Prevention and care strategies for type 2 diabetes in Mexico

Estrategias en prevención y cuidado de Diabetes tipo 2 en México

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Abstract:

Diabetes is a disabling disease; the treatment of this condition aims to maintain a good quality of life in the person suffering from it, avoiding symptoms in situations such as decompensation by hyperglycemia or acute or chronic complications, decreasing the rate of mortality. Currently, governmental strategies to treat diabetes are aimed at taking care of the disease and not preventing it. The importance of prevention lies in the high mortality rates and high costs that the disease or its complications generate for a country. The objective of this review is to analyze governmental and non-governmental strategies focused on taking care of diabetes or the risk factors that promote the development of the disease.

Keywords:

Diabetes, risk factors, prevention strategies

Resumen:

La diabetes es una enfermedad incapacitante, el tratamiento de esta patología tiene como objetivo el mantener una buena calidad de vida en la persona que la padece, evitando la sintomatología en situaciones como la descompensación ocurrida por hiperglucemia o las complicaciones agudas o crónicas y disminuyendo la tasa de mortalidad. En la actualidad las estrategias gubernamentales para la atención a la diabetes van encaminadas a la atención de la enfermedad y no la prevención. La importancia de atender desde la prevención a la población radica en las altas tasas de mortalidad y costos elevados que la enfermedad o complicaciones propias de esta genera para un país. El objetivo del presente proyecto es analizar las estrategias tanto gubernamentales como no gubernamentales que se enfocan en la atención a la diabetes o factores de riesgo que promueven el desarrollo de la enfermedad.

Palabras Clave:

Diabetes, factores de riesgo, estrategias de prevención

INTRODUCTION

Diabetes is a heterogeneous group of disorders that is characterized by an elevation of glucose in the blood that is accompanied to a greater or lesser extent by alterations in the metabolism of carbohydrates, proteins and lipids. It is also considered a disabling disease for individuals who are diagnosed with it. The correct management and monitoring will lead to patients having an acceptable life quality with no complications at an early age, delaying the development of the disease.[1]

In general, the treatment of this condition aims to maintain a good quality of life in the person who suffers from it, preventing symptoms in situations like decompensation occurred by acute hyperglycemia or chronic complications, decreasing the mortality rate.[2] To achieve these goals, various actions are carried out based on activities that include dietary modifications, making a plan of physical activities and medication. By 2013, type 2 diabetes has caused more than 5 million deaths worldwide. In Mexico, it is one of the leading causes of mortality, placing it as a national and global public health problem. The costs in Mexico to treat the disease increase annually and in 2011 they represented around $ 343,226,541.00 Mexican pesos.[3]

DEFINITION

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Diabetes is a complex chronic disease that requires continuous medical treatment with multifactorial risk reduction strategies beyond glycemic control[4]. In recent years, the concept of type 2 diabetes has been extended to the idea of being an inflammatory condition.[5,6] Diabetes can be classified into the following categories[4]:

• Type 1 diabetes, (autoimmune destruction of β cells of the pancreas, which usually leads to an absolute deficiency of insulin).

• Type 2 diabetes, (progressive loss of insulin secretion, with insulin resistance).

• Gestational Diabetes Mellitus (GDM) diabetes that is diagnosed in the second or third trimester of pregnancy.[4]

Type 2 diabetes was previously known as "non-insulin dependent diabetes", this represents 90-95% of all diabetes cases, so it is important to understand the pathogenic mechanisms of the disease, allowing to implement better treatments and prevention methods. Most diagnosed patients may be overweight or obese (OW/OB); excess weight by itself causes a certain degree of resistance to insulin and in patients who do not have OW/OB, they may present a higher percentage of body fat distributed predominantly in the abdominal region.[7] It has been observed that when comparing the population with and without diabetes, people with diabetes have 300% more risk of being hospitalized for this condition, this way annual health costs per capita for people with diabetes are three to four times higher compared to those without diabetes.[7]

DIAGNOSIS

Diabetes can be diagnosed based on plasma glucose levels, either through a rapid plasma glucose test 2 hours after receiving 75 grams of glucose orally or through a glycosylated hemoglobin test (A1C). The American Diabetes Association (ADA) gives the following criteria for the diagnosis of diabetes[4] (Table 1).

