ORIGINAL RESEARCH

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Correlation between glycemic control and knowledge in patients with type 2 diabetes mellitus treated at the Family Health Center of the Araucanía region, Chile

Relación del control glicémico con el nivel de conocimientos en pacientes con diabetes mellitus tipo 2 pertenecientes al Centro de Salud Familiar de la región de la Araucanía, Chile

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Marcelo Rosas-Muñoz[1] • Camila Chávez-Sepúlveda[1] • Manuel Alarcón-Hormazabal[1] • Fabiola Godoy[1] • Paulina Vázquez-Aguilar[1] Fredy Cea-Leiva[1]

[1] Universidad Santo Tomás - Faculty of Health - School of Nutrition and Dietetics - Temuco - Chile.

Corresponding author: Marcelo Rosas-Muñoz. School of Nutrition and Dietetics, Faculty of Health, Universidad Santo Tomás. Manuel Rodríguez No. 060. Telephone number: +56 452942290. Temuco. Chile. Email: mrosas@santotomas.cl.

| Abstract |

Introduction: Diabetes mellitus type 2 (DM2) is a public health problem considering its magnitude and repercussions.

Objective: To determine the correlation between glycemic control and the level of knowledge about their disease in patients with DM2.

Materials and methods: The sample consisted of 65 adults with DM2, aged between 55 and 74 years. The Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test was applied to measure the level of knowledge about DM2. Glycemic control was determined based on the last glycosylated hemoglobin value. Information on educational attainment, years of diagnosis of the disease and use of insulin therapy was obtained from clinical records.

Results: Patients with a sufficient level of knowledge of their disease had better glycemic control than those whose knowledge was insufficient ($p<0.001$). There were no differences when comparing educational attainment ($p=0.201$), years of diagnosis of the disease ($p=0.126$) and insulin use ($p=0.108$) with glycemic control.

Conclusion: Glycemic control in DM2 patients can be improved by delivering tools that allow them to be empowered with knowledge about their disease, regardless of their educational attainment, the duration of the disease course or the type of treatment.

Keywords: Glycemic Index; Knowledge; Type 2 Diabetes Mellitus (MeSH).

| Resumen |

Introducción. La diabetes *mellitus* tipo 2 (DM2) es un problema de salud pública dadas su magnitud y sus repercusiones.

Objetivo. Determinar la relación entre el control glicémico y el nivel de conocimientos sobre su enfermedad en pacientes con DM2.

Materiales y métodos. Se seleccionó una muestra de 65 adultos con DM2 de entre 55 y 74 años de edad. Para medir el nivel de conocimiento sobre DM2 se aplicó el Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test. El control glicémico fue determinado mediante el valor de hemoglobina glicosilada vigente. Nivel educacional, años de diagnóstico de la enfermedad y uso de terapia insulínica fueron obtenidos de la ficha clínica.

Resultados. Los pacientes con un nivel de conocimiento suficiente de su enfermedad presentaron mejor control glicémico que aquellos cuyo conocimiento era insuficiente ($p<0.001$). No existieron diferencias al comparar nivel educacional ($p=0.201$), años de diagnóstico de la enfermedad ($p=0.126$) y uso de insulina ($p=0.108$) con el control glicémico.

Conclusión. El control glicémico de pacientes con DM2 es mejorable mediante la entrega de herramientas que permitan empoderarlos de conocimientos acerca de esta patología, independiente de su nivel de instrucción, tiempo que llevan padeciendo la enfermedad o tipo de tratamiento.

Palabras clave: Glucemia; Conocimientos; Diabetes *mellitus* tipo 2 (DeCS).

