ORIGINAL ARTICLE

Diabetes mellitus and its association with chronic depression in adults in the Peruvian population

Sergio Suijon Chang Espejo [1,a]; Manuel André Chaparro Calderón [1,a]; Leidy Maricielo Collazos Guevara [1,a]; Tatiana Milagros Cruz Riquelme* [1,a]

ABSTRACT

Objective: To determine the association between diabetes mellitus and chronic depression in adults in the Peruvian population.
Materials and methods: A quantitative, observational, cross-sectional and correlational study was carried out, based on the data collected by the 2020 Encuesta Demográfica y de Salud Familiar (ENDES – Demographic and Family Health Survey, 2020). The sample was made up of 14,245 adults; depression was considered as a dependent variable (with depression/without depression), and the independent variables were *diabetes mellitus (Yes/No), wealth index (the poorest, poor, middle class, rich, the richest), education (kindergarten-preschool and primary, secondary, non-university higher, university higher and graduate), alcoholism (Yes/No), area of residence (urban/rural)*. The program used for the statistical analysis was IBM SPSS: Release 23. A univariate data analysis was carried out by determining the frequencies and percentages. Subsequently, in the analytical phase, bivariate and multivariate analyses by logistic regression were used to evaluate the strength of the association between the variables ($p < 0.05$).
Results: A total of 15.7 % of adults between 27 and 59 years of age experienced chronic depression. Furthermore, the bivariate analysis revealed an association between the outcome variable and covariates—*diabetes mellitus*, *level of education* and *wealth index*—($p < 0.05$). Depression is more common in lower socioeconomic groups, with higher rates among the poor (16.63 %) and less educated population, especially in those with kindergarten, preschool and primary education (18.88 %). In contrast, the rich and richest classes show lower rates of depression (15.27 % and 12.04 %, respectively). On the other hand, in the multivariate analysis, the risk estimation was carried out, and it was found that having diabetes increased the risk of suffering depression by 1.66 times compared to patients who did not have diabetes.
Conclusions: There is an association between chronic depression and diabetes mellitus in the adult population aged 27 to 59 years; in addition, a low wealth index and a lower level of education are risk factors for chronic depressive disorder.

Keywords: Dysthymic Disorder; Diabetes Mellitus; Adult (Source: MeSH NLM).

INTRODUCTION

Depression represents a worldwide public health challenge and is a common disorder. According to statistics published by the WHO, it affects 5 % of adults and about 280 million people suffer from this disease [1]. Different factors influence depression in adults, such as biological, psychosocial and socioeconomic factors. Biological factors affect those subjects who present neurotic traits in 40 % of similar genes. Psychosocial factors include situations that cannot be controlled: loss of employment, abandonment, legal proceedings, divorce, debts, age and the death of a family member, among others. Socioeconomic factors encompass subjects with low wealth who generally fail to achieve their goals throughout life and become depressed in adulthood [2-4].

In Peru, about 33.7 % of the population, i.e., 9'510,397 people, go through mental disorders at some point of their lives. This means that one out of every three Peruvians faces this condition at some moment of their live, so they develop depression—whether mild, moderate or chronic—which is the main cause of suicide in our country. There are 1'700,000 subjects suffering from this condition [5,6].

Diabetes mellitus is a chronic disease that occurs when the human body cannot effectively use the insulin it produces or when the pancreas does not produce enough insulin [7].

The percentage of people with type 2 diabetes mellitus in Peru was recorded at 96.7 % between 2018 and 2021.

1 Universidad de San Martín de Porres, School of Human Medicine. Lima, Peru.
[a] Medical student.
*Corresponding author.

In addition, an increase in frequency was observed, with an average of about two new cases per 100 people annually [8-10].

Depression is known to be a very critical illness and a public health challenge. It is related to other diseases and is the leading cause of morbidity. Moreover, it significantly affects individuals' well-being in comparison with chronic diseases [11]. Unfortunately, despite its impact, it has been demonstrated that there are issues in diagnosing this condition [12].

