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Suicidal ideation in Peruvian adults at risk of type 2 diabetes mellitus: an analytical study*

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Abstract

Objective: To analyze the potential association and probability of suicidal ideation in Peruvian adults at risk of type 2 diabetes *mellitus*.

Methods: cross-sectional study based on the database of the National Demographic Health Survey conducted in Peru in 2022. The population was 29 831 Peruvian adults. The Patient Health Questionnaire-9, concerning the item on suicidal ideation, and the Diabetes Risk Questionnaire of Bang *et al.* were used.

Results: 32.60% of the respondents were in the risk group for type 2 diabetes *mellitus*, according to the risk scale of Bang *et al.* The risk score for this type of diabetes was higher in adults who reported suicidal thoughts. The frequency of suicidal ideation was higher in adults who presented a score equal to or higher than 4 points on the Bang *et al.* questionnaire (risk of type 2 diabetes *mellitus*). The association between the presence or absence of risk of type 2 diabetes *mellitus* and suicidal ideation was statistically significant ($p < 0.001$) and of low intensity. In the multivariate analysis, in both sexes we found potential association of suicidal ideation with the risk of having type 2 diabetes mellitus (women: aOR 2.010-IC95% 1.720-2.349; men: aOR 2.703-IC95% 2.209-3.302), Native mother tongue (women: aOR 1.283-IC95% 1.099-1.489); men: aOR 1.661-IC95% 1.338-2.062) abdominal circumference (women: aOR 0.745-IC95% 0.639-0.870), ethnic identification (women: aOR 1.273-IC95% 1.099-1.476; men: aOR 1.306-IC95% 1.050-1.625), and educational level (women: aOR 1.719-IC95% 1.462-2.022; men: aOR 2.445-IC95% 1.863-3.101).

Conclusions: In both men and women, a significant association was found between suicidal ideation and being at risk of type II diabetes mellitus, as well as being of an ethnic identity other than mestizo, having a native language and having studied up to secondary school, while high abdominal circumference (>88 cm) was associated only in women.

-----Key words: adults, type 2 diabetes *mellitus*, risk factors, suicidal ideation, mental health.

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Ideación suicida en adultos peruanos con riesgo de diabetes *mellitus* tipo 2: un estudio analítico

Resumen

Objetivo: Analizar la asociación potencial y la probabilidad de ideación suicida en adultos peruanos con riesgo de diabetes *mellitus* tipo 2.

Métodos: Estudio de corte, a partir de la base de datos de la Encuesta Nacional Demográfica de Salud, desarrollada en Perú el año 2022. La población fue de 29 831 adultos peruanos. Se usaron el Cuestionario de Salud del Paciente-9, concerniente al ítem sobre ideación suicida, y el Cuestionario de Riesgo de Diabetes, de Bang *et al.*

Resultados: El 32,60 % de los encuestados se halla dentro del grupo de riesgo de diabetes *mellitus* tipo 2, según la escala de riesgo de Bang *et al.* El puntaje de riesgo para este tipo de diabetes fue mayor en adultos que refirieron pensamientos suicidas. La frecuencia de ideación suicida fue mayor en adultos que presentaron un puntaje igual o mayor que 4 puntos en el cuestionario de Bang *et al.* (riesgo de diabetes *mellitus* tipo 2). La asociación entre la presencia o la ausencia de riesgo de diabetes *mellitus* tipo 2 y de ideación suicida fue estadísticamente significativa ($p < 0,001$) y de baja intensidad. En el análisis multivariado, en ambos sexos se encontró potencial asociación de ideación suicida con el riesgo de tener diabetes *mellitus* tipo 2 (mujeres: ORa 2,010- IC95% 1,720-2,349; hombres: ORa 2,703- IC95% 2,209-3,302), Lengua materna originaria (mujeres: ORa 1,283-IC95% 1,099-1,489); hombres: ORa 1,661-IC95% 1,338-2,062) perímetro abdominal (mujeres: ORa 0,745-IC95% 0,639-0,870), identificación étnica (mujeres: ORa 1,273-IC95% 1,099-1,476; hombres: ORa 1,306-IC95% 1,050-1,625), y nivel educativo (mujeres: ORa 1,719-IC95% 1,462-2,022; hombres: ORa 2,445-IC95% 1,863-3,101).

Conclusiones: en hombres y mujeres se encontró asociación significativa de tener ideación suicida con estar en riesgo de diabetes *mellitus* tipo II, así como con el ser de otra identidad étnica diferente a mestizo, tener lengua materna originaria y haber estudiado hasta secundaria, mientras que el perímetro abdominal elevado (>88 cms) se asoció solo en mujeres.

-----**Palabras clave:** adultos, diabetes mellitus tipo 2, factores de riesgo, ideación suicida, salud mental

Ideação suicida em adultos peruanos com risco de diabete mellitus tipo 2: um estudo analítico

Resumo

Objetivo: Analisar a associação potencial e a probabilidade de ideação suicida em adultos peruanos com risco de diabetes mellitus tipo 2.

