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Diabetes: the cost of globalization

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Abstract

The epidemic of type 2 diabetes mellitus (T2DM) on a global scale is a matter of concern, not only from a public health perspective, but also with consideration of societal costs. The increased call on health care resources to treat and monitor T2DM and its complications could put a heavy burden on national health care systems and financing. An important contributing factor for development of T2DM is lifestyle, reflecting increasing affluence and exposure to increased calorie intake in combination with sedentary lifestyle and less human energy expenditure. More detailed glucometabolic studies have been conducted in high-risk migrant populations, eg, from the Middle East. Recently, intervention programs have also been tested to improve lifestyle and reduce the risk of developing T2DM in at-risk individuals. There are many obstacles to success for such programs, which should be tailored not only to the individual in a culture-sensitive way, but also to families and local ethnic communities. ■ *Heart Metab*. 2017;73:4-8

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The growth of type 2 diabetes (T2DM) as a global public health threat has attracted considerable attention over the last 2 decades. Epidemiological studies have predicted that whereas 422 million subjects were affected by diabetes in 2014, the coming decades will see an astonishing 438 million adults affected by 2030 (www.idf.org). A recent review in *The Lancet* concluded that the burden of diabetes, both in terms of prevalence and number of adults affected, has increased faster in low-income and middle-income countries than in high-income countries.[1] The tremendous cost of this diabetes epidemic can be counted not only in financial terms as cost of illness, treatment, and disability, but also in terms of the human cost of suffering and a lowered health-related quality of life.

Contributing factors to the diabetes epidemic

The increasing burden of T2DM on a global scale is a reflection of a number of contributing factors with considerable health consequences. First of all, the aging of many populations, with an increasing proportion of elderly people, will contribute to the growing number of subjects reaching the age ranges where T2DM becomes more prevalent. Other contributing factors include a wider screening effort in health care and a time trend for lowering the plasma glucose threshold for a diagnosis of T2DM. However, the most important factor is probably the detrimental lifestyle changes that are now characteristic of not only Western populations, but also to a substantial proportion of populations in developing countries.[2,3] For example, the growing middle class in countries

such as India, China, and some countries in the Middle East is a factor and it is related to increasing affluence and a change in diet and calorie-intake composition. At the same time, increased mechanization of the transport system and working conditions has reduced the amount of physical exercise needed on a daily basis. This is further influenced by a passive lifestyle related to sedentary leisure activities, such as watching television or time spent on the computer, so-called "screen time." The young generation is especially affected, and this is a reason to worry, as the sedentary young individuals of today risk becoming the patients with T2DM of tomorrow. Another contributing risk factor is smoking, now very prevalent in developing countries even though smoking prevalence rates have decreased in many Western countries. Heavy smoking has been associated with increased insulin resistance, β-cell unresponsiveness to secreted insulin, chronic inflammation, and impaired glucose metabolism.[4] Furthermore, smoking is often combined with an increased intake of alcohol, at least in cultures and countries with no ban on alcohol. This factor could contribute to the damage of pancreatic function and thus act in synergy with heavy smoking to increase the risk of T2DM. Also, smokers tend to have a spontaneously chosen selected diet, including more coffee, alcohol, sucrose, and saturated fat, but less vitamins, vegetables, and fruits, than nonsmokers.[5] This may be influenced by impaired taste bud function or triggering of brain reward systems due to smoking.

The role of obesity in a global perspective

An interesting aspect is that obesity could be a major contributing factor for T2DM, as it is globally increasing, but with different thresholds for diabetes risk. For example, in Asian populations, the risk of type 2 diabetes starts to increase at a lower body mass index (BMI) than in Western populations,[6] and this could also be influenced by the fat distribution; there is a relatively more pronounced tendency for abdominal obesity in subjects of Asian origin. Therefore genetic factors could contribute to differential susceptibility to obesity-induced glucometabolic changes.

