Proposal for Educational Intervention in people living with Type 2 Diabetes Mellitus and in their family caregiver

Abstract

Objective. Design a proposal of educational intervention for both, people who live with Diabetes Mellitus type 2 and their family caregiver.

Methodology. Methodology. A case series study was conducted with the participation of 12 people living with type 2 diabetes mellitus and attending a Mutual Help Group in Pachuquilla, Hidalgo. Sociodemographic data, somatometric measurements (weight, height, BMI, waist circumference), blood pressure, and capillary blood samples for glycosylated hemoglobin were collected.

Results. The mean age was 64 and range of 39-79 years, O.D. of 12; 67% women; 25% finished secondary school, 50% worked at home, 17% in commerce, 33% unemployed; 58% married, 25% widowed, and 17% divorced and in common law; 33.% with less than 5 years diagnosed, 67% have been diagnosed for more than 5 years; 75% depend economically; 67% have complications, 75% with family support, in diabetes knowledge 33% obtained intermediate score and 67% inadequate score; the weight average was of 77 kg and range of 57-116.5 kg, and O.D. 17 kg; in waist circumference, 100% exceed the recommended limit, in BMI, 50% is classified as overweight and 50% as obese; in blood pressure 50% > 130/80 mmHg and in glycosylated hemoglobin 75% > 7% mg/dl.

Conclusion. The currently implemented strategy does not reflect good knowledge and control of the disease. This study invites us to continue with research where an educational intervention is implemented in which family caregivers are included and active participation is encouraged, in addition to implementing the IEP as a theoretical basis for the intervention.

Key words: educational intervention, type 2 diabetes mellitus, family caregiver, support, glycemic control.

Introduction

The World Health Organization (WHO) defines diabetes as a chronic disease that appears when the pancreas does not produce enough insulin or when the body does not use the insulin it produces effectively. The effect of uncontrolled diabetes is hyperglycemia (a rise in blood sugar above normal ranges).[1]

The International Diabetes Federation (IDF) in 2017 estimated, with data from 221 countries, that the prevalence of people with diabetes was 425 million worldwide with an age range of 20 to 79 years. Of these, 89% to 91% have type 2 diabetes mellitus (DT2) and 7% to 12% have type 1 diabetes mellitus. It should be noted that 79% correspond to people living in low- and middle-income countries. However, if the age range increases to people aged 18 to 99, the number of people also increases to 451 million. If this incidence is maintained, the projections for 2045 indicate that, 629 million people between 20 to 79 years and 693 million people between 18 to 99 years.[2]

On the other hand, the International Diabetes Federation (IDF) in 2015 mentions that the estimated burden of mortality is 5 million people between the ages of 20 and 70. Add that it is the equivalent

of one kill every 6 seconds. Diabetes and its multiple complications generate a great economic loss for the people who suffer from it, their families and, in addition, to the health systems at the national level.[3, 4]