Métodos: Estudo transversal, baseado na base de dados da Pesquisa Nacional Demográfica e de Saúde, desenvolvida no Peru em 2022. A população era de 29.831 adultos peruanos. Foram utilizados o Patient Health Questionnaire-9, relativo ao item sobre ideação suicida, e o Diabetes Risk Questionnaire, de Bang *et al.*

Resultados: 32,60% dos entrevistados estão no grupo de risco para diabetes mellitus tipo 2, segundo a escala de risco de Bang *et al.* O escore de risco para esse tipo de diabetes foi maior em adultos que relataram pensamentos suicidas. A frequência de ideação suicida foi maior em adultos que obtiveram pontuação igual ou superior a 4 pontos no questionário de Bang *et al.* (risco de diabetes mellitus tipo 2). A associação entre presença ou ausência de risco de diabetes mellitus tipo 2 e ideação suicida foi estatisticamente significativa ($p < 0,001$) e de baixa intensidade. Na análise multivariada, foi encontrada potencial associação de ideação suicida com risco de ter diabetes mellitus tipo 2 em ambos os sexos (mulheres: aOR 2,010- IC 95% 1,720-2,349; homens: aOR 2,703- IC 95% 2,209-3,302), Língua materna nativa (mulheres: aOR 1,283-IC95% 1,099-1,489); homens: aOR 1,661-95% IC 1,338-2,062) circunferência abdominal (mulheres: aOR 0,745-95% IC 0,639-0,870), identificação étnica (mulheres: aOR 1,273-95% IC 1,099-1,476; homens: aOR 1,306-95% IC 1,050-1,625) e escolaridade (mulheres: aOR 1,719-95% IC 1,462-2,022; homens: aOR 2,445-95% IC 1,863-3,101).

Conclusões: em homens e mulheres foi encontrada associação significativa entre ter ideação suicida e estar em risco de diabetes mellitus tipo II, bem como ser de outra identidade étnica que não mestiça, ter língua materna nativa e ter estudado até o ensino médio, enquanto o perímetro abdominal elevado (>88 cm) esteve associado apenas em mulheres.

-----**Palavras-chave:** adultos, diabete mellitus tipo 2, fatores de risco, ideação suicida, saúde mental

Introduction

Suicidal ideation” (also known as “suicidal thoughts” or “suicidal ideation”) is a term that implies a set of desires, contemplations and concerns about death and suicide [1]. It is a heterogeneous phenomenon; variable in severity, intensity and characteristics, as there is no set pattern of people with suicidal ideation [2], just as there is no consensus on a “typical” suicide victim [3]. Suicidal ideation is a symptom that is part of different diagnoses, which may include mental disorders such as major depressive disorder, schizophrenia, among others [4].

In the context of chronic debilitating diseases or processes, suicidal ideation may be an expression of the desire to escape from the feeling of entrapment brought on by the disease, as in patients with end-stage chronic renal failure and multiple sclerosis, where non-adherence to treatment has sometimes been reported as a deliberate suicide attempt, which poses a difficulty regarding the differentiation between ideation and consummation of the suicidal act. This may be coupled with patients’ ideas about becoming dependent on others due to physical deterioration, which generates a sum of emotional and somatic burdens that they perceive as impossible to manage [5].

Likewise, in a study with a population of 47 million people, healthy people were compared with patients at risk of suicide and diseases such as low-survival cancer, chronic ischemic heart disease, chronic obstructive pulmonary disease and degenerative neurological conditions [6]. The results showed suicide rates higher than 20 per 100,000 population compared to the general population, with uncertainty caused by the chronic and incurable nature of their medical condition and pessimistic outlook on progressive physical deterioration as risk factors for suicidal ideation, where patients had passive ideation, e.g., imagining not waking up in the morning, and active ideation, involving planned thoughts of self-elimination. In many cases, people with suicidal ideation can control these thoughts, and a low percentage actually attempt suicide [7]; however, the presence of suicidal ideation has an impact on quality of life and can affect the interrelationship of those affected with their family, work and social environment.

Type 2 diabetes *mellitus* (DM-2) is an endocrinopathy characterized by high blood glucose levels, insulin resistance and relative insulin deficiency [8]; it represents about 90% of diabetes cases [9]. It is a serious and frequent chronic disease, which involves high morbimortality, due to micro and macrovascular complications in different organs of the body, resulting in economic and logistical wear and tear on the health system, as well as emotional deterioration at the personal, family and social levels [10]. Genetic, environmental and metabolic risk factors are interrelated and involved in the develop-

ment of the disease, with people with older age, obesity, physical inactivity and family history of the disease being at the highest risk [11]. Worldwide, 531 million people suffer from DM, 95% of whom have DM-2 [12]. In Peru, DM-2 affects about 8 % of the population [13], 65 % of whom do not achieve adequate control [14]; in turn, about 20 % of Peruvians have prediabetes [15].

Diabetes may increase the risk of suicidal ideation and behavior, especially when accompanied by depressive symptomatology, in adults on insulin therapy, unmet glycemic control goals, and in long-term disease [16]. Even medications such as GLT-1 receptor agonists may increase the risk of suicidal behavior [17]. In contrast, people at risk for DM-2, despite having characteristics consistent with impaired physical capacity and personal self-perception, are a population that has not been prioritized in possible negative aspects of mental health, being studied as part of the general population in national and international studies [18]. For their part, studies related to prediabetes consider basal glucose or glycated hemoglobin in the context of depression [19], giving lower priority to anthropometric and lifestyle parameters, which are risk factors for developing the disease.

In addition to biological characteristics, the increased likelihood of occurrence of depressive symptoms and signs, including suicidal ideation, may be influenced by sociocultural aspects linked to ethnic identity: it has been observed that customs and traditions linked to ethnic and cultural identity could decrease the likelihood of developing suicidal ideation [20].