In the 17th century, the physician Thomas Willis observed the relationship between depression and diabetes. He noted that such relationship was common in people who had gone through periods of melancholy at some point in their lives [13].

At the international level, in 2016, author Antúnez investigated the frequency of depression among patients with type 2 diabetes and found a high association between these variables, affecting 82 % of them. Furthermore, a relationship was identified between depression and age group; adults aged 39 to 48 years were the most affected and females were the most likely to suffer from depression and diabetes [14]. Likewise, at a global level, as part of a research study, Salinero (2021) explained how individuals with diabetes can develop psychiatric disorders (either depression or anxiety) caused by the impact that this disease. Most of them cannot accept that they should follow a treatment, resulting in depression, which goes unnoticed in most cases [15].

At the national level, a study was conducted so that health professionals give due importance to this disease, particularly those involved in the treatment of diabetes, since their patients are likely to develop undiagnosed psychiatric disorders—often anxiety and depression—and these would negatively influence their self-care. This would result in inadequate glycemic control and diminished quality of life [16].

This research project is extremely important because, in the post-pandemic context, it is crucial to address the consequences arising from the crisis on mental health and other diseases, such as diabetes. During this stage, there was evident neglect of these essential aspects of health care. Currently, we are dealing with the tangible repercussions of such neglect, which are reflected in various issues that require immediate attention. The Centers for Disease Control and Prevention (CDC) state that a person with diabetes is two to three times more likely to have a depressive disorder [17].

Depression is closely linked to different factors that should be identified. Therefore, the objective of this study is to determine the relationship between type 2 diabetes mellitus and chronic depression, in addition to other associated factors such as socioeconomic level, education, alcoholism and area of residence in adults.

MATERIALS AND METHODS

Study design and population

A quantitative observational, cross-sectional and correlational study was carried out based on data collected by the 2020 Encuesta Demográfica y de Salud Familiar (Demographic and Family Health Survey - Endes 2020) administered by the Instituto Nacional de Estadística e Informática (INEI – National Institute of Statistics and Informatics).

The study population consisted of Peruvian individuals, who were interviewed through the Endes 2020. The sample design for the Endes 2020 was probabilistic, stratified and multistage, and covered both urban and rural areas in all departments of Peru, including Metropolitan Lima.

The study included a sample of 14,245 adults aged 27 to 59 years with depression, diabetes, and education background, excluding those younger than 27 and older than 59 years. Only type 2 diabetes mellitus was considered as a chronic disease.

Variables and measurements

In our study, the variable *depression* was categorized dichotomously, following the diagnostic parameters established for major depressive disorder according to the guidelines of the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition) [18], and the value of each of the questions was set at 1 point. In interpreting of the results, a score equal to or greater more 5 points was indicative of chronic depression. Questions QS700A-QS700I of the Endes 2020 health questionnaire were used.

The covariates studied were *diabetes mellitus*, *wealth index*, *education*, *alcoholism* and *area of residence*. The level of education was confirmed by the evidence of some degree of education (kindergarten-preschool, primary, secondary, non-university higher education, university higher education, graduate), whereas the variable diabetes mellitus was dichotomized (yes or no), as was the variable alcoholism. The variable wealth index was based on economic income and social status (very poor, poor, middle class, rich or very rich). Finally, the variable *area of residence* was also dichotomized (urban or rural).

Statistical analysis

The Statistical Package for Social Sciences (SPSS, Release 26) software was used for data analysis. A univariate analysis of the data was carried out and absolute and relative frequencies were determined. A bivariate and multivariate analysis was then conducted using logistic

regression because our dependent variable is dichotomous in nature. A statistical significance level of $p < 0.05$ was considered.

Ethical considerations

It was not necessary to submit this work to the institutional review board because the secondary data source Endes was used; hence, the anonymity of the participants and the confidentiality of the information were assured.

RESULTS

Prior to an in-depth analysis exploring the connection between diabetes mellitus and chronic depression in the Peruvian adult population, it is imperative to understand the overall prevalence of depression in this demographic segment. Figure 1 provides a broad context, highlighting the prevalence of depression among the 14,245 surveyed adults, aged between 27 and 59 years, with 15.7 % showing symptoms indicative of chronic depression, according to the established criteria. This initial analysis lays the groundwork for exploring the relationship between the study variables.