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Introduction

Type 2 diabetes mellitus (DM2) is a chronic noncommunicable disease characterized by sustained hyperglycemia, which is caused by defects in insulin action or secretion. This pathology usually develops in people >40 years old, who have a sedentary lifestyle and poor eating habits, and is associated with family history. (1) Chronic hyperglycemia can manifest with damage to multiple organs, being the leading cause of blindness, kidney failure and amputations in adults; it is also one of the leading causes of heart disease and thrombosis. (2)

According to the International Diabetes Federation's 2015 report, an estimated 415 million adults between the ages of 20 and 79 worldwide have diabetes, of whom 193 million are undiagnosed. Another 318 million people have impaired glucose tolerance, putting them at high risk of developing the disease. If this increasing number is not stopped, an estimated 642 million people will be living with the disease by 2040. (3) In Chile, the prevalence of DM2 has increased from 6.3% to 9.4% according to the National Health Survey. (4)

Considering this world scenario, the American Diabetes Association recommends assessing the level of knowledge about DM2 and self-care skills, at least annually, and encouraging or providing tools for permanent education. (1) Health education in diabetic patients is an ongoing process that seeks to promote the knowledge, skills and self-care capacity of people diagnosed with DM2, which has a very positive impact on the reduction of unnecessary morbidity and mortality rates due to poor glycemic control. (5) Therefore, it is important for the patient to understand why good glycemic control should be maintained, know how to achieve it, and learn the appropriate strategies to solve any problem. To achieve this, there are international standards that define the characteristics that make up education in DM2 to be applied in the health system. (6)

In Chile, health promotion and education activities aimed at most patients with DM2 are the responsibility of primary care teams of the different health centers. These actions are fundamental to inform and motivate the population to adopt and maintain healthy practices and lifestyles, in addition to fostering environmental changes and directing human resource training and research in their own field. (7)

Several methodologies have been used to assess knowledge in patients with DM2. (1,8,9) In turn, different educational interventions that combine individual or group education have been made public, as well as the use of internationally validated instruments to measure the level of knowledge. (10) To select these instruments, linguistic validation should also be considered.

According to the available literature, having better knowledge of the disease is associated with a better level of self-care, thereby favoring glycemic control expressed in the reduction of glycosylated hemoglobin (HbA1c) and improving quality of life in these patients. (1,3,10-13)

Given the importance of the level of knowledge in the patient and its fundamental role in the proper management of the disease, the objective of this study is to determine whether glycemic control measured with HbA1c and the level of knowledge in patients with DM2 treated at a family health center in the region of Araucanía, Chile, are correlated or not.

Materials and methods

A cross-sectional correlational study in 65 adults diagnosed with DM2 (47 women and 18 men) was carried out using convenience sampling. The average age of the study participants was 62.8±6.22 years, all with recent HbA1c tests and users of the Cardiovascular Health Program of the Family Health Center (CESFAM) located in the commune of Padre Las Casas, Araucanía region, Chile. Participants were informed and made aware of the importance and objectives of the research and signed an informed consent. This research was approved by the Bioethics Committee of the Universidad Santo Tomás de Chile through Minutes CEC UST N°82/2015, issued on August 14, 2015. In addition, this work took into account the ethical principles for medical research involving human subjects of the Declaration of Helsinki. (14)

The instrument used to measure the level of knowledge was the Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test, developed and validated by the Michigan Diabetes Training and Research Center. (15) This instrument consists of 23 questions that measure knowledge regarding the disease and has been translated into Spanish and adapted for studies in the Chilean adult population. (16) It is a multiple-choice test with only one true answer; the first 14 questions refer to general information about diabetes, symptoms, diet and exercise, while the remaining 9 are related to insulin-based treatment and should be answered only by those on insulin-based therapy.

In order to classify the level of knowledge of the patients, the authors of this study defined a score >60% for approval, which was interpreted as sufficient knowledge of the disease. It is worth noting that this is a validated questionnaire for patients with DM2, that its components refer to practical aspects of disease management and that it does not contain questions related to the physiopathology of the disease.

The test was applied in a written and individualized way, and was taken only once by each participant after being explained by a nutritionist.

Glycemic control in each patient was determined by means of the value of the last HbA1c test, which was obtained from the clinical records of CESFAM; the evaluation of this indicator was analyzed in the laboratory of the center. HbA1c <7% was considered adequate glycemic control and HbA1c >7% as uncontrolled blood glucose. This categorization was made based on the Clinical Guidelines for Diabetes Mellitus type 2 in force in national primary care centers. (7) In addition, the information of each patient such as age, insulin use, educational attainment and years of diagnosis of the disease, was obtained from the clinical records.