Educational level is a factor that has been associated with a lower risk of suicidal thoughts and acts: although its causal relationship has not yet been clarified, it has been observed that cognitive performance and years of study influence a lower frequency of suicidal thoughts and attempts, this probably being attributed to the integration of the individual to environments and social contacts that strengthen security, empathy and supportive behaviors, as well as to a lower exposure and greater distance from addictive and harmful habits, such as alcohol and drug consumption [21]. Likewise, a higher level of education has been related to employment and financial stability, decreasing the stress linked to economic challenges. In this sense, economic recession and unemployment have been associated with an increased risk of suicidal ideation at the population level, while at the individual level it has been linked to debt and financial stress [22].

Age has been linked to suicidal ideation, mainly in older adults, due to depression attributed to the loss of physical health and independence, as well as to loneliness and disengagement from the work environment, aspects that influence the loss of meaning in life [23]. In young people, it has been related to feelings of helplessness, loneliness, rejection and guilt, family con-

flicts and conflicts with schoolmates or peers in the work environment, as well as a history of harmful habits [24].

Blood pressure has been connected with suicidal ideation, specifically with low systolic pressure levels: Joung and Cho, in a study of 10 768 adults with normal or low blood pressure in South Korea, found a significant link between low systolic pressure and suicidal ideation, suggesting that low blood pressure, which is associated with increased tiredness and fatigue, leads to psychological conditions and even cognitive disorders, probably because cerebral hypoperfusion affects serotonin, norepinephrine, and neuroleptic Y neurotransmission [25].

Likewise, the risk of diabetes, identified using the Bang *et al.*, developed by Bang *et al.* in 2009 [26], in its highest scores, reflects potentially limiting and debilitating health conditions that imply a lower quality of life, such as advanced age, overweight or obesity, sedentary lifestyle and the presence of hypertension, which, similarly to the stress and anxiety generated by severe chronic diseases, would be factors that contribute to suicidal ideation, due to the potential psychological overwhelm and inability to manage the risk of suicide, would be factors that contribute to suicidal ideation, due to the potential psychological burden and inability to manage social, work, family and emotional circumstances around the factors that increase the risk of DM-2 in common with suicidal ideation, among them, poverty.

Likewise, the presence of suicidal ideation may be underestimated and undervalued, inasmuch as suicide attempts have become a public health problem in the Peruvian population, with more than 1300 cases annually [27]. Therefore, the aim of this research was to analyze the potential association and probability of suicidal ideation in Peruvian adults at risk of DM-2. The results will allow us to determine whether this population is more susceptible to suicidal ideation than adults without risk, which will lead to develop an awareness of this problem from a patient-oriented perspective, and possible socioeconomic conditioning factors, as well as to observe suicidal ideation as a probable symptom in this DM-2risk group.

Methods

For the development of this research, a quantitative approach was chosen from a secondary database with anonymous and confidential questionnaires, and the application of a formula consisting of anthropometric and lifestyle data, whose information was obtained thanks to the survey applied to the study population.

Study design and population

Cross-sectional study based on the database of the Peruvian Demographic and Family Health Survey (ENDES)

[28], conducted from January 1 to December 31, 2022, throughout the national territory.

The ENDES-2022 is a complex, probabilistic, two-stage, independent, two-stage population-based sampling survey that annually evaluates the demographic and health dynamics of the Peruvian population. After having carried out a pilot test and through a type of sampling called “bucket method”, samples are collected with estimates of totals approximately equal to the characteristics of the survey’s target population and the population structure is replicated within the selected sample, considering age groups, sex and other balance variables. The purpose of this is to improve the representativeness coverage of the target populations and the statistical accuracies of the main indicators. The selection of the ENDES population was characterized by being two-stage, probabilistic, balanced, stratified and independent, at the departmental level, by urban and rural area, in 36,650 dwellings in the Peruvian territory [29].

The population of this study consisted of adults aged 18 years and older who had completed the *nine-item Patient Health Questionnaire* (PHQ-9) [30], which is included in the ENDES-2022, and who had taken the measurements and answered the questions compatible for inclusion in the Diabetes Risk Questionnaire of Bang *et al.* In this regard, in the ENDES-2022, anthropometric measurements were performed on each individual surveyed, which included the measurement of blood pressure, weight, height and waist circumference. Blood pressure was measured on two occasions, 10 minutes apart, with the second measurement of systolic and diastolic pressure being used for the purposes of this study.

The total population registered in the secondary database was used, which consisted of 29 737 adults for the question on suicidal ideation in the last 14 days. Adults who reported having DM were excluded from the study ($n = 4585$). We also followed the recommendations of the guidelines for observational studies derived from health databases, as well as the RECORD guidelines for observational studies [31].

The specifications of the population selected for this research are shown in Figure 1.

Variables and measurements

The variables were: suicidal ideation, diabetes risk, native language, ethnic self-identification, abdominal perimeter, body mass index, educational level.

Suicidal ideation was obtained from the question of the PHQ-9 questionnaire (validated by the Peruvian Ministry of Health in 2012), concerning item 9, which consisted of the question: “In the last 14 days, have you felt or had thoughts that it would be better to be dead or that you would like to harm yourself in some way by seeking to die?” [30].