EPIDEMIOLOGY

In Mexico, type 2 diabetes has had an accelerated increase in the number of epidemic cases. Among the chronic-degenerative diseases, it has shown the most significant increase in recent years. In the National Survey of Health and Nutrition 2016 (ENSANUT), 9.4% of adults reported having previous medical diagnosis of diabetes, with a slight increase with respect to 2012 and 2006 (9.2% and 7%, respectively).[8] Obesity is the main risk factor for the development of diabetes in the population; ENSANUT mentions that obesity in women is 71%, in the three age groups (children, adolescents and adults), being higher in rural than urban areas. Adult male population (OW/OB) increased in rural areas (from 61.1% in 2012 to 67.5% in 2016) while it has been stabilized in urban areas, where it remains at a high level (69.9%). On the other hand, 44.5% of adults reported having measured the levels of cholesterol in the blood and 28.0% had a previous medical diagnosis of hypercholesterolemia. The most affected group was adults aged 50 to 79 years old. The survey helped finding that the prevalence of high-blood pressure was 25.5%, of which 40.0% did not know that they had this disease and only 58.7% of adults with previous diagnosis were in adequate control (<140/90 mmHg). The previous diagnosis of this disease is usually higher in women than men (70.5 vs. 48.6%) and decreased 7.8% from 2012 to 2016.[8]

Table 1. Diagnostic criteria for diabetes ADA 2018

Diagnostic	Reference value
Glucose fasting (fasting in the last 8 hours)	≥126 mg/dL
Oral glucose tolerance test, performed with a load of 75 grams of anhydrous glucose dissolved in water, plasma glucose is measured at 2 hours	≥200 mg/dL
Glycosylated hemoglobin (A1C), a test performed in certified laboratories according to the A1C standards of the Control and Complications of Diabetes test (DCCT)	≥6.5%
Patients with classic symptoms of hyperglycemia or hyperglycemic crisis with a random glucose	≥200 mg/dL

***Modified for**: ADA, 2018.[4]*

RISK FACTORS

Obesity: it is one of the main risk factors in non-communicable diseases (NCD's). In 2013 the World Health Organization (WHO) declared OW/OB as a global epidemic.[9] The increase in adipose tissue is related to the increase in the production of proinflammatory cytokines that, together with fatty acids, appear to be responsible for insulin resistance.[5]

Body fat: adipose tissue is a highly dynamic energy reservoir, which stores excess energy during periods of positive energy balance; stores the fatty acids from the diet as triglycerides (TG).[10] Adipose tissue hypertrophy is associated with adipose tissue inflammation, which alters the secretion of bioactive products derived from adipose tissue, known as adipokines. Adipokines determine properties such as smooth muscle tone and inflammation of the vessel wall. Exercise is a mainstay of prevention of NCD'S, such as type 2 diabetes. In addition to reducing adipose tissue mass, exercise has been shown to reduce inflammatory activity in this tissue.[11] In individuals with an ideal percentage of fat, 80% is found in the subcutaneous tissue and 20% in the visceral adipose tissue, this tissue has a participation in the metabolic activity since it releases adipocytokines that affect some processes such as appetite, insulin secretion[11], alteration of glucose and lipid metabolism and the production of adipokines associated with excess adipose tissue that occurs in obesity are associated with insulin resistance, which is a major risk factor in the development of type 2 diabetes or hypertension.[10]

High-density lipoprotein cholesterol (HDL-C): in the liver, free fatty acids (FFA) increase the release of glucose and triglycerides together with the secretion of VLDL (very low-density lipoproteins). It is associated with a decrease in high-density lipoproteins (HDL) and an increase in low-density lipoproteins (LDL). These events are associated with the reduction of the conversion of glucose into glycogen and an accumulation of lipids.[11]

Waist circumference: this measure reflects the abdominal fat with greater sensitivity and specificity. It is a good indicator to evaluate central obesity and represents the central fat. Evaluation criteria proposed by the Centers for Disease Control (CDC) and those of the WHO, are used-.[12]

High Blood Pressure (HBP): is a multifactorial clinical condition, characterized by high and sustained levels in blood pressure. It is frequently associated with metabolic disorders, with the consequent increase in cardiovascular risks. Risk factors that may be associated are: malnutrition "in utero", OW/OB, sedentary lifestyle and metabolic alterations.[13] Nascimento Kluczynik Vieira et al., mentioned in their study that the factors associated with the development of hypertension are an abnormal weight due to the increase in body weight caused by the increase in hypertrophy of adipose tissue along with the excessive intake of nutrients and the lack of exercise.[13] Currently the most consumed food with low quality nutrients, related to cardiovascular problems are: fast foods, sausages, pastries and fats.[14]

Physical activity: is defined as any body movement produced by the contraction of muscles and resulting in the expenditure of energy above the baseline. In recent years, along with the profile of physical activity (type, intensity and duration) it has become more important because of the great benefits associated to health and life quality improvement. The WHO recommends that children and adolescents invest at least 60 minutes a day in moderate to vigorous physical activities.[15]

Obesogenic environment: the eating patterns in a society include the socioeconomic conditions that come from public policies in Mexico, which, since 1983, have been imposed to the population. It has been observed that in recent years the consumption of calories in the population has increased significantly from 2,316 kcal to 3,146 kcal, being that the average balanced diet is 2,000 kcal for a person with basic activities in their daily lives.[3] Hernández-Murúa et al., in 2016[16], mentioned that children who have higher levels of triglycerides, HDL, insulin and glucose, are obese and with an obesity circumference greater than the ideal.