An exploratory data analysis was carried out to debug the information, thus determining the prevalence of the variables of the main study together with a descriptive analysis. The chi-square test was used to determine the association between two qualitative variables, and in case of obtaining one degree of freedom because both variables were dichotomous, the Fisher's exact test was preferred. Contrasts were significant with a value of $p<0.05$. All analyses were performed using the SPSS software, version 19, for Windows.

Results

Table 1 shows that the subjects participating in this study were characterized by having a higher percentage of elementary educational attainment, followed by secondary education. It is also evident that the largest amount of patients of both sexes was diagnosed between 1 and 5 years earlier. In addition, a higher percentage of men were on insulin therapy compared to women. It can be seen that women have more metabolic control than men, and a higher percentage in terms of knowledge sufficiency in the test.

Table 1. Characterization of the sample according to sex.

Characteristics		Women n=47	Men n=18	Total n=65
		n (%)	n (%)	n (%)
Educational attainment	Elementary	36 (76.6)	14 (77.8)	50 (76.9)
	Secondary and higher	11 (23.4)	4 (22.2)	15 (23.1)
Years of diabetes diagnosis	Between 1 and 5 years	27 (57.5)	10 (55.5)	37 (56.9)
	Between 5 and 10 years	9 (19.1)	3 (16.7)	12 (18.5)
	>10 years	11 (23.4)	5 (27.8)	16 (24.6)
	With insulin treatment	20 (42.6)	10 (55.5)	30 (46.2)
	Adequate metabolic control	16 (34.0)	4 (22.2)	20 (30.8)
	Sufficient knowledge	26 (55.3)	6 (33.3)	32 (49.2)

Source: Own elaboration.

Table 2 shows that the group with sufficient knowledge has, in a significant way, better glycemic control in comparison with the group with insufficient knowledge, which has higher rates of uncontrolled blood glucose ($p<0.001$). It is also evident that there were no statistically significant differences between the level of knowledge in relation with sex ($p=0.166$). In addition, there were no significant differences ($p=0.042$) regarding the level of knowledge about the disease among subjects who had higher educational attainment (secondary or higher education) when compared with those with a lower level of studies.

Table 2. Comparison of glycemic control, sex and educational attainment according to level of knowledge.

Characteristics	Sufficient knowledge (n=32)	Insufficient knowledge (n=33)	p
	n (%)	n (%)	
Glycemic control <7% HbA1c	17 (85.0)	3 (15.0)	0.000
Uncontrolled blood glucose ≥7% HbA1c	15 (33.3)	30 (66.7)	
Male sex	6 (33.3)	12 (66.7)	0.166
Female sex	26 (55.3)	21 (44.7)	
Subjects with primary education	21 (42.0)	29 (58.0)	0.042
Subjects with secondary or higher education	11 (73.3)	4 (26.7)	

Source: Own elaboration.

Table 3 shows that there were no statistically significant differences when comparing sex ($p=0.549$), educational attainment ($p=0.201$), years of diagnosis ($p=0.126$) or insulin use ($p=0.108$) with glycemic control.

Discussion

This research shows that most patients with DM2 who have sufficient knowledge of their disease (Table 2) have a normal glycemic control, as well as a significant difference when compared with patients whose knowledge was insufficient, where a lower percentage presented normoglycemia; all this evidence confirms that the level of knowledge does affect glycemic control.

Table 3. Comparison of educational attainment, years of disease progression and use of insulin therapy in relation to glycemic control.

Characteristics		Glycemic control <7% HbA1c (n=20)	Uncontrolled blood glucose ≥7% HbA1c (n=45)	p
		n (%)	n (%)	
Sex	Male	4 (22.2)	14 (77.8)	0.549
	Female	16 (34)	31 (66)	
Educational attainment	Subjects with primary education	13 (26)	37 (74)	0.201
	Subjects with secondary or higher education	7 (46.7)	8 (53.3)	
Years of diabetes diagnosis	Between 1 and 5 years	10 (27)	27 (73)	0.126
	Between 5 and 10 years	2 (16.7)	10 (83.3)	
	>10 years	8 (50)	8 (50)	
Treatment	Insulin	6 (20)	24 (80)	0.108
	No insulin	14 (40)	21 (60)	

Source: Own elaboration.