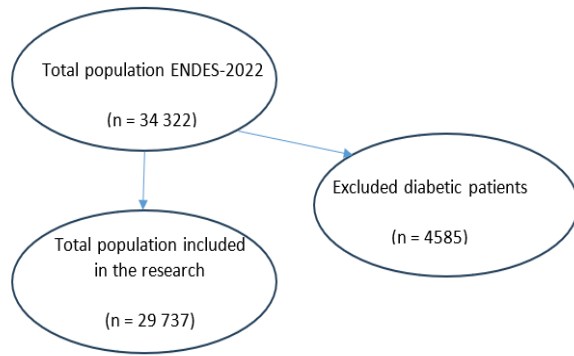


Figure 1. Population selected and excluded in the research.

The suicidal ideation score, according to the PHQ-9 questionnaire included in the ENDES-2022, is based on a score scale from 0 to 3, where 0 implies the absence of suicidal ideation, 1 corresponds to 1 to 6 days, 2 corresponds to 7 to 11 days, and 3 corresponds to 12 days or more, being dichotomized, for this research, in “no”, in case they have reported not having felt or had suicidal thoughts or ideas, and in “yes”, in case they have felt them, for this research, being dichotomized into “no”, in case they have reported not having felt or had suicidal thoughts or ideas, and “yes”, in case they have felt or thought about it, regardless of the number of days they have expressed it.

Although suicidal ideation is assessed with greater complexity using instruments such as the Beck Suicidal Ideation Scale or the “Positive and Negative Suicidal Ideation Inventory” by Osman *et al* [32], the detection of the presence of this depressive symptom in the PHQ-9 questionnaire is an alarm indicator to initially address the patient who has manifested suicidal ideation. Also, despite its limitations, item 9 of the PHQ-9 questionnaire has been reported to be a strong predictor of suicide attempts and deaths, regardless of age [33].

For its part, diabetes risk was determined using the Diabetes Risk Questionnaire developed by Bang *et al.* validated by the American Diabetes Association for epidemiological studies [34]. This variable was dichotomized into presence and absence of DM risk, where presence of risk is from 4 points or more, and absence of risk corresponded to a score below 4 points.

The score was determined from data extracted from the ENDES database. The formulas for obtaining the score were derived from the formulas developed by Bang *et al* [cited in 35], and were as follows:

$$BMI \text{ score} = \left[\frac{\left(\frac{Weight}{2,205} \right)}{\left(\frac{Height}{39,37} \right)} \right] \times 2,$$

where for the body mass index (BMI) score, a value from 0 to 3 points is assigned according to the previously calculated BMI. The second formula is:

$$Diabetes \text{ risk score} = BMI \text{ score} + Age + Sex + Family \text{ story of DM} + Physical \text{ activity} + HTN,$$

where DM, diabetes *mellitus*; HTN, hypertension.

The Diabetes Risk Questionnaire of Bang *et al.* includes the determination of hypertension history as part of the equation, which was obtained from the mean arterial pressure, a variable created with the data from the second measurement of systolic and diastolic pressure, using the following formula [36]:

$$Mean \text{ Blood Pressure} = \frac{(Diastolic \text{ pressure} \times 2) + Systolic \text{ pressure}}{3}.$$

The other data, such as family history of diabetes and physical activity, were obtained directly from the survey, by means of questions related to whether the respondent has family members with diabetes and whether or not he/she regularly engages in physical activity.

All data were grouped into ranges to assign a score, which were: age (< 40 years = 0; 40-49 = 1; 50-59 = 2; ≥ 60 = 3), sex (female = 0; male = 1); physical activity (if yes, subtract one point), presence of hypertension (if yes, add one point), family history of diabetes (if yes, add one point), while the BMI score was directly assigned for the final sum of the total DM-2 risk score [28].

For the multivariate analysis using binary logistic regression, the explanatory variables were: presence of risk of DM-2, native language -which was divided into Spanish, and other native languages, which grouped Quechua, Aymara, etc.-; ethnic self-identification - dichotomized into mestizo, and others, which grouped self-identification as white, creole, black and others-; abdominal perimeter - dichotomized into high perimeter (greater than 95 in men and greater than 82 in women) and normal-; educational level - dichotomized into two groups: up to secondary level, which grouped adults who had concluded or unfinished studies up to secondary level, and technical-university, which grouped adults who have had higher level studies, either in technical training, or university, including postgraduate-. Blood pressure and age were not included in order to avoid multicollinearity, since both are variables from the Diabetes Risk Questionnaire of Bang *et al.*

Data collection and cleaning

The data collection procedure for this study consisted of the collection of information obtained from the secondary database of the ENDES-2022, concerning PHQ-9, as well as the determination of the risk of DM-2 based on

anthropometric data and sedentary lifestyle. Likewise, sociodemographic data collection was used for multivariate analysis.

The entire database was accessed without any prior request, due to the open data policies promoted by the Peruvian State.

Regarding the cleaning of the data used, we proceeded to correct incorrect data (correction of decimals), misspelled variable entries, inconsistent formats of categories and numerical values, and data transformations in the case of the formula for diabetes risk of Bang *et al.*

The study did not include person-level, institutional-level, or other data linkage between two or more databases.

Statistical analysis

Tables were used for descriptive statistics, obtaining frequencies and percentages. The adjusted Odds Ratio test (aOR) was used, by means of binary logistic regression, to determine the probability of suicidal ideation (response variable), including in the model, in addition to the risk of DM-2, mean arterial pressure, native language, ethnic self-identification, abdominal perimeter, educational level as explanatory variables. The Spearman correlation coefficient was used after determining that the distribution of the variables (in numerical form) was not normal according to the Kolmogorov-Smirnov test.

