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RESEARCH ARTICLE

Educational Diabetic Care Program: Clinical and Biochemical Evaluation One Year after the End of the Program

Mario Alberto González-Ballesteros[1], Patricia Teresa Reyes-Gabino[1], Juan Carlos Espinoza-Rodriguez[1], Maria Valeria Jiménez-Baez[2] and Luis Sandoval-Jurado[2]*

[1]*Mexican Social Security Institute (IMSS), Primary Health Care No. 16, Mexico*

[2]*Mexican Social Security Institute (IMSS), Health Research Coordination, Mexico*

*Corresponding author: *Luis Sandoval Jurado, Health Research Coordination, Mexican Social Security Institute (IMSS), Av. Instituto Politécnico Nacional, Región 509, Cancún, Quintana Roo, 77500, Mexico, Tel: (52)-(998)-2678699*

Abstract

Introduction: Diabetes mellitus is a global public health problem, millions of deaths per year are directly related to this condition and it is the fourth leading cause of death from disease. The increase in causes for type 2 diabetes reflects a lifestyle adopted by people and without referred prevention strategies therefore constitute a priority objective of therapeutic and educational interventions

Objective: To evaluate the clinical and biochemical parameters in the patients of the diabetic patient care program at the beginning, end and one year after completion.

Material and methods: Retrospective cohort in a Primary Health Care Unit in Cancun, Mexico in adults who completed the diabetic patient care program called Diabet IMSS. Records of diabetic patients from the Diabet IMSS program were obtained and evaluated: Glucose, HbAc1, Total cholesterol, Triglycerides, Blood pressure and BMI at the beginning, end and one year after finished the program. The information was analyzed by t student for related samples

Results: 195 records of patients with a mean age of 58 ± 10.5 years and 10 ± 5.8 years of diabetes evolution. At the end of the program, HbA1c, Glucose and triglycerides showed a decrease ($p < 0.05$) but, other evaluated parameters showed no difference. After one year of the end of the program, a significant increase ($p < 0.05$) was reported in all the clinical and biochemical parameters evaluated.

Conclusions: The improvement reached at the end of the Diabet IMSS program corresponds to significant descends results in some variables; although finally, the control goals are not reached. However, the patients did not manage to maintain the improvements reached at the end of the program, registering a considerable increase of all clinical variables one year after finished

Introduction

Diabetes mellitus has proved to be a major problem for global public health. It is estimated that about 4 million deaths per year are directly related to this condition, actually is the fourth leading cause of death by disease [1]. The prevalence of DM2 for all age groups worldwide was estimated at 2.8% for the year 2000 and 4.4% for 2030 [2].

In the year 2000 the number of people with diabetics in America continent was approximately 35 million people, this value will increase to 64 million in 2025 and 52% of diabetics patients in the continent, live in Latin America and the Caribbean, and that proportion will grow to 62% in 2025 [3].

The problem is magnified by the fact that at least one third of people with DM2 in Latin America do not know they are sick and represent a challenge to the screening program and complicate the implementation of care, control and prevention strategies [4].

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In 2012, the National Health and Nutrition Survey (ENSANUT) reported a prevalence of 9.2% which shows a significant increase compared to report in ENSANUT 2006, with a 7% [5]. In the Mexican Institute of Social Security (IMSS), between 2000 and 2011, the diabetes prevalence increased from 8.7 to 10.5% [6].

The increase´scauses in cases of type 2 diabetes and prevention strategies referred as principal responsible tothe lifestyles adopted for the people, and are therefore priority target of therapeutic and educational interventions [7].

In this situation, the DiabetIMSS module comes within the Mexican Social Security Institute (IMSS) as an educational program based on changes in the patient´s lifestyle, by pharmacological and non-pharmacological treatment with the participation by family physician, nurse, social worker, nutritionist, dentist and psychologist, which includes medical consultations and monthly educational sessions over a period of one year during which they must meet targets metabolic control, including glucose, HbA1c, total cholesterol, High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), triglycerides (TGC), Blood Pressure (BP) and maintenance of glomerular filtration rate, among other clinical variables [8,9].