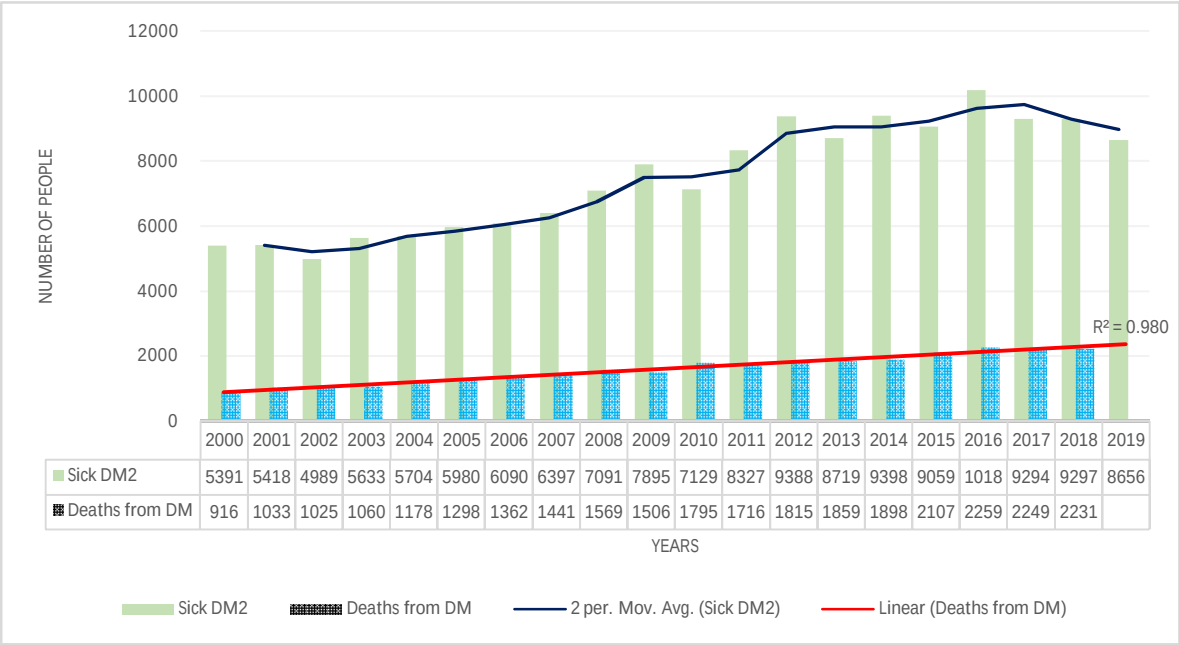
In data from the IDF, Mexico ranks fifth in the world in people with diabetes with an estimated total of 12 million. In addition to this, Mexico went from 9.2% in 2012 to 9.4% in 2016 in the prevalence of diabetes by medical diagnosis, this in men between 60 and 69 years of age and among women with 60 years of age or more.[3] In addition, it is reported that the highest prevalence of people with a medical diagnosis of diabetes was found in the southern region with 10.2%. For women, the highest prevalence was found in the center of the country with 11.7%, whereas for men it was found in the southern region with 11.2%.[5]

In 2019 data National Institute of Statistics and Geography (INEGI), it is considered the second cause of death with 104,352 total cases, only below heart diseases with 156,041cases.[6] Likewise, Mexico is the first place in diabetes within the Organization for Economic Cooperation and Development (OECD), having a prevalence of 15.8% in the population between 20 and 79 years of age. In this way, Mexico doubles in figures to the other countries of this organization, when the average of the member countries is 7%. Due to this, there is a mortality alert compared to Estonia, Ireland, Luxembourg, Sweden and the United Kingdom, where only 5% of the adult population suffers from this disease.[8]

In Hidalgo, the National Health and Nutrition Survey (ENSANUT) 2012 estimates that the prevalence of diabetes due to a previous medical diagnosis in people aged 20 or over was 8.2%, higher than that reported in ENSANUT 2006, which was 7.1%. Likewise, the prevalence in women was slightly higher with 9.7% compared to 6.4% in men. At the same time, it was possible to observe an increase in the prevalence of a previous diagnosis of diabetes from the 40 to 59 age group of 10.4% in men and 15.4% in women. The state, in that same year, was below the national average, which was 9.17%.[9]

In the state of Hidalgo, diabetes cases and deaths have been increasing. For example, in 2002 DT2 ranked number 17 and by 2019 it ranked number 11 as a cause of morbidity.[8]

Figure 1. Morbidity and mortality due to diabetes in the state of Hidalgo, year 2000 - 2019.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sick DM2	5391	5418	4989	5633	5704	5980	6090	6397	7091	7895	7129	8327	9388	8719	9398	9059	1018	9294	9297	8656
Deaths from DM	916	1033	1025	1060	1178	1298	1362	1441	1569	1506	1795	1716	1815	1859	1898	2107	2259	2249	2231	

Own elaboration. Data obtained from the National Institute of Statistics and Geography [INEGI] [6] and the General Directorate of Epidemiology [DGE] [10]

The impact of mortality from diabetes in the population of Hidalgo is clearly observable. Figure 1 shows a sustained growth in the number of deaths from DM, and when comparing the year 2000 where 916 deaths were registered with the year 2018 with a total registry of 2231 deaths, there was an increase of 59%. It should be noted that there are no existing data on deaths from DM in the year 2019 in the state of Hidalgo. Likewise, for the cases of people who fell ill with DM2, an average sustained increase is observed until 2017, given by the moving average line. As of 2018, a slight decrease is shown.[6, 10]

Alulima[11] mentions that people with diabetes have limited family and social support in 100% and also have adherence to regular treatment in 58.3%. Regarding the above, various studies show that involving the family in the care of a person with diabetes mellitus improves their glycemic control. One of the determinants to support the patient with diabetes mellitus is the information that their family has, since this influences metabolic control.[12]