Findings were measured at a significant *p* value of less than 0.05, with a confidence interval (IC) of 95 %.

The IBM software® SPSS statistics 25™ was used for the statistical analysis.

Ethical considerations

The use of open data was authorized in accordance with the document in response to request for use number 001-2023-UDT-OTIC-INS from the Peruvian Ministry of Health, through the National Institute of Health.

The open database did not include personal data, such as names, addresses, or any other data that would allow the identity of the participants to be known. In addition, the Helsinki declaration [37] was followed.

Complementary information, including research protocols, is available through the website of the National Institute of Statistics and Informatics [37].

Results

In the general description of the population variables, it was observed that 32.60 % of the respondents fell within the DM-2 risk group, according to the risk scale of Bang *et al.* According to age, the majority were between 18 and 39 years of age (59.01 %). A close proportion of

adults identified themselves as mixed-race and non-mixed-race. Most respondents had Spanish as their mother tongue (74.50%), followed by Quechua (20.90%). According to educational level, the majority (68 %) reached the highest level of schooling up to secondary school. The blood pressure averages were within normal ranges (see Table 1). Table 2 presents the mean DM-2 risk scores of the Bang *et al.* questionnaire in adults with and without the presence of suicidal ideation, the latter extracted from the PHQ-9 questionnaire. It was observed that, in both sexes, the DM-2 risk score was higher in adults who reported suicidal thoughts. Table 3 describes the frequency of suicidal ideation reported by means of the PHQ-9 questionnaire belonging to the ENDES-2022 in adults with and without risk of DM-2, according to the Bang *et al.* questionnaire, obtained after the application of a formula based on anthropometric and lifestyle data from the endes-2022. It was found that this frequency was higher in adults with a score equal to or greater than 4 points (DM-2 risk).

Table 4 shows a significant difference and correlation by sex of the presence of suicidal ideation and risk of DM-2.

Table 5 shows the multivariate analysis, where it was found that women at risk of DM-2 were 2.01 times more likely to have suicidal ideation than women not at risk of becoming ill from DM-2. Men at risk of DM-2 were 2.70 times more likely to have suicidal ideation than men not at risk.

Discussion

Suicidal ideation occurred more frequently in adults who had a score compatible with DM-2 risk according to the Bang *et al.* questionnaire. Likewise, adults with suicidal ideation showed higher DM-2 risk scores than adults without suicidal ideation. In turn, the presence or absence of DM-2 risk according to the Bang *et al.* questionnaire and the presence or absence of suicidal ideation were related, albeit at a low intensity, which implies that a low but significant percentage of adults likely to develop DM-2 are prone to generate this type of thoughts, which justifies preventive mental health intervention for all adults at risk of developing this endocrinopathy.

The increased likelihood of suicidal ideation in adults at risk for DM-2 could not be contrasted with other studies, because the scientific literature has focused primarily on the effect of DM-2 on mental health [38]. Regarding prediabetes, although persistent hyperglycemia is a highly related risk factor, many patients at risk may have normal blood glucose levels on tests and have other anthropometric and lifestyle risk factors, so the findings of this research can be conjectured based on the characteristics of the questionnaire of Bang *et al.*

Table 1. Descriptive statistics of the characteristics of the Peruvian population studied

Features		Frequency	Percentage
Age group	18-39 years old	17548	58,82
	40-59 years	7680	25,75
	60 years and over	4603	15,43
Ethnic identification	Others	15247	51,11
	Mongrel	14584	48,89
Mother tongue	Quechua	6126	20,53
	Aimara	1043	3,50
	Other native languages	655	2,20
	English	22007	73,77
Educational level	Up to high school	20995	70,37
	Technical-university	8836	29,63
Risk of DM-2	Diabetes risk	10141	34
	No risk of diabetes	19690	66
		Average	DS
Blood pressure	Systolic	115,71	16,849
	Diastolic	74,18	10,437
Abdominal circumference	Women	91,15	11,9443
	Men	91,31	11,6873

Risk DM-2: risk of diabetes *mellitus* 2; DS: standard deviation.

Table 2. Mean suicide ideation scores in the last 14 days of the PHQ-9 questionnaire in Peruvian adults in the ENDES-2022 survey

		N (%)	Average risk of DM-2	Standard deviation
Women	($p < 0,001$)	16 985 (100)		
	Suicidal ideation	1581 (9,30)	3,50	1,56
	No suicidal ideation	15 404 (90,70)	2,86	1,32
Men	($p < 0,001$)	12 846 (100 %)		
	Suicidal ideation	653 (5,09)	4,89	1,51
	No suicidal ideation	12 193 (94,91)	4,21	1,31
Both sexes	($p < 0,001$)	29 831 (100)		
	Suicidal ideation	2234 (7,49)	3,92	1,67
	No suicidal ideation	27 597 (92,51)	3,46	1,48

DM-2: Diabetes *mellitus* 2; N: Count.