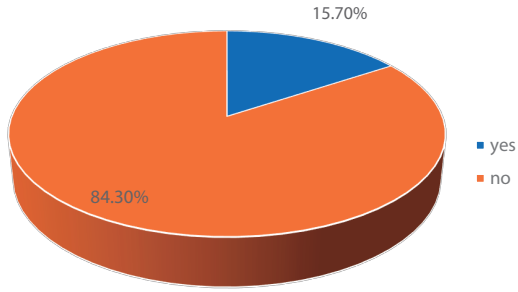

Figure 1. Prevalence of depression in Peru in the adult population aged 27 to 59 years (Endes 2020)

Table 1 sought the association between the dependent variable (depression) and the other covariates (diabetes mellitus, wealth index, education, alcoholism, and area of residence).

Of all the covariates studied, those with the greatest statistical significance were diabetes mellitus, wealth index and education ($p < 0.05$). Alcoholism and area of residence were not taken into account ($p > 0.05$).

There is a higher rate of depression in the group with diabetes mellitus (25.7 %) than in those without diabetes mellitus (15.41 %). Concerning the wealth index, the poor (16.63 %), very poor (16.29 %) and the middle class (16.28 %) have a higher depression prevalence than the rich (15.27 %) and very rich (12.04 %). When classified by level of education, the group with kindergarten-preschool and primary education (18.88 %) has the highest rate, followed by those with secondary education (16.06 %), university and graduate education (13.97 %), and finally non-university education (13.49 %).

Table 1. Factors associated with depression in adults in the Peruvian population

Factors	With depression		Without depression		*p* value*
	n	%	*n*	%	
Diabetes mellitus					
Yes	96	4.30	277	2.31	0.00
No	2,139	95.70	11,733	97.69	
Wealth index					
Very poor	567	25.36	2,913	24.25	0.00
Poor	616	27.56	3,089	25.72	
Middle class	496	22.19	2,551	21.24	
Rich	345	15.43	1,915	15.94	
Very rich	211	9.44	1,542	12.83	

Factors	With depression		Without depression		*p* value*
	n	%	*n*	%	
Education					
Kindergarten-preschool and primary	446	19.95	1,916	15.95	0.00
Secondary	1,105	49.44	5,775	48.08	
Non-university higher	344	15.39	2,206	18.36	
University higher and graduate	340	15.21	2,213	18.42	
Alcoholism					
Yes	868	38.83	4,676	38.93	0.931
No	1,367	61.16	7,334	61.06	
Area of residence					
Urban	1,588	71.05	8,604	71.64	0.571
Rural	647	28.94	3,406	28.35	

*Statistical significance resulting from the comparison of rates between variable categories considering the complex sampling of the survey

In Table 2, in the multivariate analysis of the factors associated with depression in adult patients, it is concluded that the presence of diabetes mellitus increases 1.66 times more the risk of having depression compared to the group without diabetes. It is also evident that the group of patients who have completed secondary education is protected by 18 % with respect to presenting depression compared to the group that only has completed preschool and primary education. The same occurs with the wealth index factor: having a higher wealth index, i.e., very rich, protects by 30 % compared to the very poor group.

Table 2. Multivariate logistic regression analysis of factors associated with depression in adult patients in the Peruvian population

Factors	adjusted *OR***		*p* value **
	Value	CI	
Diabetes mellitus			
Yes	1.66	1.39 - 1.99	
No	0.87	0.82 - 0.93	< 0.00
Alcoholism			
Yes	0.99	0.92 - 1.07	
No	1.00	0.98 - 1.01	< 0.93
Area of residence			
Urban	0.97	0.89 - 1.06	
Rural	1.00	0.98 - 1.02	< 0.57
Education			
Preschool, primary			
Secondary	0.82	0.73 - 0.93	
Non-university higher	0.67	0.57 - 0.78	
University higher and graduate	0.69	0.59 - 0.81	< 0.05
Wealth index			
Very poor			
Poor	1.02	0.90 - 1.16	
Middle class	1.00	0.88 - 1.14	
Rich	0.93	0.80 - 1.07	
Very rich	0.70	0.59 - 0.83	< 0.05