Most sick patients with diabetes mellitus do not receive adequate family support, this is because the family is unaware of the influence that the family exerts on the well-being of the person with diabetes, affecting family functionality.[11]

Based on the above, the importance now focuses on educating first-degree relatives in relation to family and social support, this to provide an important indirect treatment intervention and thereby achieve favorable results for the patient and his family.[13]

The Instrumental Enrichment Program (IEP)[14,18,23-27] is a program whose purpose is meaningful learning that contributes to the motivation of the individual to learn and benefit through their own experiences and their learning. Therefore, this program does not have thematic content, which is a great advantage for the individual and for the mediator, since it allows this openness and flexibility of the sessions so that it can be learned by socializing, through the experience it gives as The result

is a significant learning that will directly impact the daily life of the person and contribute to appropriate behaviors and above all, responding adequately to the demands of society itself, having as a precedent an optimal adaptation to the environment. [14, 15]

On the other hand, the IEP bases its structure and ideas on the Theory of Structural Cognitive Modifiability (TSCM) which mentions that human beings are modifiable entities and that the person who is educated under this theory is modifiable despite having determinants that make it difficult. Likewise, it embodies the conceptual position that human cognition is flexible and plastic, which allows it to be open to new knowledge with significant potential and, by nature, needs knowledge. That family support is one of the factors that directly influence the compliance of pharmacological and non-pharmacological treatment.[14, 15]

Objective

Design a proposal for an educational intervention for people living with type 2 Diabetes Mellitus and their family caregiver describing the sociodemographic characteristics, knowledge of diabetes, degree of control of diabetes mellitus and the existence of family support in patients from a Mutual Help Group of Chronic Diseases (GAM-EC), to identify their health status and contribute to improving the quality of life of the patient. This proposal is based on the utility that the Theory of Cognitive Modifiability can provide through the Instrumental Enrichment Program (IEP)[14,18].

Methodology

A case series study was carried out in which 12 people living with type 2 Diabetes Mellitus and their family caregiver, who attended a GAM-EC participated and consisted of collecting sociodemographic data from the participants through an instrument, as well as obtaining somatometric measurements (weight, height, BMI, circumference waist), blood pressure and capillary blood samples for glycated hemoglobin. Likewise, a semi-structured interview was conducted in which qualitative information was collected. All of the above to support the need for a diabetes intervention proposal for the patient and their family caregiver.

To characterize the group, the participants were first given an informed consent letter which they could read carefully and sign, later they were given a sociodemographic survey which they answered in full.

Also, to measure diabetes knowledge, a semi-structured interview was conducted based on the survey conducted by Noda, Perez, Malaga and Aphang[16] on diabetes knowledge, which consists of 13 questions referring to etiopathogenesis, diagnosis, treatment, adverse effects and complications of DM, and for their evaluation a card was used where the responses are classified as inadequate, intermediate or inadequate (Annex 1 and 2). Values were assigned to the responses: Adequate (2 points), intermediate (1 point) and inadequate (0 points). Finally, patients with adequate knowledge were classified as those who obtained between 20 and 26 points, intermediate between 14 and 19 points, and inadequate between 0 and 13 points.

Results

The results were collected from the information provided by twelve people who met the inclusion criteria. The people are part of the Mutual Help Group for Chronic Diseases of the Health Center. The informed consent letter was read to them and later signed by each of them.

Demographic Data

Table 1 shows the demographic characteristics in order to characterize the participants. This information was collected from the identification card, after accepting voluntary participation in the study, and signing the informed consent.

Table 1. Demographic characteristics

Characteristics	N = 12
Age	Minimum: 39 years Maximum: 79 years Average: 64 years
Sex • Men • Women	 33% 67%
Scholarship • No studies • Completed Elementary • Completed High School	 25% 50% 25%
Occupation • Unemployed • Home • Merchant • Miscellaneous services	 33.3% 50% 8.3% 8.3%
Civil status • Married • Widower • Divorced • Free Union	 58.3% 25% 8.3% 8.3%
Years with DM2 since diagnosis • Less than 5 years • From 6 to 10 years • 11-15 years • More than 15 years	 33.3% 8.3% 25% 33.3%
Economic dependence • Yes • No	 75% 25%
Complications • Yes • No	 66.6% 33.3%
Types of complications • Eye damage • Cardiovascular diseases • Oral diseases • Diabetic neuropathy	 75% 25% 12.5% 12.5%
Family support • Yes • No	 75% 25%
Support from • Spouse • Children • Spouse and children	 33.3% 55.5% 11.2%
Economic income	

Less than $ 6,000.00 pesos per month	83.3%
Between $ 6,000.00 and 8,000.00 pesos per month	16.7%

Direct source. Own elaboration, Pelcastre et al, 2020.