The Diabet IMSS program reports in its Technical Guide, up to 44% of patients attended reaches metabolic control; however, no structured assessments to determine success rates and metabolic control in the patients [10]. Within the Diabet IMSS program exist assessments by the administration of IMSS although the clinical impact so far has only been evaluated in some studies [9,10], the long-term scope has not been reported, in other words if graduatespatients keep to maintain over time the improvements achieved during his instruction in the program.

Therefore, the aim of the study was to evaluate the patient´s clinical and biochemical parameters one year after the end of the DiabetIMSS program.

Methods

A retrospective cohort with records of diabetic patients attended inthe educational program for the Diabetic patient (Diabet IMSS) during a year in a primary health care unit, in Cancun, México. Patients are sent to participate in this program with the following criteria: a) Be a carrier of any type of diabetes, b) Accept being referred to the program, c) No cognitive impairment, psychosis or drug dependence, d) No chronic complications (renal replacement therapy, diabetic foot). With a commitment to a family or social support network and f) Can go once a month to take medical care and aneducational session. The courses programming is weekly with an average of 11 participants, with a dropout rate of approximately from 11% to 20%. The topics for the 12 scheduled sessions consist about

knowledge of diabetes, myths, self-monitoring, hyper and hypoglycemia, nutrition, behavior modification, physical activity, self-care, family history and sexuality.

The selection of patients was made from the internal files from each one medical officedesignated for the realization of this program with a register of patients attended in the 12 sessions that make up the program. Subsequently, the Family Medicine Information System (SIMF) was entered to search the electronic files of previously selected patients; the data obtained were recorded on the collection sheet designed for it (self-structured). The study variables were obtained from the files in three periods: at the beginning of the Diabet IMSS program, at the end of the program, and one year after finish.

The eligibility criteria used were: patient's records with DM2 and assistance at the DiabetIMSS program during the 12 sessions (one year), one year after starting the program and keep continue to follow up in the primary health care clinic. Were excluded the files of patients unfinished the DiabetIMSS program and those records of patients with incomplete or missing biochemical parameters records. The biochemical parameters evaluated were serum glucose, glycated hemoglobin (HbA1c), cholesterol, triglycerides, blood pressure and BMI, which were obtained at the beginning, end and one year after finished the program.

The values established by the American Diabetes Association (ADA 2016) were used as reference: HbA1c < 7%, Fasting glucose < 130 mg/dL, Cholesterol < 200 mg/dL, Triglycerides < 150 mg/dL, BMI < 25, Pressure Arterial < 140/90 mm/Hg [11].

The sample size was determined through the STATS program with the following considerations: universe of 393 patient's records enrolled in that year, maximum acceptable error: 5%, estimated percentage of the sample: 50% and confidence level of 95%. The sample obtained corresponded to 197 records of diabetic patients with a complete assistance to 12 sessions corresponding to the Diabet IMSS program. The sampling was non-probabilistic because the patients with the inclusion criteria of the immediate previous years were included until obtaining the required sample number.

After obtaining the data, they were captured in the software SPSS version 21 for statistical analysis. A descriptive statistic was used with measures of central tendency and dispersion: range, means, mode, standard deviation, proportions and / or percentages, as well as the statistical analysis by the "t" student´s for related samples and one-way ANOVA. A minimum value of p of 0.05 was obtained.

Results

A total of 393 finished the diabetic patient care

program and the required sample was 197 patient records, which represents 50.1%. The female sex predominated with 66.5%; the average age was 58 years (S.D. ± 10.5), the minimum 33 and the maximum of 86 years, with a maximum frequency for 60 years and less (58.4%). About the diabetes evolution, the average was 10.0 years (S.D. ± 5.8), with a range from 1 to 25 years; 54.8% of the cases correspond to patients with 10 years and less of diabetes evolution and 45.2% to patients with a 10 years or more evolution (Table 1).