This finding is consistent with other studies that also state that glycemic control is achieved when patients' level of knowledge on DM2 is high. (1,3,10-12,17) Another research also exposes that poor patient education and low awareness of such issues in people with high blood pressure or diabetes mellitus can affect their level of control. (18) On the other hand, it has been documented that people with greater knowledge about their own health condition have greater adherence to the recommendations given by health professionals, which in the future represents a greater control of complications. (19)

It should be noted that the percentage of metabolic compensation (normoglycemia) in the subjects who had an adequate level of knowledge of their disease in this study is higher than the goal set by the Government of Chile through the National Health Strategy for meeting the Health Objectives of the 2011-2020 decade, which seeks to achieve metabolic compensation in at least 31.8% of patients with DM2. (20)

Thus, by analyzing the variables related to level of knowledge, it is evident that there is a need to continue strengthening the Cardiovascular Health Program, which has been the most important strategy for the management of DM2 in Chile since 2002, and includes actions related to health promotion and education as essential tools to control the disease. (7) It should be noted that all patients participating in this research are part of this health program, which includes pharmacological and non-pharmacological treatments provided by a multidisciplinary health team. These strategies, based on the need to provide permanent education to diabetic patients, are also a priority for updating the clinical guidelines for DM2 management published in Chile in 2010. (7)

Furthermore, this study found that low level of knowledge on DM2 is a determining factor for poor glycemic control, thus exposing patients with poor metabolic control to the onset of chronic complications, disability and premature death.

Metabolic control in patients with DM2 could be related to educational attainment, since a less educated population has limitations to identify the name of the medications, reading instructions, understanding an appointment card, monitoring glycemic figures

and keeping a record of them. (6,21) Regarding sex, some studies conclude that women have a greater number of non-clinical factors that help accepting self-care actions and prevent complications in DM2. (22) Despite this, no statistically significant differences were found in the present study in the level of knowledge about diabetes (Table 2) or glycemic control (Table 3) in subjects when compared by sex or educational attainment. This finding reveals the vulnerability of the patients treated at the Padre Las Casas Family Health Center in the Araucanía region, who, besides having elementary and secondary education, are residents of rural areas with a high or low degree of marginalization. Consequently, health teams face challenges related to generating effective strategies for education in DM2 based on the strengthening of the non-pharmacological treatment of this disease, emphasizing healthy eating habits and targeted physical activity for a population with low education.

As it has been shown in other works, patients who have suffered from DM2 for more years should have greater knowledge of it, which would be reflected in better glycemic control. (23) However, this research did not find significant differences when comparing the years of diagnosis of the disease with adequate glycemic control (Table 3). This proves the importance of maintaining long-term educational interventions to increase the level of knowledge and self-care skills and thereby achieve sustained improvement in metabolic control. (18,24-28)

When analyzing glycemic control in patients according to insulin use (Table 3), it was observed that, of those who were on insulin treatment, only 20% had an adequate glycemic control, being this percentage lower than that presented in patients that did not have this treatment, as only 40% had normal glucose levels. Although the difference was not statistically significant, it was expected due to a greater pathophysiological involvement in patients with DM2 who require insulin therapy, which explains their lower glycemic compensation. (29) This was also in line with a recent review that reported that most insulin users have high HbA1c levels, resulting in less metabolic control. (30)

The main limitation of this study is the lack of studies conducted at a local level applying the Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test to measure the level of knowledge on diabetes mellitus. It would be interesting if national health programs addressing these patients implement locally-adapted instruments to measure their knowledge of their disease.

Conclusions

The results of this study are relevant to continue strengthening patient-centered educational processes at the onset and during the evolution of the disease, which should be addressed even from primary health care services.

A meta-analysis concludes that education on diabetes applied in any format, but performed on a regular basis, leads to glycemic improvement for patients. (31) Therefore, the health team should be trained with appropriate techniques, knowledge and skills to achieve adequate diabetes education in terms of improved quality of life and prevention of complications in these patients.