Diabetes knowledge

The results reported in the table 2 shows the score obtained participants semistructured interview regarding knowledge about had diabetes mellitus. 33.3% (4) obtained an intermediate score and 66.7% (8) obtained an inadequate score (Figure 2).

Table 2. Knowledge score about diabetes

Participant	Score	Ranking by score		
		Inadequate (0-13)	Intermediate (14-19)	Adequate (20-26)
1	10	X		
2	5	X		
3	16		X	
4	6	X		
5	12	X		
6	17		X	
7	16		X	
8	10	X		
9	17		X	
10	3	X		
11	11	X		
12	6	X		

Direct Source. Own elaboration, Pelcastre et al, 2020

Measurements

Table 3 shows a BMI classification regarding the degree of control of the patient, based on NOM-015-SSA2-2010,[13] for the prevention, treatment and control of diabetes. This indicates that 100% of the participants have poor BMI control, which results in the participants having a high weight for height. Furthermore, 50% of the participants are overweight and 50% have obesity. Of the latter, 66.7% have class I obesity, 16.6% class II obesity and 16.6% class III obesity (Figure 2). The classification was obtained from the WHO.[1] Likewise, of the total number of participants, 50% obtained a blood pressure result <130/80 mmHg (Table 3).

On the other hand, regarding glycosylated hemoglobin, it is observed that only 25% of the participants obtained a result of HbA1c <7%. This classification is based on NOM-015-SSA2-2010, for the prevention, treatment and control of diabetes.[13] Finally, regarding waist circumference, 100% of men and women have a waist circumference above the recommendations made by the Ministry of Health of Mexico, which for men should be less than 90 cm and for women less than 80cm.[17]

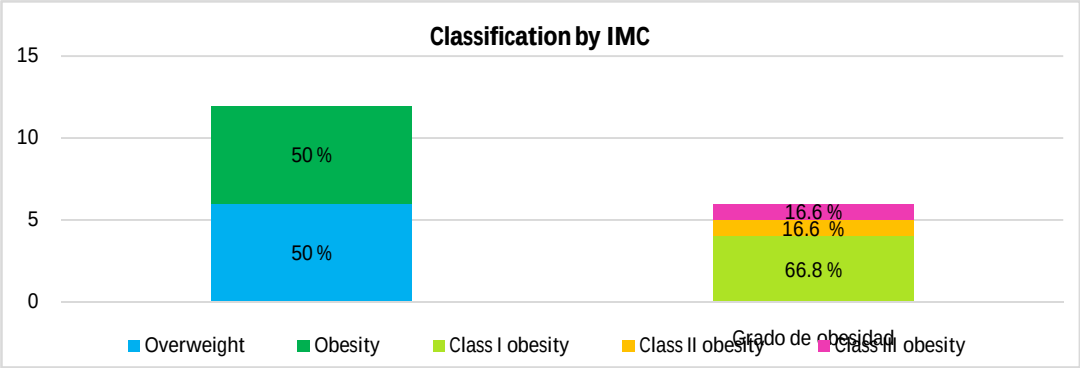
Table 3. Treatment goals of the participants (patients)

Treatment goals for BMI

	Normal weights >18.5 y < 24.9 kg/m2	**Overweight IMC > 25 y < 29.9kg/m2**	**Obesity > 30kg/m2**	**Total**
Results N = 12	0%	50%	50%	100%
Treatment goals for blood pressure				
	<130/80 mmHg	**> 130/80 mmHg**		**Total**
Results N = 12	50%	50%		100%
Glycated Hemoglobin (HbA1c) treatment goals				
	<7% mg / dl	**>7% mg / dl**		**Total**
Results N = 12	25%	75%		100%
Treatment goals for waist circumference				
	Men <90cm	**Women <80cm**	**Men> 90 cm and Women> 80 cm**	**Total**
Results N = 12	0%	%	100%	100%

Direct Source. Own elaboration, Pelcastre et al, 2020

Figure 2. Classification of participants (patients) by BMI



Direct Source. Own elaboration., Pelcastre et al, 2020

Educational Intervention Proposal

The educational intervention proposal based on the Theory of Cognitive Modifiability - Instrumental Enrichment Program (IEP)[23-27] by Reuven Feuerstein is presented below (Table 4). This theory has the advantage of being dynamic, elevating cognition, and adapting to individual needs.