To compare the averages of biochemical parameters at the beginning and the end of the program, a decrease was observed in the values of Hb1Ac (7.6 vs 7.0), glucose

(148.4 mg/dl vs. 127.5 mg/dl) and triglycerides (167 mg/dl vs 150.6 mg/dl) (p < 0.05). Others showed a decrease such as blood pressure and BMI, but without statistical significance. Contrary, the cholesterol waskept at the same value at the beginning and end (195.5 mg/dl vs 195.8mg/dl) (p > 0.05) (Table 2).

One year after finished the DiabetIMSS program, the averages values for the biochemical parameters were evaluated for compared to the obtained at the end of the program, an increase was observed in serum glucose of 7.9 mg / dl. (p < 0.05), 7.6 mg / dl (p < 0.05) and triglycerides of 37.5 mg / dl (p < 0.05). The blood pressure and BMI, also increased (p > 0.05) one year after conclude the care program for diabetic patient DiabetIMSS (Table 3).

At compare the biochemical and clinical parameters from the beginning to the year after finished the Diabet IMSS program in relation to age, the ≥ 60 year old group the Systolic arterial pressure at the end of the program was greater than in the group < 60 years (121 mm / Hg versus 116 mm / Hg) (p < 0.05). Likewise the arterial pressure diastolic was greater in the group of < 60 years (77.7 mm / Hg vs. 75.3 mm / Hg) (p < 0.05) one year after the program was concluded (Table 4).

In relation to the diabetes evolution, those with a time of10 years or less and those with 10 years and more were compared, finding significative differences

Table 1: Population characteristics.

Characteristic	Frecuency	
	n	%
Gender		
Male	66	33.5
Female	131	66.5
Age		
< 60 years old	115	58.4
≥ 60 años years old	82	41.6
Evolution		
≤ 10 years	108	54.8
> 10 years	89	45.2

Table 2: Clinical variables at the beginning and end of the program.

	Mean (± S.D.)			
	Initial	Final	Differences CI 95%	p*
Hb A1c (%)	7.6 ± 1.6	7.0 ± 1.4	0.4-0.7	**0.00**
Glucose (mg/dL)	148.4 ± 52.6	127.5 ± 40.5	13.8-28.1	**0.00**
Cholesterol (mg/dL)	196.5 ± 33.35	196.8 ± 42.4	-6-0-5.3	0.90
Triglycerides (mg/dL)	167.2 ± 79.7	150.6 ± 90.7	1.8-31.4	**0.02**
SBP (mm/Hg)	119.3 ± 14.2	118.2 ± 14.5	-1.3-3.5	0.37
DBP (mm/Hg)	72.8 ± 9	71.5 ± 9.4	-0.2-3.0	0.10
BMI (kg/m²)	30 ± 4.9	29.7 ± 5.1	-0.01-0.5	0.06

*t Student test Significant difference p < 0.05; C: Confidence Interval; HbA1: Glycated Hemoglobin; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; BMI: Body Mass Index

Table 3: Clinical variables at the end and one year completed the program.

	Mean (± S.D.)			
	Final	OneYear	DifferencesCI 95%	p*
Hb A1c (%)	7 ± 1.4	-	-	-
Glucose (mg/dL)	127.5 ± 40.5	135.4 ± 44.8	(-14.2)-(-1.7)	**0.01**
Cholesterol (mg/dL)	196.8 ± 42.4	204.4 ± 36.8	(-13.3)-(-1.8)	**0.00**
Triglycerides (mg/dL)	150.6 ± 90.7	188.1 ± 81.8	(-48.6)-(-26.3)	**0.00**
SBP (mm/Hg)	118.2 ± 14.5	123.8 ± 13.4	(-7.9)-(-3.3)	**0.00**
DBP (mm/Hg)	71.5 ± 9.4	76.7 ± 7.1	(-6.6)-(-3.7)	**0.00**
BMI (kg/m²)	29.7 ± 5.1	30.1 ± 5	(-0.7)-(-0.07)	**0.01**

*t Student test Significant difference p < 0.05; CI: Confidence Interval; HbA1: Glycated Hemoglobin; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; BMI: Body Mass Index

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Table 4: Clinical variables by age group.