Conflicts of interest

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References

1. **American Diabetes Association.** Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care.* 2011;34(Suppl 1):S62-9. http://doi.org/bmc582.
2. **Campuzano-Maya G, Latorre-Sierra G.** La HbA1c en el diagnóstico y en el manejo de la diabetes. *Medicina & Laboratorio.* 2010;16(5-6):211-41.
3. International Diabetes Federation (IDF). Atlas de la Diabetes de la FID. 7th ed. Bruselas: IDF; 2015.
4. Chile. Ministerio de Salud. Encuesta Nacional de Salud ENS Chile 2009-2010. Santiago de Chile: Minsal; 2010 [cited 2017 Feb 10]. Available from: https://goo.gl/aAZyVM.
5. **Funnell MM, Brown TL, Childs BP, Haas LB, Hosey GM, Jensen B, *et al.*** National Standards for Diabetes Self Management Education. *Diabetes Care.* 2010;33(Suppl 1):S89-6. http://doi.org/bn8hpw.
6. **López-López E, Ortiz-Gress AA, López-Carvajal MJ.** Intervención educativa sobre el nivel de conocimientos en pacientes con diabetes y baja o nula escolaridad. *Inv. Ed. Med.* 2016;5(17):11-6.
7. Chile. Ministerio de Salud. Guía Clínica Diabetes Mellitus tipo 2. Santiago de Chile: Minsal; 2010 [cited 2016 Jul]. Available from: https://goo.gl/iK4FP3.
8. **De los Santos-Roig M, Fernández-Alcántara M, Guardia-Archilla T, Rodríguez-Morales S, Molina A, Casares D, *et al.*** Efectos diferenciales de los programas de educación en diabetes según los niveles de HbA1c y la presencia de complicaciones crónicas en el paciente tipo 1. *Anales Sis San Navarra.* 2014;37(2):235-40. http://doi.org/cqvk.
9. **Noda-Milla JR, Perez-Lu JE, Malaga-Rodriguez G, Aphang-Lam MR.** Conocimientos sobre su enfermedad en pacientes con diabetes mellitus tipo 2 que acuden a hospitales generales. *Rev Med Hered.* 2008;19(2):46-7.
10. **Ávila-Jiménez L, Cerón D, Ramos-Hernández RI, Velázquez L.** Asociación del control glicémico con el apoyo familiar y el nivel de conocimientos en pacientes con diabetes tipo 2. *Rev Méd. Chile.* 2013;141(2):173-80. http://doi.org/cqvp.
11. **Salcedo-Rocha AL, Alba-García JE, Sevila E.** Dominio cultural del autocuidado en diabéticos tipo 2 con y sin control glucémico en México. *Rev. Saúde Pública.* 2008;42(2):256-64. http://doi.org/bbttnk.
12. **Rojas de P E, Molina R, Rodríguez C.** Definición, clasificación y diagnóstico de la diabetes mellitus. *Rev. Venezolana de Endocrinología y Metabolismo.* 2012;10(Suppl 1):7-12.
13. **Pimentel-Jaimes JA, Sanhueza-ALvarado O, Gutiérrez-Valverde JM, Gallegos-Cabriales EC.** Evaluación del efecto a largo plazo de intervenciones educativas para el autocuidado de la diabetes. *Ciencia & Enfermería.* 2014;20(3):59-68.
14. Asociación Médica Mundial. Declaración de Helsinki de la Asociación Médica Mundial. Principios éticos para las investigaciones médicas en seres humanos. Fortaleza: 64.a Asamblea General de la AMM; 2013.
15. Michigan Diabetes Research Center. Michigan Diabetes Research and Training Center's Brief Diabetes Knowledge Test. Michigan: University of Michigan; 1998 [cited 2016 Mar]. Available from: https://goo.gl/CMwkrv.
16. **Barceló A, Robles S, White F, Jadue L, Vega J.** Una intervención para mejorar el control de la diabetes en Chile. *Rev Panam Salud Publica.* 2001;10(5):328-33.
17. **Ozcelik F, Yiginer O, Arslan E, Serdar MA, Uz O, Kardesoglu E, *et al.*** Association between glycemic control and the level of knowledge and disease awareness in type 2 diabetic patients. *Pol Arch Med Wewn.* 2010;120(10):399-406.
18. **López-Martell M.** Control glucémico y su relación con sus redes de apoyo social en pacientes diabéticos tipo 2 adscritos a la UMF 66 xalapa Veracrúz. Instituto Mexicano de Seguro Social; 2014.