** adjusted *OR* $p < 0.05$
***p value < 0.01

DISCUSSION

The findings reveal a significant connection between type 2 diabetes mellitus and depression, which has been confirmed by previous research studies. The concurrent depression in patients with diabetes adversely impacts quality and life expectancy. In addition, it complicates disease management, metabolic control, increases the probability of chronic complications and leads to increased health care costs [13].

In Peru, the risk of depression in patients with diabetes is two to three times greater. Unfortunately, only 25 % to 50 % of people with diabetes and depression receive appropriate diagnosis and treatment. Nevertheless, there is hope, as treatment—whether through medication, therapy, or a combination of both—tends to be effective [17,19,20].

Previous research, such as the study by Salinero et al., found that the prevalence of depression in patients with diabetes mellitus was associated in 20.03 % with a history of depression, previous mental state, self-reported health status and other complications related to this disease, showing relationship with different degrees of depression [15].

Regarding the severity of depression in patients with diabetes, Constantino (2014) stated that more patients had mild depression (26.3 % of 270 patients), indicating that the frequency of anxiety, depression and their comorbidities was high in patients with diabetes. However, no association was found between the presence of depression, anxiety and the control of type 2 diabetes mellitus [21].

The rate of patients with diabetes and depression is 77.6 %, according to a study conducted by De la Cruz in 2017, where through surveys of 117 patients revealed that 64.96 % of them suffered from depression associated with chronic diseases. This confirms that the prevalence of mental disorders is 33.7 %, i.e., one in three Peruvians had gone through mental disorders in the course of their lives [22]. Furthermore, a relationship was observed between depression and the duration of diabetes mellitus, and it was also related to other medical conditions [23]. Likewise, Namdeo et al. emphasize that early detection, diagnosis, treatment and follow-up of depression in patients with type 2 diabetes are essential to improve their overall health and quality of life [24].

On the other hand, Moulton et al. present a scenario wherein several factors—such as sociodemographic characteristics, current life events and poor glycemic control—are related to depression among patients with diabetes [25]. Adorno V, in addressing this issue, points to several explanations for this relationship and even suggests a bidirectional influence, where factors such as unhealthy lifestyle, environmental conditions and lifestyle changes may play a significant role [26].

When considering sex, Rodríguez et al. and Arshad et al. show that most of the individuals with both diabetes mellitus and depression are married or cohabiting women [27,28]. On the other hand, Accinelli et al. emphasize their concern about the high percentage of depression among patients with diabetes treated in public health centers, which adversely impacts their quality of life. This underscores the need to recognize depression as an additional component in the burden of disease associated with diabetes [29].

In this scenario, the present study determined within a population of 14,245 individuals aged 27 to 59 years that those with type 2 diabetes mellitus (25.7 %), poor wealth index (16.63 %), preschool and primary education (18.88 %), no alcohol intake (15.71 %) and residence in rural areas (15.96 %) had a higher prevalence of depression compared to the other associated factors.

In conclusion, a significant association is established between chronic depression and diabetes mellitus. The prevalence of depression in adults in Peru is 15.7 %. A relationship between depression, socioeconomic level and wealth index is observed when analyzing several variables.

It is important to point out that the presence of diabetes mellitus increases the risk of developing depression by 1.7 times compared to subjects without this health condition.

Author contributions: TMCR, SSCE, MACC and LMCG participated in the writing and thorough evaluation of the manuscript, as well as in approving the final version. They also took responsibility for safeguarding the scientific integrity of the article.

Funding sources: This article was funded by the authors.

Conflicts of interest: The authors declare no conflicts of interest.

