

DATA REGARDING THE PREVALENCE AND INCIDENCE OF DIABETES MELLITUS AND PREDIABETES

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Abstract

Diabetes Mellitus (DM) represents one of the highest challenges in our century, due to the fact that in the last 20 years the number of patients with DM has doubled, at present affecting hundreds of millions of people worldwide, both in developed countries and in developing ones, as well. One of the most serious consequences of this increase is the onset of type 2 DM in children, adolescents and young people, the main causes being an unhealthy lifestyle: unhealthy food, lack of physical exercise, which, most of the times, lead to obesity. Also, DM is often associated to micro and macrovascular complications, thus determining disabilities and high costs in the healthcare systems, respectively. DM is one of the main causes of death all over the world, a reason for which there are required prevention programs worldwide.

key words: *diabetes mellitus, prediabetes, prevalence, incidence.*

Introduction

Diabetes mellitus (DM) is a chronic, complex disease, requiring a continuous medical care, with strategies of reducing the multifactorial risks beyond the glycemia control [1]. Chronic hyperglycemia is associated to lesions, dysfunction, various organs failure, being the main cause of cecity in persons aged between 20 and 74 years old, and chronic kidney disease requiring a renal function substitution treatment, the main cause of non-traumatic amputations [2], the sixth cause of death worldwide [3]; every 7 seconds, one person dies because of DM [4], but DM is also an

independent risk factor for cardiovascular (CV) pathology, with a direct impact upon the CV morbidity and mortality [2,5,6].

DM is one of the highest priorities in medicine worldwide in the 21st Century, the number of patients with DM being in a constant growth, World Healthcare Organization (WHO) estimating hyperglycemia as the third highest risk factor for premature death, after high blood pressure and smoking [4], as well as one of the highest hazards in our century [7]. Ever since 1921, Dr Elliot Joslin appreciated that in the next decades, the number of patients with DM will double [8]. Among the main reasons for DM

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prevalence increase we mention: increase of new cases number [9], population decay [10], increase of obesity prevalence [11], as well as the survival increase in patients with DM [12].

General worldwide data

The International Diabetes Federation (IDF) reported that, at present, there are 415 million people worldwide suffering from DM, aged between 20 and 79 years old, the global prevalence being of 8.8%, and it is estimated that in 2040 their number will grow up to 642 million, with a prevalence of 10.4%. Regarding sex distribution, the number of men with DM (215.2 million) is slightly higher than the women with DM (199.5 million), a difference that will also be preserved in 2040 (328.4 million versus 313.3 million). Regarding the environment, most of them live in the urban area (269.7 million), and only 145.1 million come from the rural area [4].

Several features of global diabetes epidemiology were reported in the IDF Diabetes Atlas 2015 [4], including:

The first 10 countries with the highest number of DM patients: China – 109.6 million, India (69.2 million), USA (29.3 million), Brazil (14.3 million), Russia (12.1 million), Mexico (11.5 million), Indonesia (10 million), Egypt (7.8 million), Japan (7.2 million) and Bangladesh (7.1 million) [4].

Type 1 DM is less frequent than type 2 DM, but the number of patients suffering from this condition is constantly increasing every year, the reasons remaining unclear. It is thought that changes regarding the environmental factors, namely infections, could be involved. It is estimated that about 86,000 children will develop type 1 DM every year, as in 2015, for the first time, their total number exceeded half a million (542,000) [4]. Type 1 DM incidence recorded a higher increase in some countries of

Central and Eastern Europe, where the condition is less frequently found. More European studies suggested that the highest increase was recorded in small children. The highest incidence of type 1 DM is found in: Finland, Sweden, Kuwait, Norway, Saudi Arabia, United Kingdom, Ireland, Canada, Denmark and USA [4].

IDF estimates that about 193 million persons, namely half of the total of DM persons, are not diagnosed, most of them suffering from type 2 diabetes. The earlier the diagnosis is made, the higher the chance to prevent multiple and expensive complications. Worldwide, over 80% of the non-diagnosed persons are found in low and medium income countries, the best example being of sub-Saharan Africa, where the percentage of non-diagnosed persons with DM is 66.7% [4].

Hyperglycemia during pregnancy may be classified as follows: gestational DM (GDM), DM detected during pregnancy and DM diagnosed before pregnancy. IDF estimates that in 2015 - 20.9 million (16.2%) of newborns came from mothers with glycemia changes during pregnancy. In 85.1% of the cases, GDM was involved, in 7.4% of the cases – DM firstly detected during pregnancy, and in 7.5% - diabetes diagnosed prior to pregnancy. The highest prevalence of hyperglycemia during pregnancy was recorded in South-East Asia (24.2%), while Africa had the lowest prevalence (10.5%). Most cases of this type (87.6%) were recorded in low and medium income countries, where the access to maternal healthcare is often a limited one [4].