Food behaviors: they are generated from different biological, psychological, social and cultural factors. Together they define the abundance of food and the obsession to lose weight. The use of strict hypocaloric

diets leads to overeating, having feelings of control loss, preceding the development of eating disorders.[13]

MAIN DIABETES CARE PROGRAMS IN MEXICO

Educational program DiabetIMSS

At the moment of diabetes diagnosis, the patient begins with a process of modifying a lifestyle modification that he/she has learned throughout his/her life. As a result, the patient will be informed of the care, proper management and complications of his/her illness.[15] The Instituto Mexicano del Seguro Social (IMSS), in view of the increase in the prevalence of type 2 diabetes in Mexico since 2001 and its complications in the insured persons, it implemented, in 2008, the preventive diabetes education program "DiabetIMSS". By 2011, 3,240,827 patients were identified with diabetes and its complications; 21,096 deaths. It is estimated that by 2025 there will be 11 million insured persons who will be treated by the IMSS.[17] The intervention of the DiabetIMSS program is multidisciplinary and integral, in which the family doctor, nurse, social worker, nutritionist, stomatologist and psychologist participate. The intervention consists of medical consultations and educational sessions per month, for one year, during which metabolic control goals must be met (glucose control, HbA1c, total cholesterol, c-HDL, c-LDL, triglycerides, blood pressure, maintenance of the glomerular filtration rate, mainly), prevention of complications, limitation of damage and rehabilitation, in order to achieve positive behaviors and changes for healthy lifestyles.[18] DiabetIMSS is a program that offers group care, representing certain advantages due to the emotional and social support of people with similar experiences and serves as a model for patients in similar circumstances to promote the ability to achieve their goals.[19]

Evaluation of DiabetIMSS program

In 2013, a study was carried out in the Family Medical Unit (UMF) 3 of Jiutepec, Morelos, in 127 subjects who were enrolled in the DiabetIMSS education program, in which the clinical and biochemical parameters were evaluated. The study mentions a minimum statistical significance in clinical parameters such as weight, Body Mass Index (BMI) and abdominal circumference; and statistical significance in glucose, triglycerides and HbA1c was present in biochemicals; despite the significance, optimal control parameters were not obtained.[18] Another assessment carried out from 2010 to 2011, in 698 patients their stay in the program most participants had an average of 8 visits in a period of 3 months. The result was a decreased glucose (165-72 mg/dL, p=0.002), 76 patients managed to achieve optimal blood glucose values at the end of their stay in the program, the majority of them females, those who were older and with a shorter time of evolution of type 2 diabetes. Normal or abnormal blood glucose at the end of DiabetIMSS program was not associated with the number of consultations per patient or the age of the patient.[19]

Social Protection System for Health (SPSS)

The General Law for Health (LGS) was approved in 2003, and on January 1, 2004, the universal security scheme called the Social Protection System for Health (SPSS) (commonly identified as *Seguro Popular*) came into force. The SPSS has the objective of promoting financial protection for citizens who do not have social security. Currently, this system is the second most important system in the country in terms of the number of its members; only in 2007 there were 2.2 million people living with diabetes.[20]

Evaluation of the SPSS

During 2008 a cross-sectional study was carried out in the 32 states of the country, to measure the technical quality of care for patients with diabetes, the sample design consisted of 20 health centers per entity, in total 5,754 type 2 diabetes. This study describes that only one in five diabetic patients attended in health centers was metabolically controlled at the time of the study. The national average of consultations per patient was 6 in the last year, it was not observed a good metabolic control in patients.[20]

Groups of Mutual Help (GAM)

