of the two data sets was done after weighing for type of settlement and age.

According to the reports of the National Statistical Institute (NSI) of Bulgaria, the country's population 20 years of age or older was 6,168,000 as of 31 December 2005[16] and 6,011,713, as of February 2011.[17] The studied population was adjusted for gender, age, and type of place of living according to the NSI reports. Both the studies were cross-sectional. The sample size was calculated with the expectation of at least 6% prevalence of the studied variable among the target population, confidence level 95%, and an absolute precision 5%. The geographic regions, the nests, and the gender and age distribution of the sample were planned to represent the adult general population (20–80 years).

All participants signed an informed consent approved by the local ethics committee at the University Hospital of Endocrinology, and the research was conducted in accordance with the Declaration of Helsinki. The participants filled in a questionnaire containing demographic data, current health status, medical history, family history for cardiovascular and thyroid disorders and diabetes, past history and therapies, menstrual status for the females, and current smoking. Body height, weight, waist circumference (WC) and sitting arterial pressure at the arm were measured. Increased waist circumference was defined after IDF recommendations if >80 cm for the females and >94 cm for the males. Hypertension was defined according to the Nation Institute for Health and Care Excellence/British Heart Society (NICE/BHS) hypertension guidelines (blood pressure (BP) cutoff is 140/90 mmHg).[18] We ruled out the option to apply the IDF consensus for diabetes type 2 recommending arterial pressure levels up to 130/80 mmHg.[19]

Diabetes was diagnosed after the WHO 1999 criteria when fasting glucose ≥7.0 mmol/L was measured.[20] Standard oral glucose tolerance test (measurement at 120 minutes after a 75 g glucose load) was performed in subjects with fasting glucose 6.1–6.9 mmol/L), and the results were interpreted after the WHO 1999 definition:

- IGT: 120 minutes glucose 7.8–11.0 mmol/L;
- Impaired fasting glucose (IFG): 120 minutes glucose <7.8 mmol/L;
- diabetes mellitus: 120 minutes glucose ≥11.1 mmol/L.

Laboratory tests. Blood was drawn between 7 and 9 a.m. after an overnight fast. Plasma glucose was measured in both the studies by an automated glucose–oxidase analyzer (Glucose Analyzer II, Beckman Coulter, Inc.), and all samples were processed by a single laboratory technician. The daily calibration and quality control was performed as per the manufacturer recommendations with a standard Presinorm (Roche)—glucose 4.9 ± 0.3 mmol/L and Presipath (Roche)—glucose 12.6 ± 0.5 mmol/L.

Statistical processing. The data were analyzed with SPSS for Windows v.13.0. A descriptive analysis was done, and the subjects were grouped by one or more factors. A diagnostic analysis was performed to assess the presence of statistically significant effects by conducting statistical hypothesis tests for certain relationships, also including variables measured at nominal or ordinal scales. Suitable assumptions about the variable distribution were made to measure the significance levels of the analyzed empirical characteristics. Unless otherwise stated, the reference point for significance was 95% (risk of I type error 5%).

A dynamic analysis of the two epidemiological studies (2006 and 2012) was done. The raw data from the two studies were first weighed by type of settlement and age, and then comparative analyses were done.

Table 1. Comparison of the diabetes prevalence in 2006 and 2012. The data are presented by gender and age group by decade.

GROUPS	2006, NUMBER, %	2012, NUMBER, %	*P*
Total	**190/2396 (7.9%)**	**194/2033 (9.55%)**	**0.06**
Gender			
Females	92/1328 (6.9%)	84/1076 (7.8%)	0.41
Males	**98/1068 (9.2%)**	**110/957 (11.5%)**	**0.09**
Age group by decade			
20–29	0	1/177 (0.6%)	0.25
30–39	5/531 (0.9%)	7/408 (1.7%)	0.30
40–49	36/621 (5.8%)	25/506 (4.9%)	0.53
50–59	**49/523 (9.4%)**	**53/338 (15.7%)**	**0.01**
60–69	51/284 (18%)	70/401 (17.5%)	0.87
70+	49/200 (24.5%)	38/201 (18.9%)	0.17

Results

The data on the diabetes prevalence from the two screening studies are presented in Table 1.

The prevalence of diabetes in the subjects in active age (20–60 years) was 5.4% (90/1675) in 2006 and increased to 6.0% (86/1429) in 2012. A decrease from 20.7 to 17.9% was registered for the same period in the elderly (over 60 years of age). The only significant difference was in the age group 50–59 years.

The difference in the prevalence of the risk factors that contribute to diabetes (increased waist circumference—WC, body mass index (BMI), arterial hypertension) was explored. The comparison of the prevalence of the risk factors in the studied population is presented in Table 2. There was no significant increase in the prevalence of any studied factor.

Discussion

The monitoring of the national trends in the course of the diabetic epidemic is important, and it helps assess the severity of the problem, the role of risk factors, and the necessary interventions and design appropriate healthcare measures and structure.[21]

By monitoring the global epidemic increase in diabetes prevalence, the IDF has come to the conclusion that the changes in diabetes epidemiology in certain countries are linked to the fast urbanization and the increased life expectancy.[15] The Canadian Health Agency presented in 2011 an analysis of unpublished data, according to which the largest relative increase in diabetes prevalence between 1998/1999 and 2008/2009 was observed in the age groups 35–39 and 40–44 years. This observation has been attributed to the increase in overweight and obesity.[22] In our comparative analysis of diabetes prevalence in the period 2006–2012 in Bulgaria, we found a marginally significant increase, which is concordant with the already published data.