Prediabetes: it is estimated that worldwide 6.7% of the adult population, equivalent to 318 million persons have prediabetes, half of them aged under 50 years old. About one third are aged between 20 and 39 years old. Most of them (69.2%) live in low and medium income countries. It is estimated that until 2040 the

number of persons with prediabetes will reach 482 million, which means about 7.8% of the adult population. North America and Carabe regions have the highest prevalence of prediabetes (15%), while Europe is at the other pole (4.8%) [4].

DM and prediabetes prevalence/ incidence in different countries all over the world

Most European studies have shown a prevalence of DM lower than 10% in persons aged under 60 years old and of 10-20% in those included in the age group between 60 and 79 years old [13]. The highest prevalence was recorded in Malta - 13.9%, while the highest age-adjusted rate was recorded in Turkey – 12.8%, according to IDF [4].

In Europe, DM has a prevalence of 9.1%, with 59.8 million persons suffering from DM, estimations for 2040 being of 71.1 million people with DM, with a prevalence of 10.7%. In Europe, is recorded the highest incidence of type 1 DM, 140,000 children being recorded with this diagnosis [4].

Between 2009 and 2010, in Spain was performed the Di@bet.es study showing that about 30% of the studied population presented glycemia changes. The DM prevalence adjusted by age and sex was 13.8%, almost half of them being undiagnosed with this condition until then. Impaired fasting glycemia (IFG) was present in 3.4 %, and the impaired glucose tolerance (IGT) in 9.2%, while both simultaneously present alterations (IFG + IGT) were recorded in 2.2% from the adult population in Spain [14].

During the same period, in Portugal was performed the Prevadiab study, similar to that in Spain and with comparable results. Thus, the DM prevalence was 11.7%, 5.1% not being previously diagnosed. Prediabetes prevalence was 23.3%, of which 8.2% presented IFG,

12.6% IGT and 2.4% presented both alterations (IFG + IGT) [15].

In Denmark, the data extracted from the “Danish Diabetes Impact Study 2013” showed that, between 2000 and 2011, the DM incidence increased by approx. 5% every year (18 000 new cases - 1999 vs. 32 000 new cases in 2011), while its prevalence doubled. Thus, from 140,000 patients at the end of 1999, their number exceeded 300,000 at the end of 2011. For every year included in the study, men presented a higher prevalence than women [16].

Recently, there have been published data regarding the incidence and prevalence of DM patients treated pharmacologically and/ or through diet in Sweden, between 2005 and 2013. The age standardized incidence of pharmacologically treated DM during the follow-up period was 4.34 in 1000 subjects for men, and 3.16/1000 for women, respectively. A slight incidence decrease was observed, with 0.6%/year in men and 0.7%/year in women. Regarding the age standardized prevalence of pharmacologically treated DM, it recorded a moderate increase from 41.9/1000 (2005-2006) up to 50.8/1000 (2012-2013) in men, and from 29.9/1000 (2005-2006) up to 34.6/1000 (2012-2013) in women, the annual increase being of 2.4% in males and 1.9% in women. The DM total prevalence in Sweden is relatively low compared to what is happening worldwide, the number of DM persons increasing from 313.181 (2005-2006) up to 404.611 (2012-2013), an equivalent to a 29% increase. The highest increase was recorded in men aged >65 years old and in women aged between 40 and 64 years old, the highest prevalence being found in the age group >65 years old.

The percentage of patients treated only through diet was 10% in men and 13% in women. In 2012, the age adjusted prevalence of DM persons (treated both pharmacologically and

through diet) was 46.9/1000 subjects, of which 55.6/1000 men and 38.8/1000 women [17].

In Germany, a data comparison was performed regarding two periods: 1997-1999 vs. 2008-2011. Although the age and sex standardized prevalence remained relatively stable between the 2 periods (9.3% vs. 9.2%), the diagnosed DM prevalence increased from 5.6% (3 million) to 7.2% (4.6 million), while the undiagnosed DM prevalence decreased from 40.9% (1997-1999) down to 21.7% (2008-2011). Also the prediabetes prevalence decreased, from 27.7% (15.6 million) – 1997-1999 down to 20.8% (13.1 million) – 2008-2011 [18].

In Switzerland, the DM global prevalence in the adult population of this country was 4.9% in 2011, compared to 3.9% in 2006. Prevalence was higher in men than in women, although in the age group (19-39 years old), the prevalence was higher in the latter ones. The incidence decreased from 0.8% (2006) down to 0.7% (2011), the highest incidence being recorded in men aged over 59 years old [19].