Table 4. General program of educational activities based on the Instrumental Enrichment Program (PEI) of Reuven Feuerstein[14,18,23-27] in patients.

Duration	objective	Exercise	Material
2 hours maximum	-Obtain informed consent signature -Characterize the sample by obtaining sociodemographic data using the -Somatometry (weight, height, BMI, waist circumference), blood pressure, glycated hemoglobin and preprandial capillary glucose.	-Read the informed consent and proceed with the signature of the document by the participants. -They will be asked to write their corresponding data on a previously prepared sheet where they will ask about sex, completed educational level, age, years of diabetes treatment, complications of diabetes, address, economic	-Informed consent sheets and general data sheets. Scale, stadiometer, tape measure, glucometer, test strips, sterile lancets, sphygmomanometer, stethoscope, and equipment for measuring glycated hemoglobin.

		dependency. -Perform somatometric and blood pressure measurements, glycosylated hemoglobin and preprandial capillary glucose.	
2 hours maximum	Present the framework of the course-workshop. Stimulate visuospatial relationships through tasks of organization and structuring of a "field".	Application of the first part of Instrument 1 Organization of points, with the first exercise. With the support of questioning and mediation, the participants will be guided to their full resolution.	-Instrument 1 with the first exercise that composes it. -Pencil -Pencil sharpener -Rubber
2 hours maximum	Stimulate visuospatial relationships through tasks of organization and structuring of a "field".	Application of Instrument 1 Organization of points, with the two remaining exercises. With the support of questioning and mediation, the participants will be guided to their full resolution.	-Instrument 1 with the two remaining exercises. -Pencil -Pencil sharpener -Rubber
2 hours maximum	Develop the ability to orient oneself in a related way in space, with oneself and with objects.	Application of Instrument 2 Spatial orientation I. With the support of questioning and mediation, the participants will be guided to their full resolution.	-Instrument 2 with the three exercises that compose it. -Pencil -Pencil sharpener -Rubber
2 hours maximum	Subjects understand the meaning and the very process of the comparison in order to forge the creation of a “related” thought.	Application of Instrument 3 Comparisons. With the support of questioning and mediation, the participants will be guided to their full resolution.	-Instrument 3 with the three exercises that compose it. -Pencil -Pencil sharpener -Rubber
2 hours maximum	Subjects know and apply the basic principles of classification: color, size and shape.	Application of Instrument 4 Classifications. With the support of questioning and mediation, the participants will be guided to their full resolution.	-Instrument 4 with the three exercises that compose it. -Pencil -Pencil sharpener -Rubber
2 hours maximum	Develop perceptual skills related to perceptual proximity, continuity and similarity through exercises where subjects must dynamically discriminate, analyze and synthesize the whole and its parts.	Application of Instrument 5 Analytical Perception. With the support of questioning and mediation, the participants will be guided to their full resolution.	-Instrument 5 with the three exercises that compose it. -Pencil -Pencil sharpener -Rubber
2 hours maximum	Develop the ability of the subjects to orient themselves in a related way in space, with themselves and with objects, acquiring complexity when relating to the cardinal points.	Application of Instrument 6 Spatial Orientation II. With the support of questioning and mediation, the participants will be guided to their full resolution.	-Instrument 6 with the three exercises that compose it. -Pencil -Pencil sharpener -Rubber
2 hours maximum	Subjects use a series of thinking strategies to decode a message that will lead them to the solution of a problem.	Application of the Instrument 7 Illustrations. With the support of questioning and mediation, the participants will be guided to their full resolution.	-Instrument 7 with the three exercises that compose it. -Pencil -Pencil sharpener -Rubber
2 hours maximum	Collect information such as glycated hemoglobin, total cholesterol, HDL, LDL, triglycerides from the clinical record. -Somatometry (weight, height, BMI and waist circumference) and blood pressure –Get preprandial capillary glucose.	Final measurement: Measure weight, height and waist circumference; measure capillary glucose and blood pressure.	-Scale, stadiometer, tape measure, glucometer, test strips, sterile lancets, sphygmomanometer and stethoscope.