19. **Romero S, Parra D, Sánchez J, Rojas L.** Adherencia terapéutica de pacientes con hipertensión arterial y diabetes mellitus tipo 2 de Bucaramanga, Colombia. *Revista Salud UIS.* 2017;49(1):37-44. http://doi.org/cqvq.

20. Chile. Ministerio de Salud. Estrategia nacional de salud para el cumplimiento de los Objetivos Sanitarios de la Década 2011-2020. Santiago de Chola: Gobierno de Chile; 2011.

21. **Quintana A, Merino JM, Merino P, Cea JC.** Variables psicosociales asociadas a compensación metabólica de pacientes diabéticos de tipo 2. *Rev. méd. Chile.* 2008;136(8):1007-14. http://doi.org/cx385v.

22. **Cruz-Bello P, Vizcarra-Bordi I, Kaufer-Horwitz M, Benitez-Arciniegas AD, Misra R, Valdés-Ramos R.** Género y autocuidado de la diabetes *mellitus* tipo 2 en el Estado de México. *Papeles de Población.* 2014;20(80):119-44.

23. **Domínguez Sánchez-Migallón P.** Control Metabólico en Pacientes Diabéticos Tipo 2: grado de Control y nivel de Conocimientos (Estudio AZUER). *Rev Clin Med Fam.* 2011;4(1)32-41.

24. **Carrasco F, Moreno M, Irribarra V, Rodríguez L, Martin MA, Alarcón A, *et al.*** Evaluación de un programa piloto de intervención en adultos con sobrepeso u obesidad, en riesgo de diabetes. *Rev. méd. Chile.* 2008;136(1):13-21. http://doi.org/b2pvxb.

25. **Vargas-Ibáñez A, González-Pedraza A, Aguilar-Palafox MI, Moreno-Castillo Y.** Estudio comparativo del impacto de una estrategia educativa sobre el nivel de conocimientos y la calidad de vida en pacientes con diabetes mellitus tipo 2. *Rev Fac Med UNAM.* 2010;53(2):60-8.

26. **Aguilar-Escobar J, Espinoza-Dávila E.** Evaluación del conocimiento y práctica dietética en pacientes diabéticos tipo 2. *Gac Méd Bol.* 2006;29(1):17-20.

27. **Álvares-Palomeque CE, Ávalos-García MI, Morales-García MH, Córdova-Hernández JA.** Nivel de conocimiento y estilo de vida en el control metabólico del paciente con diabetes mellitus tipo 2 en la UMF. No 39, centro, tabasco. *Horizonte Sanitario.* 2014;13(2):188-93. http://doi.org/cqvr.

28. **Augstein P, Vogt L, Kohnert KD, Heinke P, Salzsieder E.** Translation of personalized decision support into routine diabetes care. *J Diabetes Sci Technol.* 2010;4(6):1532-9. http://doi.org/cqvs.

29. **Pereira-Despaigne OL, Palay-Despaigne MS, Rodríguez-Cascaret A, Neyra-Barros RM, Chia-Mena MA.** Hemoglobina glucosilada en pacientes con diabetes mellitus. *MEDISAN.* 2015;19(4):555-61.

30. **Harper R, Donnelly R, Yixi B, Bashan E, Minhas R, Hodish I.** Dynamics in insulin requirements and treatment safety. *J Diabetes Complications.* 2016;30(7):1333-8. http://doi.org/f8x7kk.

31. **Choi T, Davidson ZE, Walker KZ, Lee JH, Palermo C.** Diabetes education for Chinese adults with type 2 diabetes: A systematic review and meta-analysis of the effect on glycemic control. *Diabetes Res Clin Pract.* 2016;116:218-29. http://doi.org/cqvt.