With globalization, there is an increased flux of people, goods, and work opportunities across borders and regions all around the world. There remain many obstacles to globalization, such as restrictive regulations, laws, and border controls; nevertheless, political and societal changes in the wake of war, famine, and catastrophes has forced millions of refugees and migrants to cross borders and to move from one country or region to another, often far away. So far, this has influenced lifestyle changes, cultural norms, and health behaviors (and will continue to do so). One typical example is the profound change in lifestyle that migrants from the Middle East region experience as they come to live in Western countries. In addition, these immigrants will also face social problems and adverse living and working conditions, as well as social tensions, prejudice, and even racism, factors that could contribute to social stress, isolation, and difficulties in coping with cultural changes during the acculturation process. For some migrants with a cultural background where obesity is seen as a sign of wealth and prosperity and, for women, a sign of fertility, the health messages of leanness and calorie restriction in Western societies is sometimes hard to understand and accept. In addition, some religious beliefs could affect eating habits and the timing of food intake (eg, Ramadan), a factor that is associated with adverse changes in glucose metabolism.[7]

On the other hand, it should not be overlooked that globalization can also encourage healthy eating as free trade can increase the supply of cheap vegetables, fruits, and seafood. The flux of people visiting other countries could increase exposure to sunshine (vitamin D) and recreation, both of which are health-promoting factors. However, there is also a downside to global trade and traveling, as transportation is energy dependent and contributes to the burden on the environment.

Migration and type 2 diabetes risk

The risk of T2DM in the wake of migration and globalization has been studied in certain populations, for example, in people of South Asian origin moving to London in the UK and adapting a Western lifestyle.[8] These subjects are known to be at increased risk for developing features of the metabolic syndrome (eg, abdominal obesity, impaired glucose metabolism, and T2DM). One contributing factor besides genetics could be an individual background of impaired fetal growth and the small-for-gestational-age birth phenotype, as this has been shown to affect the risk of developing T2DM in adult life if combined with un-

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healthy lifestyle.[9] Also, diabetes in pregnancy is a growing problem in developing countries,[10] with an impact on health in the offspring, thus reinforcing the importance of early life conditions for understanding the global epidemic of T2DM.

In Sweden today, 1.6 million out of almost 10 million inhabitants are born abroad with the largest non-European immigrant groups represented by immigrants from the Middle East, Africa, and Asia (Statistics Sweden, 2016). Extensive epidemiological research on the risk of T2DM in migrants from the Middle East to Sweden has been carried out. Wändell et al has documented that the prevalence of T2DM is at least doubled in migrants from the Middle East, including Turkey and Iraq, as compared with Swedish-born subjects.[11-13] This phenomenon is especially pronounced in obese Turkish women, as influenced by parity, sedentary lifestyle, and suboptimal dietary habits, even if smoking is not frequent.

The MEDIM study in Iraqi immigrants

In the MEDIM study (the impact of Migration and Ethnicity on Diabetes In Malmö), conducted in the city of Malmö, Sweden, a number of observational, mechanistic, and intervention studies were undertaken to elucidate mechanisms contributing to the increased risk of impaired glucose metabolism and T2DM in adult migrants from Iraq.[14-17] The findings from MEDIM, which investigated approximately 1400 Iraqi immigrants and 800 native Swedes via oral glucose tolerance testing (OGTT), shows prevalence rates of T2DM of 12% and 6%, respectively. However, the prevalence of T2DM in urban areas in Iraq reaches 19% and is considerably higher than in rural areas (7.5%).[18] This higher prevalence in Iraqi cities is thought to be a consequence of a less physically active lifestyle, sedentary work, and higher access to calorie-dense foods than in rural life. Such data could indicate that there is no "true" worsening migration effect (ie, that stress and lifestyle change during migration should increase cardiometabolic disease as is shown in other immigrant groups). One reason for this could be that life in an urban area in Sweden presents a relatively healthy environment compared with urban areas in the Middle East, with access to healthy foods, physical activity opportunities, and public health care, in spite of social adversities. Still, the prevalence of T2DM in Iraqis is twice as high as in the native Swedish population, and furthermore, the Iraqi immigrants develop T2DM 6 to 7 years earlier than native Swedes. The high T2DM is thus not fully explained by well-known diabetes-related risk factors, such as unhealthy lifestyle, obesity, family history, or socioeconomic vulnerability that clusters in this population; this indicates that a genetic mechanism may contribute to the increased risk. The Iraqi population displays impaired glucose metabolism with higher glycated hemoglobin (HbA_{1c}) levels and increased insulin resistance, even in the nondiabetic range.[19] Further, for the same BMI level, insulin sensitivity is more impaired in the Iraqi immigrant population (*Figure 1*). One contributing factor to this insulin resistance could be a higher prevalence of nonalcoholic fatty liver disease (NAFLD), which is found to differ in prevalence across ethnicities. Estimation of NAFLD via index scores has shown that the Iraqi population has a higher prevalence, and that NAFLD indices are more strongly associated with insulin resistance in the Iraqi than in the native Swedish population. This indicates that the liver may play a key role in fat and glucose regulation in this population.[20]