		Age Group		
		< 60 AÑOS	*≥ 60 AÑOS*	p[*]
HbA1c[†] (%)	Initial	7.66	7.67	0.99
	Final	7.11	6.94	0.43
Glucose (mg/dL)	Initial	147.5	149.7	0.77
	Final	127.9	126.8	0.86
	OneYear	139.7	129.4	0.11
Cholesterol (mg/dL)	Initial	194.3	199.5	0.28
	Final	199.7	192.8	0.26
	OneYear	206.6	201.4	0.33
Tryglicérides (mg/dL)	Initial	161.7	174.9	0.25
	Final	156.6	142.1	0.26
	OneYear	194.2	179.4	0.21
SBP (mm/Hg)	Initial	118.2	120.8	0.21
	Final	116.1	121.1	**0.01**
	OneYear	123.7	124.0	0.88
DBP (mm/Hg)	Initial	73.8	71.5	0.08
	Final	72.1	70.6	0.25
	OneYear	77.7	75.3	**0.02**
BMI (kg/m²)	Initial	30.1	29.9	0.84
	Final	29.9	29.5	0.56
	OneYear	30.4	29.7	0.34

†t Student test *ANOVA Significant difference $p < 0.05$; CI: Confidence Interval; HbA1: Glycated Hemoglobin; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; BMI: Body Mass Index

Table 5: Clinical variables and diabetes evolution time.

		Evolution time		
		≤ 10 Years	*>10 Years*	p[*]
HbA1c[†](%)	Initial	7.2	8.2	**0.00**
	Final	6.7	7.3	**0.00**
Glucose (mg/dL)	Initial	131.6	168.9	**0.00**
	Final	124.9	130.5	0.33
	OneYear	134.2	137.0	0.66
Cholesterol (mg/dL)	Initial	194.5	198.8	0.36
	Final	202.2	190.2	**0.04**
	OneYear	206.0	202.5	0.51
Tryglicérides (mg/dL)	Initial	169.8	164.0	0.61
	Final	160.5	138.5	0.09
	OneYear	196.9	177.3	0.09
SBP (mm/Hg)	Initial	116.1	123.2	**0.00**
	Final	116.6	120.1	0.09
	OneYear	122.4	125.6	0.09
DBP (mm/Hg)	Initial	73.4	72.2	0.36
	Final	72.4	70.4	0.14
	OneYear	77.3	76.0	0.22
BMI(kg/m²)	Initial	30.7	29.2	**0.04**
	Final	30.4	28.9	**0.03**
	OneYear	30.5	29.7	0.25

†t Student test *ANOVA Significant difference $p < 0.05$; CI: Confidence Interval; HbA1: Glycated Hemoglobin; SBP: Systolic Blood pressure; DBP: Diastolic Blood Pressure; BMI: Body Mass Index

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(p < 0.001) in the initial and final Hb A1c values, in glucose, systolic blood pressure and BMI. In the rest of the variables there are no significant differences between the two groups (Table 5).

Discussion

The metabolic control in all the parameters evaluated in these patients with diabetes was 5 per 100. This result is lower than the control observed in a Health Center in Manzanares, Spain [12], with a 7.07% of the patients attend their medical date and do not belong to a diabetes education program complete all metabolic control goals.

The most significant changes in the present study were achieved on glycemic control, with an increase in the percentage of controlled patients (HbA1c < 7%), from 42.1% at the beginning to 62.9% at the end of the program, this represents a difference of 20.8%. The result is comparable to showed in a study conducted in the United States of America [13], based on the DSME (Diabetes Self-Management Education) program [14], and recommended by the ADA, with an improvement in the number of controlled patients of 26.67%. It is noteworthy that this program includes, in addition to the teaching of theoretical knowledge, the implementation of self-care strategies and problem solving through self-efficacy; and, it takes place in a short period of 4 weeks.