Table 3. Frequency of suicidal ideation, in the last 14 days, in Peruvian adults with and without risk of DM-2 of the ENDES-2022

		Suicidal ideation	No suicidal ideation
		n (%)	n (%)
Women	Risk DM-2 (n = 3778)*	639 (16,90)	3139 (83,10)
	No risk DM-2 (n = 13178)	942 (7,10)	12 236 (92,90)
	Total (n = 16956)	1581 (9,30)	15 375 (90,70)
Men	Risk DM-2 (n = 6269)*	431 (6,90)	5838 (93,10)
	No risk DM-2 (n=6512)	218 (3,30)	6294 (96,70)
	Total (n = 12781)	649 (5,10)	12 132 (94,90)

DM-2: Diabetes *mellitus* 2. *Risk DM-2: risk of diabetes *mellitus* 2, equivalent to 4 or more points in the questionnaire of Bang *et al.*

Table 4. Measures of correlation between suicidal ideation in the last 14 days and risk of DM-2 in Peruvian adults in the endes-2022

	p	V*
Women	< 0,001	0,140
Men	< 0,001	0,118
Both sexes	< 0,001	0,101

V: Cramer's V coefficient

* Dichotomous variables: presence or absence of suicidal ideation; risk of diabetes *mellitus* 2, no risk of diabetes *mellitus* 2.

Table 5. Bivariate and multivariate analysis using binary logistic regression for factors associated with a higher probability of suicidal ideation in the Peruvian population of the ENDES-2022*

	Women**		Men**	
	CRUDE OR (CI 95 %)"	Adjusted OR (CI 95 %)	CRUDE OR (CI 95 %)"	Adjusted OR (CI 95 %)
Risk DM-2	2,372 (2,169-2,593)	2,010 (1,720-2,349)	2,353 (1,752-2,408)	2,703 (2,209-3,302)
p	< 0,001	< 0,001	0,001	< 0,001
Native language	1,395 (1,649-1,746)	1,283 (1,099-1,489)	2,269 (1,969-2,615)	1,661 (1,338-2,062)
p	< 0,001	0,002	0,002	< 0,001
Abdominal circumference	0,756 (0,681-0,839)	0,745 (0,639-0,870)	NA	
p	< 0,001	< 0,001		
Ethnic identification	1,797 (1,643-1,966)	1,273 (1,099-1,476)	1,782 (1,532-2,075)	1,306 (1,050-1,625)
p	< 0,001	0,001	< 0,001	0,017
Educational level	2,139 (1,876-2,438)	1,719 (1,462-2,022)	2,572 (2,078-3,184)	2,445 (1,863-3,101)
p	< 0,001	< 0,001	< 0,001	< 0,001

DM-2 risk: risk of diabetes *mellitus* 2; IMC: body mass index; MAP: mean arterial pressure; NA: not applicable.

* Response variable: presence of suicidal ideation.

** Explanatory variables: presence of DM-2 risk, mean arterial pressure, native language, ethnic self-identification, abdominal perimeter, body mass index, educational level.

The Bang *et al.* questionnaire, in adults with scores above the normal range, indicates the presence of characteristics compatible with a prediabetic phenotype based on aspects related to the presence of overweight or obesity, aging, blood pressure, and lifestyles.

This phenotype, according to a high score, is represented by adults with overweight or obesity and high blood pressure, which are related to socioeconomic stressors, unhealthy lifestyles and low physical activity. These are the expression of emotional discomfort and inability to manage stressful situations, for example, through exercise or balanced diets, which affects personal esteem and future prospects, and opens the possibility of transient or persistent symptoms of anxiety or depression, which can lead to the development of passive or active suicidal ideation.

In this sense, the questionnaire explores multifactorial characteristics of the development of DM-2, which implies, in addition to the conditioning factors inherently attributed to the patient, a relationship with causal factors of DM-2 risk phenotype, including sociodemographic and socioeconomic conditioning factors, such as the environment and work schedules, sufficient remuneration for monthly expenses, less pollution and vehicular traffic, and greater safety, as well as other elements that improve the population's quality of life. All these aspects should be a priority of the State, with the purpose of improving the physical and emotional health of the population, with the consequent reduction of anxious and depressive disorders that may cause suicidal thoughts.

The limitations of the research were related to the origin of the information source, a secondary database, with the consequent risk of information biases, such as the one referring to the measurements made in the ENDES-2022, as well as the answers given in the questionnaires, including the one referring to the suicidal ideation item, which is a possibility due to the high volume of data handled in the database.

In addition, although a follow-up and data cleaning procedure was performed, a faulty classification bias could not be ruled out in the collection after processing by the survey developers, who might have misclassified cases of suicidal ideation, anthropometric characteristics or sociodemographic data.

Likewise, variables that could have influenced the results, such as confounding factors that could have contributed to the interpretation of aspects associated with suicidal ideation, such as average income, number of children, history of depression or anxiety, type of employment contract, among others, were not included due to their unavailability in the ENDES-2022.

In conclusion, the risk of DM-2 is associated with an increased probability of suicidal ideation in Peruvian adults studied in ENDES-2022. The higher frequency of suicidal ideation found in this group of patients, based

on the modifiable and non-modifiable personal risk factors of the Bang *et al.* questionnaire, requires the exploration of socioeconomic and psychological factors that contribute to the DM-2 risk phenotype, which may be a reflection of emotional conflict, psychological instability, and difficulty in managing problems and stressful situations, manifested as weight problems, hypertension, and sedentary lifestyle. The final purpose is to propose socioeconomic welfare and preventive-promotional mental health policies for adults at risk of DM-2, as well as to influence the possible triggers of passive or active suicidal ideation, which requires, beyond individualized intervention, a bio-psycho-social approach oriented to the physical, mental and socioeconomic welfare of the Peruvian population.