Direct Source. Own elaboration, Pelcastre et al, 2020

Consistent educational intervention and in conducting educational sessions 8 based on (IEP) and 2 sessions to gather information from participants, aimed at patients and their family caregivers. It is recommended that one session per week be held.

Discussion

In the present study, a predominance of women (66.7%) is observed, possibly related to various sociocultural factors, where men are resistant to going to a health unit and receiving medical attention, a situation similar to that reported by Ávila. that this situation be analyzed and strategies applied to incorporate a greater number of men.[18]

The 25% of the participants concluded level secondary studies may be an important factor for poor control of the disease and 75% of participants obtained a glycosylated hemoglobin ≥ 6.5%, which is classified as fair to poor for goals treatment;[13] relationship mentioned by ENSANUT[9] in which they found that diabetes mellitus occurs more frequently in people with less education; as well as that indicated by Mejía et al.[19] where they found that individuals with low education had glucose levels above normal.

People who answered having support from their family reported in some cases that they do not live with them, that they only support them in buying the pantry and that they visit them every 8 days or more. This shows the lack of support in a correct way from the family and that, in addition, they refer to the need for daily and continuous support in terms of taking medicines, preparing food, traveling to their respective consultations and feeling cared for by their family. Also, patients mention that their family caregivers refuse to accompany them to the GAM sessions because they do not have time, have to work, are not interested in the topics, or simply do not have importance in supporting them, which is why the great lack of support is evident, possibly adding that a formal invitation is not sent from the Health Center to be part of the group explaining the reason and their essential work in the control of diabetes and the care of their family.

In relation to knowledge about diabetes mellitus, only 33.3% obtained an intermediate score, the rest (66.7%) were inadequate, which contributes to the lack of control of the disease. Inadequate knowledge of the disease does not allow the person to make correct decisions and this results in glycemic lack of control buy Bustos et al.[20] where they mention the relationship between the lack of adequate knowledge in diabetes and the risk of hospitalization in people with type 2 diabetes mellitus.

Education in diabetes is one of the pillars of the treatment of the disease, having to be necessary immediately after the medical diagnosis by entering a structured educational program (Latin American Diabetes Association [ALAD][21] therefore, the use of alternatives educational intervention based on the Theory of Cognitive Modifiability (CCT) by Reuven Feurstein would be a good tool for patients and their family caregiver to modify unhealthy habits and lifestyles that contribute to the control of the disease, especially based on glycated hemoglobin levels; relation to what was observed by Ávila[18] where he carried out an educational intervention in people with diabetes mellitus based on the IEP in which he reported statistically significant results for glycated hemoglobin, waist circumference and systolic blood pressure, in addition, he mentions that the TMC offers to be an alternative educational intervention in people living with type 2 diabetes mellitus as it proves to be adaptable to the needs and can be adapted to the sociocultural context of the people by modifying the instruments of the IEP[14,18,23-27].

The participants of the GAM studied present important risk factors, their treatment goals have not been met even though 66.6% have been with the disease for more than 5 years and the same time belonging to the GAM, in addition, the knowledge they have about the disease does not they are adequate and therefore do not allow them to reach the goals of treatment and control of diabetes mellitus.

Possibly the commitment factor of both the patient and the professionals in charge of the GAM affects development and meaningful learning, as reported by Jáuregui et al.[22] where they found that control depends on the commitment of patients and the ability of health professionals to motivate them. That family support is one of the factors that directly influence the compliance of pharmacological and non-pharmacological treatment. [15]

The foregoing shows the lack of a novel educational proposal with a different approach to what is being done in the health sector, a proposal that modifies the behavior of both the patient and their caregiver because, as observed, the average age of the sample was 64 years old, it is an adult population, mainly women with complications from diabetes, with a glycosylated hemoglobin greater than 6.5% mg / dl in 75% that is classified as fair and poor, and with inadequate knowledge of their condition, In addition, most are economically dependent, which would imply that in the very near future there will be greater complications and therefore the costs of medical care, out-of-pocket expenses and probably catastrophic would rise.

Despite the efforts made within the GAM, it is essential that the patient and their caregiver have better tools to control their disease. The proposal was the result of hard work and an exhaustive analysis of the results that will allow working on future projects with a group of people of any social nature, regardless of socioeconomic level, cognitive level, since the program used allows to be flexible and adaptable to the needs of people and above all that it has a constructivist approach that will serve to better interact with people.