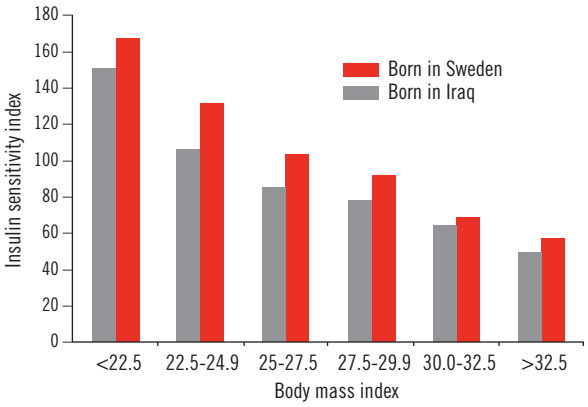

Fig. 1 *Insulin-sensitivity index (ISI) in relation to body mass index (BMI) in a population of immigrants from Iraq and of native Swedes. Differences in median values of ISI between the two ethnic populations increase with lower BMI and are most obvious in nonobese participants.*

Data from the National Diabetes Register in Sweden shows that although non-Westernized immigrants diagnosed with T2DM are offered more frequent visits to physicians, their glycemic control is worse, and they develop diabetic microvascular complications faster, than native Swedes.[21] Altogether, these data indicate that T2DM in non-Westernized populations progresses faster and is a more complex condition to prevent and manage than T2DM in a native Swedish population.

Diabetes prevention programs in immigrants

Increased knowledge of mechanisms contributing to the increased diabetes risk in non-European immigrants is important for the prevention and treatment of diabetes in these populations. A Cochrane review provides evidence that culturally adapted lifestyle interventions addressing non-Westernized immigrants with T2DM have beneficial effects on glycemic control in the short term (<24 months), but longer studies are needed.[22] In Sweden and Norway, beneficial effects of culturally adapted programs targeting immigrants from Iraq and Pakistan still free from T2DM have shown beneficial effects on cardiometabolic control, indicating that such programs have beneficial preventive effects.[17,23] The question is how such programs should be organized, since resources addressing preventive actions are not prioritized today.

It is highly probable that more proactive primary prevention strategies addressing non-Westernized immigrant populations could save costs spent on diabetes, but would also contribute to a higher quality of life and health equality.

Summary

In summary, the high cost of globalization for the growing epidemic of T2DM is not only counted in terms of health care, but also in terms of human suffering and reduced health-related quality of life. Public health measures to tackle the epidemic should involve both societal changes, such as promotion of healthy lifestyle and improved social conditions for growing populations, and prevention aimed at individuals, families, and local communities.[22,24] The technological changes on a global scale could promote sedentary lifestyle, but they could also be used to support a healthy lifestyle if consumption of healthy food could be made easier and cheaper. A reduction in smoking and alcohol intake could add to the preventive measures of importance not only to counteract the epidemic of T2DM, but also of other chronic disease conditions. Further studies on mechanisms involved to better understand the transition to T2DM in migrant populations at risk will be of importance to tailor preventive programs. The time is ripe to offer at-risk populations and individuals access to preventive programs to improve lifestyle and glucose metabolism. Such projects are already underway and should be expanded in order to increase the evidence base for effective methods. ■

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