The Groups of Mutual Help (GAM), also known as clubs of people who live with diabetes, are conceptualized as the organization of the patients themselves, who are under

medical supervision and with the support of health services. It serves as a scenario for the voluntary and necessary training for the control of diabetes, its main objective is to guarantee that each patient receives the periodic training that is needed for a good control of their disease with emphasis on non-pharmacological management and health self-care.[21] Each participant expresses themselves freely and favors the exchange of experience what it means for them to live with the disease, provide the information to adequately manage their disease, emphasizes the process of improving individual control skills (measuring their glucose levels, measuring blood pressure, taking medication, applying insulin), carry out daily actions of self-control of their disease (follow a diet plan, exercise). The activities carried out within a GAM are: a) organization of courses and workshops, b) prevention and detection of diabetes in relatives and at community level, c) social and recreational activities, d) acquisition of own resources, e) accreditation of the group (criteria for accreditation, re-accreditation and accreditation with excellence).[22]

Evaluation of GAM

In 2001, in 15 states of Mexico were evaluated the basic treatment goals of 6,958 people with diabetes of the GAM, 45% of the patients were with controlled diabetes, 65% of the people with diabetes also presented overweight (BMI) > 27 kg / m2).[21] A study conducted in Sonora (2014), where two groups of patients divided into 32 patients per group were compared; the experimental group (those who attended a GAM) and the control group (those who attended an ordinary consultation). The results of this study indicated that the patients with diabetes who attended the GAM showed a positive impact in the control of their disease; weight loss and the reduction of waist circumference were favored.[23]

NATIONAL STUDIES FOR THE PREVENTION OF DIABETES

For the prevention of diabetes, there are some non-governmental studies that have positively impacted on the health of individuals, some of them are presented in Table 2, being those with a greater impact on people who do have a carried out.[24-29]

DIABETES TREATMENT ALGORITHM

The treatment algorithm for diabetes represents the care model proposed by WHO (2012) to identify these subjects, starting from the natural history of diabetes (prior to its diagnosis), following with the methods of individual intervention, up to the population, considering that both methods have two levels of prevention (primary, and secondary and tertiary).[30]

Within the individual management it is important that the intervention in the three levels of attention include health services, incorporate physical activity, monitoring and control of glycemia and lipid profile, food education, examinations and periodic reviews. Regarding the collective scope, the primary intervention should promote policies, improvement of programs, development of new products, promotion of physical activity at work and schools; secondary and tertiary levels, promote physical activity and food control, promote healthy eating through political campaigns, etc.[30]

CONCLUSIONS

Health national programs have a positive impact within populations that are held captive in health institutions; however, these programs are aimed at reducing harm when health has been compromised. A greater number of effective and efficient interventions are required to reduce the risk factors present in the development of type 2 diabetes, therefore giving importance to the development of programs that present a preventive approach in the population.

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Table 2. *Studies with preventive interventions for diabetes.*

Study	Intervention	n	Duration	Risk Reduction
Effects of community-based education on the risk factors in prediabetic older adults.[24]	Food orientation Physical activity Talk	20	6 months	They improved knowledge about diabetes, dietary habits and exercise. Changes, capillary glycemia and glycosylated hemoglobin.
Modification of Clinical Indicators in Patients with Pre-diabetes or Diabetes Mellitus type 2 through an Educational Program.[25]	"Seven behaviors of self-care" Self-efficacy, learning, activation model (empowerment), health belief models, locus of control, role models and conversation maps	27	12 weeks 4 hours each one	La HbA1c reduction 0.30%, lost weight 870 g
Adaptation and feasibility of a Diabetes prevention program in Comcáac (Seri) community of Sonora, Mexico.26	Diabetes Prevention Program (DPP) validated in Mexican-American population	14	15 weeks	Greater knowledge about diabetes, nutrition and physical activity
Low-calorie and carbohydrate diet: to improve indicators of cardiovascular risk in overweight or obese adults with prediabetes.[27]	Personalized diet 1200 to 1700 calories with a carbohydrate distribution of 50%, 20% proteins and 30% fat.	86	1 year Revision each 6 months	Significant reduction in glucose, weight (obesity), BMI
Effect of a program of aerobic physical conditioning in adults with obesity and prediabetes.[28]	Aerobic fitness 5 times / 50 min	36	3 months 60 sessions	The average weight loss was 5.2 kg, the mean fasting serum glucose reduced from 111.6 mg / dL to 83.2 mg / dL
Maternal Nutrition and Physical Activities Strategies to Prevent Type ll Diabetes Mellitus in School Children.[29]	Know the feeding and physical activity strategies that mothers perform to prevent Type 2 Diabetes Mellitus in school children.	30 mothers	Cross-sectional	The highest area was r**einforcement**, which indicates the praise to the children when they perform healthy behaviors, and the lowest was the monitoring, in which the parents supervise the healthy behaviors of their children.