Conclusions

Education in diabetes is one of the fundamental pillars of the treatment of the disease, however, it is necessary to consider including the family caregiver to improve the control of the disease through a pedagogical strategy aimed at promoting health.

In relation to the knowledge they have about diabetes mellitus, they have inadequate knowledge, which is essential to be able to act in health care and make decisions that contribute at all times to improve the state of health.

Regarding the control of their disease, it is observed that none of the participants meets all the treatment goals, the group shows a lack of glycemic control.

Regarding family support, it is observed that patients have a wrong idea of what their family's support should be in controlling their disease; their relatives do not offer any support that contributes to improving their health status.

The currently implemented strategy does not reflect good knowledge and control of the disease, there is no adequate family support, therefore there is a need to implement an educational intervention with a constructivist approach that includes the family caregiver. This study invites us to continue with research where an educational intervention is implemented in which family caregivers are included and active participation is encouraged, in addition to implementing the IEP as a theoretical basis for the intervention.

Ethical Approval. A letter was presented and signed and this project was approved by the ethics committee by the Institute of Health Sciences-UAEH

CONSENT. As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

ACKNOWLEDGEMENTS. The authors deeply thank the participating patients for their collaboration in carrying out this study.

COMPETING INTERESTS. The authors declare that there is no conflict of interest for the publication of this article.

References

1. World Health Organization (WHO). Diabetes. (2020). Available from: https://www.who.int/es/news-room/fact-sheets/detail/diabetes#:~:text=La%20insulina%20es%20una%20hormona,nervios%20y%20los%20vasos% 20sangu%C3%ADneos [Accessed 2 february 2020].
2. International Diabetes Federation (IDF). IDF DIABETES ATLAS. Eighth edition 2017. (2017). Available from: http://fmdiabetes.org/atlas-idf-2017/ [Accessed 2 February 2020].
3. International Diabetes Federation (IDF). Diabetes Atlas. Seventh edition. (2015). Available from: https://www.fundaciondiabetes.org/upload/publicaciones_ficheros/95/IDF_Atlas_2015_SP_WEB_oct2016.pdf [Accessed 2 February 2020].
4. World Health Organization (WHO). World report on diabetes. (2016). Available from: http://apps.who.int/iris/bitstream/handle/10665/254649/9789243565255-spa.pdf;jsessionid=7A0E37D69BAB758FA2CA129BBE4F11B1?sequence=1[Accessed 2 february 2020].
5. Ministry of Health (SSa). National Survey of Health and Nutrition of Midway (ENSANUT MC). Final report of results. (2016). Available from: https://www.gob.mx/cms/uploads/attachment/file/209093/ENSANUT.pdf [Accessed 2 February 2020].
6. National Institute of Statistics and Geography (INEGI). United States of Mexico. Main causes of mortality by habitual residence, age groups and sex of the deceased. (2019). Available from: https://www.inegi.org.mx/sistemas/olap/registros/vitales/mortalidad/tabulados/ConsultaMortalidad.asp [Accessed 2 February 2020].
7. National Institute of Statistics and Geography (INEGI). Gentleman. Main causes of mortality by habitual residence, age groups and sex of the deceased. Available from: http://www.inegi.org.mx/est/contenidos/proyectos/registros/vitales/mortalidad/tabulados/ConsultaMortalidad.asp [Accessed 2 February 2020].
8. Mejía X. 15.8% suffer from diabetes in Mexico; the first place in the OECD. Excelcior. (2017). Available from: https://www.excelsior.com.mx/nacional/2017/11/10/1200370 [Accessed 2 February 2020].
9. Ministry of Health (SSa). National Health and Nutrition Survey (ENSANUT). (2012). Available from: https://ensanut.insp.mx/informes/Hidalgo-OCT.pdf [Accessed 2 February 2020].
10. General Directorate of Epidemiology (DGE). Twenty main causes of disease in Hidalgo, by age group United Mexican States 2018. General Population. (2018). Available from: http://www.epidemiologia.salud.gob.mx/anuario/2018/principales/estatal_grupo/hgo.pdf [Accessed 2 February 2020].
11. Alulima SM, Rivas MA. The Family as a Trigger Factor of Decompensation in Comprehensive Health and Adherence to Treatment of Patients with Type II Diabetes Mellitus who Attend the Clinical Service of the Isidro Ayora General Hospital in the city of Loja, period 2015-2016. Loja: Loja University; 2016. Available from: http://dspace.unl.edu.ec/jspui/handle/123456789/17416 [Accessed 4 March 2020].
12. Pérez A, Berenguer M, Inclán A, Dacal Y, Enrique D. Training on diabetes mellitus for relatives of people affected by a popular council. MEDISAN. 2018; 22(3):287-294.
13. Ministry of Health (SSa). Official Mexican Standard NOM-015-SSA2-2010, For the prevention, treatment and control of diabetes. (2010). Available from: https://dof.gob.mx/nota_detalle.php?codigo=5168074&fecha=23/11/2010#gsc.tab=0 [Accessed 4 March 2020].