BIBLIOGRAPHIC REFERENCES

1. Organización Mundial de la Salud. Depresión [Internet]. Ginebra: Organización Mundial de la Salud; 2023. Available from: https://www.who.int/es/news-room/fact-sheets/detail/depression
2. Mitjans M, Arias B. La genética de la depresión: ¿Qué información aportan las nuevas aproximaciones metodológicas? Actas Esp Psiquiatr [Internet]. 2012;40(2):70-83.
3. Arrieta Vergara KM, Díaz Cárdenas S, González Martínez F. Síntomas de depresión y ansiedad en jóvenes universitarios: prevalencia y factores relacionados. Rev Clin Med Fam [Internet]. 2014;7(1):14-22.
4. Dean J, Keshavan M. The neurobiology of depression: an integrated view. Asian J Psychiatr [Internet]. 2017;27:101-11.
5. Vega F. Situación, avances y perspectivas en la atención a personas con discapacidad por trastornos mentales en el Perú. An Salud Ment [Internet]. 2011;27(2):29-32.
6. Quinteros A. Salud mental: La causa principal del suicidio

en Perú es la depresión [Internet]. Lima: Chiqaq news; 2021. Available from: https://medialab.unmsm.edu.pe/chiqaqnews/salud-mental-la-causa-principal-del-suicidio-en-peru-es-la-depresion/
7. Organización Mundial de la Salud. Diabetes [Internet]. Ginebra: Organización Mundial de la Salud; 2021. Available from: https://www.who.int/es/news-room/fact-sheets/detail/diabetes
8. Revilla L. Situación de la diabetes según datos del sistema de vigilancia. Perú 2021 [Internet]. Lima: Ministerio de Salud; 2021. Available from: http://www.dge.gob.pe/portal/docs/tools/teleconferencia/2021/SE202021/03.pdf
9. Carrillo-Larco RM, Bernabé-Ortiz A. Diabetes mellitus tipo 2 en Perú: una revisión sistemática sobre la prevalencia e incidencia en población general. Rev Peru Med Exp Salud Publica [Internet]. 2019;36(1):26-36.
10. Ministerio de Salud. Cuatro de cada cien peruanos mayores de 15 años padecen diabetes en el Perú [Internet]. Perú: Plataforma digital única del estado peruano; 2020. Available from: https://www.gob.pe/institucion/minsa/noticias/314367-minsa-cuatro-de-cadacien-peruanos-mayores-de-15-anos-padecen-diabetes-en-el-peru
11. Pérez-Padilla EA, Cervantes-Ramírez VM, Hijuelos-García NA, Pineda-Cortés JM, Salgado-Burgos H. Prevalencia, causas y tratamiento de la depresión mayor. Rev biomédica [Internet]. 2017;28(2):73-98.
12. Rivas-Acuña V, García-Barjau H, Cruz-León A, Morales-Ramón F, Enríquez-Martínez RM, Román-Alvarez J. Prevalencia de ansiedad y depresión en las personas con diabetes mellitus tipo 2. Salud Tab [Internet]. 2011;17(1-2):30-5.
13. Nicolau J, Masmiquel L. Diabetes mellitus y trastorno depresivo, un mal binomio. Endocrinol Nutr [Internet]. 2013;60(10):583-9.
14. Antúnez M, Bettiol AA. Depresión en pacientes con diabetes tipo 2 que acuden a una consulta externa de medicina interna. Acta Med Colomb [Internet]. 2016;41(2):102-10.
15. Salinero-Fort MA, Gómez-Campelo P, Cárdenas-Valladolid J, San Andrés-Rebollo F, De Miguel-Yanes JM, De Burgos-Lunar C. Effect of depression on mortality in type 2 diabetes mellitus after 8 years of follow-up. The DIADEMA study. Diabetes Res Clin Pract [Internet]. 2021;176:108863.
16. Rosas-Matías J, Villanueva-Bejarano A, Pantani-Romero F, Lozano-Vargas A, Ticse-Aguirre R. Frecuencia de depresión y ansiedad no diagnosticadas en pacientes con diabetes mellitus tipo 2 que acuden a la consulta externa de un hospital general de Lima, Perú. Rev Neuropsiquiatr [Internet]. 2019;82(3):166-74.