Our initial hypothesis that a significant increase in diabetes prevalence might be found was based on several socioeconomic factors characterizing the past decade in Bulgaria. A continuous large wave of economic emigration involving 20–40-year-old population has been observed since 1990. The birth rate is continuously declining, and the population is aging. At the same time, the unemployment rate is high and the low-income proportion of the population is increasing.[23]

The increasing proportion of obese subjects in our population might contribute to the observed increased diabetes. An increase was observed in the obesity prevalence in the general population from 26.7% (640/2392) in 2006 to 32.7% (661/2021) in 2012, $P = 0.02$, a relative increase of 22.4%. There was no change in the overweight prevalence, and the proportion of the subjects with normal body weight decreased, respectively, from 37.1% (863/2392) in 2006 to 30.1% (609/2021) in 2012, $P < 0.02$. Obesity increased among the diabetic subjects from 44.2% in 2006 to 51% in 2012.

We did not find any changes in the prevalence of increased waist circumference between the total studied populations: 61.7% (1480/2396) in 2006 and 62.3% (1268/2032) in 2012 nonsignificant (NS). Similarly, the prevalence of increased waist circumference did not change significantly in the diabetic subjects: 89.4% in 2006 and 88.1% in 2012 (NS). It can be assumed that this factor hardly contributes to the observed change in diabetes prevalence in Bulgaria.

Arterial hypertension changed nonsignificantly among the diabetic subjects from 80.5% in 2006 to 84.5% in 2012, a relative increase by 4.96% (Table 2). The prevalence of arterial hypertension in the general population for the same period

Table 2. Comparison of the prevalence of some of the major risk factors for diabetes between the years 2006 and 2012. The data for the diabetic subjects and the general population are shown.

FACTOR	2006		2012		*P*
	DIABETICS	GENERAL POPULATION	DIABETICS	GENERAL POPULATION	
Increased WC	170/190 (89.4%)	1480/2396 (61.8%)	171/194 (88.1%)	1268/2033 (62.4%)	0.11
Hypertension	153/190 (80.5%)	1053/2396 (43.9%)	164/194 (84.5%)	1002/2020 (49.6%)	0.35
BMI <25	17/190 (8.9%)	863/2392 (37.1%)	22/194 (11.5%)	609/2021 (30.1%)	0.26
BMI 25–30	89/190 (46.8%)	889/2396 (37.1%)	73/194 (37.6%)	751/2021 (37.2%)	0.84
BMI ≥30	84/190 (44.2%)	640/2392 (25.8%)	99/194 (51%)	661/2021 (32.7%)	0.34

Note: The *P*-values represent the comparison between the diabetes mellitus groups in 2006 and 2012.

did not change significantly either: from 43.9% (1053/2396) in 2006 to 41.3% (839/2020) in 2012, P = NS.

Other factors that might contribute to the observed diabetes development in our population include the male gender and the age. An increase in diabetes prevalence was found in both genders, but more markedly in the males, in whom it was marginally significant (by 2.3% or a relative increase of 25%: 9.2% in 2006 vs. 11.5% in 2012, $P = 0.06$). In the females, the increase was minimal, from 6.9% in 2006 to 7.8% in 2012, a relative increase of 13% (P = NS).

Age is a well-known risk factor for diabetes mellitus. The Canadian Health Agency reported in 2011 a diabetes prevalence in the country in 2008/2009 of 8.7% (95% CI: 8.72–8.74) among the adult population over 20 years of age. That is, 1 in every 11 Canadian citizens was a diabetic, which is similar to our results. The authors observed an increase in the prevalence of the disorder with age, most markedly after the age of 40. This observation might be explained by the decline in insulin production and tissue utilization. Therefore unsurprisingly, the elderly have an increased probability of developing type 2 diabetes. The Canadian researchers reported the highest prevalence in the age group 75–79. Nevertheless, half of the diabetic subjects were in active age (25–64 years). The Canadian Health Agency reported an increase of diabetes prevalence to 9.2% in 2011 [Unpublished analysis using 2008/2009 data from the Canadian Chronic Disease Surveillance System, Public Health Agency of Canada; 2011].

In our study, we found that age was linked strongly with the increase in diabetes prevalence between 2006 and 2012. Moreover, the age group 50–59 seems critical with an increase in the disease prevalence from 9.4% (49/523) in 2006 to 15.7% (53/338) in 2012, $P < 0.01$. The diabetes prevalence increased by 6.8% (a relative increase of 42%) among the subjects of active age (20–60 years). We observed a decrease in the proportion of diabetic subjects in the elderly (60+ years). A similar observation has been reported by authors from Asia, who found the highest increase in the rate of diabetes in the younger (<55 years), but mostly among the females.[22] A total change in diabetes prevalence for the studied period from 7.9% (190/2396) in 2006 to 9.55% (194/2033) in 2012, $P = 0.06$ was found. The relative increase was by 20.88% or 3.5% per year. The change we observed was similar to the data reported in other countries.[13,17] The differences in diabetes prevalence (slightly over 7%, as reported by the German and the American teams) are probably because of the fact that they present the known diabetes, while we report the total diabetes prevalence. Bearing this in mind, our data come much similar and we can assume that the course of the disease from population point of view follows the trends in the other developed countries.

Conclusion

Our results demonstrated a trend toward an increase in diabetes prevalence that might be expected to continue over the years to come. Age, obesity, and male gender were found to be the major risk factors for diabetes in the Bulgarian population. The observed escalation in the disease prevalence requires a good planning of healthcare and long-term strategies for resource allocation and preventive measures.

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Author Contributions

Conceived and designed the experiments: AMB, AS, RK. Analyzed the data: TT. Wrote the first draft of the manuscript: AMB. Contributed to the writing of the manuscript: AS. Agree with manuscript results and conclusions: AS, RK, JV, LD. Jointly developed the structure and arguments for the paper: AMB. Made critical revisions and approved final version: AS. All authors reviewed and approved of the final manuscript.

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