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References

1. Jobes DA, Joiner TE. Reflections on suicidal ideation. Crisis [internet]. 2019 [cited 2023 Aug. 17]; 40(4):227-30. Available from: <https://psycnet.apa.org/fulltext/2019-38872-001.pdf>
2. Rogers ML, Stanley IH, Joiner TE, et al. Conceptual and empirical scrutiny of covarying depression out of suicidal ideation. Assessment. 2018;25(2):159-72. DOI: <http://dx.doi.org/10.1177/1073191116645907>
3. De Beurs D, Fried EI, Wetherall K, et al. Exploring the psychology of suicidal ideation: A theory driven network analysis. Behav Res Ther. 2019;120(103419):103419. DOI: <https://doi.org/10.1016/j.brat.2019.103419>
4. Dean-Boucher A, Robillard CL, Turner BJ. Chronic medical conditions and suicidal behaviors in a nationally representative sample of American adolescents. Soc Psychiatry Psychiatr Epidemiol. 2020; 55(3):329-37. DOI: <https://doi.org/10.1007/s00127-019-01770-2>
5. Karasouli E, Latchford G, Owens D. The impact of chronic illness in suicidality: A qualitative exploration. Health Psychol Behav

- Med. 2014;2(1):899-908. DOI: <http://dx.doi.org/10.1080/21642850.2014.940954>
6. Nafilyan V, Morgan J, Mais D, et al. Risk of suicide after diagnosis of severe physical health conditions: a retrospective cohort study of 47 million people. *Lancet Reg Health Eur*. 2023;25(100562):100562. DOI: <http://dx.doi.org/10.1016/j.lanepe.2022.100562>
7. Harmer B, Lee S, et al. Suicidal Ideation. StatPearls Publishing [internet]; 2023 [cited 2023 Aug. 17]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK565877/>
8. Goyal R, Singhal M, Jialal I. Type 2 Diabetes. In: StatPearls. Treasure Island (FL): StatPearls Publishing [Internet]; 2023 [cited 2023 Jul. 29]. Available from: <https://pubmed.ncbi.nlm.nih.gov/30020625/>.
9. Reed J, Bain S, Kanamarlapudi V. A review of current trends with type 2 diabetes epidemiology, aetiology, pathogenesis, treatments and future perspectives. *Diabetes Metab Syndr Obes*. 2021;14:3567-602. DOI: <https://doi.org/10.2147/DMSO.S319895>
10. Abdoli S, Hessler D, Doosti-Irani M, et al. The value of measuring diabetes burnout. *Curr Diab Rep*. 2021;21(8). DOI: <https://doi.org/10.1007/s11892-021-01392-6>
11. Dendup T, Feng X, et al. Environmental risk factors for developing type 2 diabetes mellitus: A systematic review. *Int J Environ Res Public Health*. 2018;15(1):78. DOI: <https://doi.org/10.3390/ijerph15010078>
12. Galicia-García U, Benito-Vicente A, Jebari S, et al. Pathophysiology of type 2 diabetes mellitus. *Int J Mol Sci*. 2020;21(17):6275. DOI: <https://doi.org/10.3390/ijms21176275>
13. Shah A, Isath A, Aronow WS. Cardiovascular complications of diabetes. *Expert Rev Endocrinol Metab*. 2022;17(5):383-8. DOI: <https://doi.org/10.1080/17446651.2022.2099838>
14. Lovic D, Piperidou A, Zografou I, et al. The growing epidemic of diabetes mellitus. *Curr Vasc Pharmacol*. 2020;18(2):104-9. DOI: <http://dx.doi.org/10.2174/1570161117666190405165911>
15. Carrillo-Larco RM, Bernabé-Ortiz A. Type 2 diabetes mellitus in Peru: a systematic review on prevalence and incidence in general population. *Rev Peru Med Exp Salud Publica*. 2019;36(1):26-36. DOI: <https://doi.org/10.17843/rpmesp.2019.361.4027>
16. Sartorius N. Depression and diabetes. *Dialogues Clin Neurosci*. 2018;20(1):47-52. DOI: <https://doi.org/10.31887/DCNS.2018.20.1/nsartorius>
17. O'Neil PM, Aroda VR, Astrup A, et al. Neuropsychiatric safety with liraglutide 3.0 mg for weight management: results from randomized controlled phase 2 and 3a trials. *Diabetes Obes Metab*. 2017;19(11):1529-36. DOI: <https://doi.org/10.1111/dom.12963>
18. Daniali H, Martinussen M, Flaten MA. A global meta-analysis of depression, anxiety, and stress before and during COVID-19. *Health Psychol*. 2023;42(2):124-38. DOI: <https://psycnet.apa.org/doi/10.1037/hea0001259>
19. Topaloglu US, Erol K. Fatigue, anxiety and depression in patients with prediabetes: A controlled cross-sectional study. *Diabetol Int*. 2022;13(4):631-6. DOI: <https://doi.org/10.1007/s13340-022-00583-0>
20. Hollingsworth DW, Polanco-Roman L. Ethnic identity protects against feelings of defeat and entrapment on suicide ideation in African American young adults. *Cultur Divers Ethnic Minor Psychol*. 2022;28(2):217-26. DOI: <https://doi.org/10.1037/cdp0000523>