17. Centros para el Control y la Prevención de Enfermedades. La diabetes y la salud mental [Internet]. Atlanta: Centros para el Control y la Prevención de Enfermedades; 2023. Available from: https://www.cdc.gov/diabetes/es/living-with/la-diabetes-y-la-salud-mental.html?CDC_AAref_Val=https://www.cdc.gov/diabetes/spanish/living/mental-health.html
18. American Psychiatric Association. Manual de diagnóstico y estadístico de los trastornos mentales. 5ª ed. España: Editorial médica Panamericana; 2014.
19. Escobar JM, Escobar M. Diabetes y depresión. Acta Med Colomb [Internet]. 2016;41(2):96-7.
20. Aldea Morales A, Castañeda Sabogal AN. Asociación entre diabetes y depresión en una población hospitalaria con diabetes mellitus. Rev Urug med Interna [Internet]. 2023;8(3):84-5.
21. Constantino-Cerna A, Bocanegra-Malca M, León-Jiménez F, Díaz-Vélez C. Frecuencia de depresión y ansiedad en pacientes con diabetes tipo 2 atendidos en un hospital general de Chiclayo. Rev Med Hered [Internet]. 2014;25(4):196-203.
22. De la Cruz-Mitac CYC, Quispe-Ilanzo MP, Oyola-García AE, Portugal-Medrano MA, Lizarzaburu-Córdova EE, Rodríguez-Chacaltana FW, et al. Depresión en adultos mayores con enfermedades crónicas en un hospital general del Perú. Rev Cuerpo Med HNAAA [Internet]. 2017;14(4):205-11.
23. Rivarola Sosa A, Brizuela M, Rolón-Ruíz Díaz A. Nivel de depresión según la cronicidad de la diabetes mellitus tipo 2 y sus comorbilidades en pacientes de las unidades de salud, Encarnación, Paraguay 2018. Rev salud publica Parag [Internet]. 2019;9(2):9-15.
24. Namdeo MK, Verma S, Das Gupta R, Islam R, Nazneen S, Rawal LB. Depression and health-related quality of life of patients with type 2 diabetes attending tertiary level hospitals in Dhaka, Bangladesh. Glob Health Res Policy [Internet]. 2023;8(1):43.
25. Moulton CD, Pickup JC, Ismail K. The link between depression and diabetes: the search for shared mechanisms. Lancet Diabetes Endocrinol [Internet]. 2015;3(6):461-71.
26. Adorno V. Depresión y diabetes. Rev salud publica Parag [Internet]. 2019;9(2):7-8.
27. Rodríguez Calvin JL, Zapatero Gaviria A, Martín Ríos MD. Prevalencia de la depresión en la diabetes mellitus tipo 2. Rev Clin Esp [Internet]. 2015;215(3):156–64.
28. Arshad AR, Alvi KY. Frequency of depression in type 2 diabetes mellitus and an analysis of predictive factors. J Pak Med Assoc [Internet]. 2016;66(4):425–9.
29. Accinelli RA, Arias KB, Leon-Abarca JA, López LM, Saavedra JE. Frecuencia de depresión y calidad de vida en pacientes con diabetes mellitus en establecimientos de salud pública de Lima Metropolitana. Rev Colomb Psiquiatr [Internet]. 2021;50(4):243-51.

Corresponding author:
Tatiana Milagros Cruz Riquelme
Address: Urb. Santa Rosa Mz. F Lt. 30, Los Olivos. Lima, Perú.
Telephone: +51 926 597 588
E-mail: tatianacruz253@gmail.com

Reception date: December 6, 2023
Evaluation date: January 22, 2024
Approval date: January 22, 2024

ORCID iDs
Sergio Suijon Chang Espejo https://orcid.org/0000-0002-8073-5052
Manuel André Chaparro Calderón https://orcid.org/0000-0002-4943-4059
Leidy Maricielo Collazos Guevara https://orcid.org/0000-0002-1241-6703
Tatiana Milagros Cruz Riquelme https://orcid.org/0000-0003-1632-6454