The mean decrease in HbA1c at the end of the DiabetIMSS program was 0.6%, a similar result to other diabetes education programs as shown by a meta-analysis [15] conducted in 2011 and included 41 clinical trials, finding an reduction of 5.1% for HbA1c. It is also similar to the result recorded in the León-Mazón study [16], for the same DiabetIMSS program in 2012 in the state of Morelos, with a HbA1c decrease of 0.58%.

Fasting glucose achieved a mean decrease of 20.9 mg/dL and triglycerides of 16.6 mg/dL; on the Systolic Blood Pressure (SBP) of 1.1 and Diastolic Blood Pressure (DBP) of 1.3 mm/Hg; over the BMI only 0.3 kg/m², and finally, Finally, and although cholesterol is more frequently related to drug therapy than to lifestyle (including diet), it was observedan upward difference of 0.3 mg/dL, that is, instead of decreasing, the mean increased. León and Mazón [16] reported decreases in fasting glucose of 12.82 mg/dL and Triglycerides of 33.65 mg/dL (p < 0.001). Figueroa-Suárez [7], in 2012 evaluated the DiabetIMSS program in Mexico City and reported significant decreases in all parameters; 46.6 mg/dL in glucose, 63.64 mg/dL in triglycerides and 13.1 mg/dL in cholesterol.

The patients of the present study did not maintain the improvements achieved after one year finished the program, this differ with a study carried out in 2008 in Sweden [17], where an educational model with 5-year follow-up was evaluated, and reports adequate values for glycemic without showing increases in HbA1c, even after 5 years of educational intervention. This model stands out from others because it focuses on the patient's needs, his doubts, what he understands about his illness and not about medical knowledge. That program Focus on cognitive restructuring, self-care strategies and coping techniques. Patients speak freely about their concerns and how they handle their illness on a day-to-day basis.

Similarly, the diabetes education program of the Cuban health system [18], proposes like strategies the approach of problematic situations for the patient in participatory techniques and, their difficulties to comply the treatment and to found solutions starting from their daily experience, having as purpose the development of motivations, feelings of responsibility and skills for decision making in daily care.

Like some studies carried out on the DiabetIMSS program [7,16,19], the present work shows the improvements reached at the end of the program correspond to discrete decreases but significant in most of the variables, although the control goals proposed by the same program and based on parameters established by different international societies are not met. Likewise, the patients did not manage to maintain the improvements reached at the end of the program, and registered considerable increases of all the clinical variables in the analysis after one year finished the program.

It is important to point the previously mentioned studies, [7,16,19] including the present, indirectly evaluated the effectiveness of the DiabetIMSS program, and although this serve as a frame of reference for estimating their capacity as an educational model, it´s important to considerate other types of evaluations that explore the other aspects within the improvement program to consolidate their effectiveness. Similarly, there is an international benchmark, such as the educational model proposed by the ADA [14] with specific guidelines and proven effectiveness, for integrated into the DiabetIMSS program, and found essentially seek to empower the patient to solve problems, encouraging motivations and self-care strategies.

It is necessary for health institutions to provide medical services consider the results by studies to evaluate educational strategies for the control of patients with DM2.

The health personal that serve, this disease, and carry out the remodeling of the strategy directed to the continuous improvement of the programs directed not only to the empowerment of the patient but to the professionalization of the health´s workers directed to solve public health problems with impact in short and long term in the patient health to intervene in the clinical horizon of a global epidemic, avoiding microvascular and macrovascular complications that generate a high cost of attention of these systems.

Conflict of Interest

The health researchers solicits the publication of this manuscript, the content is original and has not been previously published or has been sent or submitted for consideration to any other publication.

Authors Declaration

The authors certify that there is no conflict of interest and each one of them read and approved the manuscript.

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