Turkey performed the TURDEP-II study (The Turkish Epidemiology Survey of Diabetes, Hypertension, Obesity and Endocrine Disease) in 2010, 12 years after the TURDEP-I study. This showed a DM prevalence of 16.5 % [13,20], equivalent to a number of 6.5 million adults with DM, unlike 13.7% in TURDEP-I (here we can mention that if the same criteria for DM diagnosis were applied here, the DM prevalence calculated for 1997-1998 would have been 11.4%). Of the 6.5 million adults suffering from DM, 45.5% were new cases of DM, the rest being patients with a prior DM diagnosis. Prediabetes prevalence was 30.8% (isolated IFG=14.7%, IGT =7.9% and both glycemia changes =8.2%). DM was more frequent in women than in men, more frequent in the urban population than in the rural one. Also, prediabetes was more frequent in women [20]. In

January 2016 was published the first report regarding type 1 DM prevalence in children aged under 18 years old in this country. Thus, type 1 DM prevalence was 0.75/1000, higher in girls than in boys. In Turkey, type 1 DM incidence is in accordance with the geographical location of this country, higher than in Asia, but lower than in Europe [21].

In Italy a DM prevalence increase was recorded, from 3.0% in 2000 up to 4.2% in 2007. The number of patients with this condition in Lombardia region increased from 272,663 up to 402,016 during the same period, which represents an increase of 47%, while the population increased only by 6.6% [22].

In Scotland, one of the highest rate of cardiovascular disease in Europe was observed, a reason for which there was necessary to be established the trend of DM data in this country. Thus, the DM prevalence almost doubled during the following five years, namely 5.2% in 2000 and 9.4% in 2008, respectively [23].

In 2011, in Poland was performed the epidemiological study NATPOL, according to which there was estimated that DM prevalence was 6.7% in this country [24], a similar result to that published by IDF for most of the European countries, but lower than the one declared in the USA and the Golf Region [25-28].

A recent study published by Holman N. et al reported both type 1 and type 2 DM prevalence in the United Kingdom. Thus, type 1 DM prevalence was 0.4% in England, Wales, North Ireland and Great Britain and 0.5% in Scotland. Type 2 DM prevalence was 4.6% - England, 5.1% - Wales, 4.3% - Scotland, 4.6% - Great Britain and 3.9% in North Ireland. In conclusion, at the end of March 2014 in the United Kingdom DM prevalence in persons aged over 17 years old was 6.2% [29].

In Israel was performed a study in the Clalit population, aged over 26 years old, whose

number increased from 2,110,824 members in 2004 up to 2,379,712 in 2012, where DM prevalence increased from 10.7% in 2004 (226 855 cases) up to 14.4% in 2012 (343 554 cases) [30]. Also in Israel was performed a comparison regarding the DM prevalence between Arabic and Jewish people aged over 20 years old. Thus, DM prevalence was 21% in the Arabic people and 11.9% in Jewish people, the Arab's age at diagnosis being younger than the other ones, and in both cases, DM was less frequent in women [31].

In Romania, between 2013 and 2014, was performed the PREDATORR Study (National Study Regarding the Diabetes, Prediabetes, Overweight, Obesity, Dyslipidemia, Hyperuricemia and Chronic Kidney Disease Prevalence in Romania), which showed a DM total prevalence, in the adult population aged between 20 and 79 years old, of 11.6%, of which 2.4% had previously undiagnosed DM. DM prevalence increased by age and it is less frequent in men. The percentage of persons with prediabetes was 16.5%, the highest percentage being recorded in the age group 60-79 years old, more frequent in women [32].

Africa has the highest percentage of undiagnosed DM (66.7%). The current prevalence is 3.2%, namely 14.2 million adults suffering from this condition, a number that will dramatically increase until 2040, when there is estimated that their number will reach 34.2 million. In 2015 a total of 321,000 deaths due to DM were recorded in this region, women having a higher risk than men, as the latter may have other death causes (for example: an armed conflict) [4]. In the last 50 years, Sub-Saharan Africa recorded a significant increase of type 2 DM, from <1% in certain regions of the country in 1960 up to a regional prevalence of 4.3% in 2012 [33]. In Ethiopia, DM prevalence in persons aged over 35 years old was 5.1% in the

urban area and 2.1% in the rural area [34]. Mauritius, whose population is 1.3 million people (Asian Indians prevail (68%) followed by Africans (27%) and the Chinese (3%)), DM prevalence varied from 12.8% in 1987 up to 17.9% in 1998 and 23.4%, respectively, in 2009 [35,36].

North Africa and Middle East have a prevalence of 9.1%, representing 35.4 million adults with DM and it is expected that their number should double in the next 25 years, reaching 72.1 million. The countries with the highest DM prevalence in this region are: Saudi Arabia (17.6%) and Kuwait (14.3%), countries that record the highest annual incidence of type 1 DM in children in this region. The countries with the highest number of DM patients are Egypt (7.8 million), Pakistan (7.0 million) and Iran (4.6 million) [4]. DM prevalence varies from 2.6% in the rural areas from Sudan up to 20% in the urban areas of Egypt [37].