21. Rosoff DB, Kaminsky ZA, McIntosh AM, et al. Educational attainment reduces the risk of suicide attempt among individuals with and without psychiatric disorders independent of cognition: A bidirectional and multivariable Mendelian randomization study with more than 815,000 participants. *Transl Psychiatry*. 2020;10(1). DOI: <https://doi.org/10.1038/s41398-020-01047-2>
22. Mathieu S, Treloar A, Hawgood J, et al. The role of unemployment, financial hardship, and economic recession on suicidal behaviors and interventions to mitigate their impact: A review. *Front Public Health*. 2022;10. DOI: <https://doi.org/10.3389/fpubh.2022.907052>
23. De Leo D. Late-life suicide in an aging world. *Nat Aging*. 2022;2(1):7-12. DOI: <https://doi.org/10.1038/s43587-021-00160-1>
24. Hughes JL, Horowitz LM, Ackerman JP, et al. Suicide in young people: screening, risk assessment, and intervention. *BMJ*. 2023;381:e070630. DOI: <https://doi.org/10.1136/bmj-2022-070630>
25. Joung K-I, Cho S-I. Association of low blood pressure with suicidal ideation: A cross-sectional study of 10,708 adults with normal or low blood pressure in Korea. *BMC Public Health*. 2018;18(1). DOI: <https://doi.org/10.1186/s12889-018-5106-5>
26. Bang H, Edwards AM, Bomback S, et al. Development and validation of a patient self-assessment score for diabetes risk. *Ann Intern Med*. 2009;151(11):775. DOI: <http://dx.doi.org/10.7326/0003-4819-151-11-200912010-00005>
27. Chavez-Cáceres R, Luna-Muñoz C, Mendoza-Cernaqué S, et al. Factors associated with suicidal ideation in patients in a Peruvian hospital. *Rev Fac Med Humana*. 2020;20(3):374-80. DOI: <http://dx.doi.org/10.25176/rfmh.v20i3.3054>
28. Peru, National Institute of Statistics and Informatics. Peru: Demographic and Family Health Survey - ENDES 2022. Report [internet]. 2023, May 17 [cited 2023 Aug. 17]. Available from: <https://www.gob.pe/institucion/inei/informes-publicaciones/4233597-peru-encuesta-demografica-y-de-salud-familiar-endes-2022>
29. Martina Chávez M, Amemiya Hoshi I, Suguimoto Watanabe SP, et al. Depression in older adults in Peru: geospatial distribution and associated factors according to ENDES 2018-2020. *An Fac Med (Lima Peru)*. 2022;83(3):180-7. DOI: <http://dx.doi.org/10.15381/anales.v83i3.23375>
30. Calderón M, Gálvez-Buccollini JA, Cueva G, et al. Validation of the Peruvian version of the PHQ-9 for the diagnosis of depression. *Rev Peru Med Exp Salud Publica*. 2014;29(4):578-85. DOI: <http://dx.doi.org/10.17843/rpmesp.2012.294.409>
31. Benchimol EI, Smeeth L, Guttman A, et al; RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Med* [internet]. 2015 [cited 2023 Nov. 27; 12(10):e1001885. Available from: <http://www.equator-network.org/reporting-guidelines/record/>.
32. Sinniah A, Oei TPS, Chinna K, Shah SA, Maniam T, Subramaniam P. Psychometric properties and validation of the positive and negative suicide ideation (PANSI) inventory in an outpatient clinical population in Malaysia. *Front Psychol* [internet]. 2015;6. Available from: <http://dx.doi.org/10.3389/fpsyg.2015.01934>
33. Rossom RC, Coleman KJ, Ahmedani BK, et al. Suicidal ideation reported on the PHQ9 and risk of suicidal behavior across age groups. *J Affect Disord*. 2017;215:77-84. DOI: <https://doi.org/10.1016/j.jad.2017.03.037>
34. Vera-Ponce VJ, Osada Liy JE, Valladares-Garrido MJ. Validity of the American diabetes association diabetes risk test as screening for prediabetes in a sample of Peruvian workers. *Rev Fac Med Humana* [Internet]. 2021;21(3):571-7. DOI: <http://dx.doi.org/10.25176/rfmh.v21i3.3614>
35. MSD Manual Professional Version. Calculators: Diabetes risk self-assessment [internet] 1998-2022 [cited 2024 Apr. 27]. Available from: <https://www.msdmanuals.com/professional/calculators/diabetes-risk-self-assessment>

lable from: <https://www.msmanuals.com/professional/multimedia/clinical-calculator/diabetes-risk-self-assessment>

36. DeMers D, Wachs D. Physiology, mean arterial pressure [internet]. StatPearls Publishing; 2023 [cited 2023 Aug. 17]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK538226/>
37. Sawicka-Gutaj N, Gruszczyński D, Guzik P, et al. Publication ethics of human studies in the light of the Declaration of Helsinki - a mini-review. *J Med Sci* [internet]. 2022 [cited 2023 Aug. 17];91(2):e700. Available from: <https://jms.ump.edu.pl/index.php/JMS/article/view/700>
38. Lindekilde N, Scheuer SH, Rutters F, et al. Prevalence of type 2 diabetes in psychiatric disorders: An umbrella review with meta-analysis of 245 observational studies from 32 systematic reviews. *Diabetologia*. 2022;65(3):440-56. DOI: <https://doi.org/10.1007/s00125-021-05609-x>