14. Varela A, Gramacho A, Melo C. Instrumental Enrichment Program (PEI): pedagogical alternative that responds to the challenge of quality in education. Diversitas: Perspectives in Psychology. 2006; 2(2): 297-310.
15. Reynoso-Vázquez J, Hernández-Rivero E, Martínez-Villamil M, Zamudio-López J L, Islas-Vega I, Pelcastre-Neri A, Garnica-Guerrero B, and Ruvalcaba-Ledezma JC. Home care: Family support in glycemic control in patients with type 2 diabetes mellitus. Hosp Domic. 2020; 4(4):199-207.
16. Noda JR, Perez JE, Malaga RG, Aphang, MR. Knowledge about "their disease" in patients with type 2 diabetes mellitus attending general hospitals. Rev. Med. Inherited. 2008; 19(2): 68-72.
17. Ministry of Health (SSa). Indicators of overweight and obesity. 2016. Available from: https://www.gob.mx/salud/articulos/indicadores-de-sobrepeso-y-obesidad?idiom=es#:~:text=El%20riesgo%20aumenta%20si%20la,debe%20measuring%20%20regularly%20 [Accessed 4 March 2020].
18. Avila R. Diabetes education with an intercultural approach from the Theory of Cognitive Modifiability- Instrumental Enrichment Program [PEI]. Mexico: Autonomous University of the State of Hidalgo; TESIS MSP, 2018.
19. Mejía JI, Hernández I, Moreno F, Bazán M. Association of risk factors with metabolic uncontrol of Diabetes Mellitus, in patients from the ISSSTE eastern clinic. Magazine of Medical-Surgical Specialties. 2007; 12(2): 25-30.
20. Bustos R, Bustos A, Bustos R, Cabrera I, Flores JP. Lack of Knowledge as a Risk Factor to be Hospitalized in Type 2 Diabetic Patients. Archives in Family Medicine. 2011; 13(1): 62-73.
21. Latin American Diabetes Association (ALAD). ALAD Guidelines on the Diagnosis, Control and Treatment of Type 2 Diabetes Mellitus with Evidence-Based Medicine 2019 Edition. Journal of the Latin American Diabetes Association. 2019. Available from: https://www.revistaalad.com/guias/5600AX191_guias_alad_2019.pdf [Accessed 4 March 2020].
22. Jáuregui EE, González EE, Gaxiola N, Vejar T, Ocampo A, Sánchez JM. Operation of mutual aid groups (GAM) and chronic diseases. diabetes. Today Med. Salt. 2017; 18(2): 8-16.
23. Ruvalcaba JC, Magaña JC, Avila R, Hernández M, López L, Reynoso J, and Contreras L. The Instrumental enrichment program (IEP), a proposal educative intervention in eating habits of overweight and obese children. International Journal of Advanced Education and Research, 2019; 4(5):40-44 13.
24. Feuerstein R, Richelle M. Sociocultural deprivation and its educational significance. Jerusalem: Szold Foundation, 1963.
25. Feuerstein R, Rand Y, Hoffman M, Miller R. Cognitive modifiability in retarded adolescents: effects of instrumental enrichment. American Journal of Mental Deficiency, 1979, 539-550.
26. Feuerstein R, Rand Y, Hoffman M, Miller R. Instrumental Enrichment: An intervention program for cognitive modifiability. Baltimore University Park Press, 1989.
27. Feurerstein R, Rand Y, Feurerstein RS. La disabilità`non É unlimite. Se mi amicostringimi a cambiare. Firentze Libriliberi, 2005.