North America and Carraibe exhibits the highest DM prevalence in comparison to the other regions of the International Diabetes Federation: 12.9%, representing 44.3 million persons. It seems that their number will reach 60.5 million in 2040. Most of them live in the United States of America, Mexico and Canada.

About 324,000 deaths there were reported in 2015, three quarters in high income countries, the USA recording the highest number of deaths due to DM all over the world. Here, also, there are spent about 50% of the money allotted for DM healthcare worldwide. The unadjusted prevalence in the general population between 2011 and 2012 was 14.3% for total DM, 9.1% for diagnosed DM, 5.2% - undiagnosed DM and 38% for prediabetes, the highest prevalence being in non-Hispanic black subjects, non-Hispanic Asians and Hispanics [38]. In 2001, type 1 DM prevalence was 1.48/1000, in 2009 the highest prevalence of type 1 DM was

2.55/1000 in white young people, and the lowest was 0.35/1000 in Amerindian young people. During the 8 years period (2001-2009), type 1 DM prevalence increased by 21%. Regarding type 2 DM in young people, the prevalence increased from 0.34/1000 up to 0.46/1000, during the same period of time [39].

In Canada, the DM prevalence was estimated at 7.6% [40].

In South and Central America the current DM prevalence is 9.4%, equivalent to 29.6 million persons with DM, over 80% coming from the urban area. Puerto Rico recorded the highest DM prevalence in this region. Brazil is the country with the highest number of DM in this region, ranking the fourth place in the world after China, India and the USA, and the third place as far as the number of under 15 years old children diagnosed with type 1 DM, after the USA and India [4]. Differences regarding the DM prevalence in various regions of Brazil were recorded. Thus, in the North part, the prevalence varied between 3.6% and 5.5%, while in the opposite part of the country, in the South, where the population income is higher, the prevalence varied between 6.7% and 8.2% [41]. Another study showed that type 2 DM prevalence in Brazilian population was 8.68% [42].

South-Eastern Asia and West Pacific Region: in 2015 the IDF estimations showed that 8.5% of the adult population, namely 78 million persons had diabetes, only one third coming from the urban area, half of them being undiagnosed. In this region there is also included India, the second country in the world as far as the number of DM adult persons, after China, and also the second place worldwide regarding the number of children diagnosed with type 1 DM, after the USA [4].

In India as well, DM prevalence increased over time [35]. In 2011 was published a study showing that DM prevalence in certain regions

was as follows: 10.4% in Tamilnadu, 8.4% in Maharashtra, 5.3% in Jharkhand and 13.6% in Chandigarh [43].

Type 2 DM prevalence in Malaysia was 11.6% in 2006 and 15.2% in 2011 [44].

In Vietnam, DM prevalence was 6%, and prediabetes prevalence was 13.5%, less frequent in men than in women, being estimated that in 2035 the figures will reach 7% for DM and 15.7% for prediabetes [45].

In Nepal, a metaanalysis including 10 studies showed that type 2 DM prevalence varied between 1.4% and 19%, with an average prevalence of 8.4%, more frequent in the urban area (8.1%) than in the rural one (1%) [46].

West Pacific is the region including 36.9% of the total of persons with DM all over the world, its prevalence being 9.3%, totalizing a number of 153 million persons with DM. More than a half (52.1%) are not diagnosed, 61.6% coming from the urban area and 90.2% living in low and medium income countries. According to IDF, China represents the country with the highest number of DM persons [4]. In 2013, DM prevalence was estimated at 11.6 %, and prediabetes prevalence at 50.1% [47,48]. DM prevalence was higher in older people, in the urban area and in those living in economically developed regions [48]. In Nauru: in 1975 there was reported the highest DM prevalence ever in persons over 15 years old, namely 34% [35]. Later, in 2011, there was published a study stating that the sex standardized DM prevalence was 13% in men, 14.4% in women and 13.7% in both sexes, the highest prevalence being recorded in the age group 55-64 years old (42.7%). Also, the sex standardized prediabetes prevalence was 6.4% in men, 5.5% in women and 6% for both sexes, the highest prevalence being recorded in the same age group (7.1%) [49].

Conclusions

Due to the fact that most world countries reported a permanent increase of the DM prevalence and incidence, prevention measures are required for this disease, including optimizing the lifestyle and simultaneous control of body weight. Due to the fact that still a high percentage of the patients actively diagnosed with diabetes did not know they were suffering

from diabetes, active screening programs are recommended in order to diagnose this condition earlier.

Irreversible chronic complications in patients with uncontrolled diabetes mellitus, complications leading not only to a poor life quality but also to a 2-5 times increase of expenses, represent arguments that support the tight follow-up of these patients for the rest of their lives.

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