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Studying the Psychological Wellbeing and the Risk Factors Related to Glycemic Control and Development of Complications in Patients Diagnosed with type Ii Diabetes Mellitus who Come to the Private Medical Center "Consulmed"

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Summary

Type II DIABETES MELLITUS (DM II) is a complex chronic disease requiring ongoing medical care with multifactorial risk reduction strategies beyond glycemic control, continuing education for diabetes self-management, and support are critical to reducing the risk of long-term complications. Objective: to determine the risk factors related to glycemic control and development of complications in patients diagnosed with type II diabetes mellitus who attend the private medical center "CONSULMED". Materials and methods: Descriptive observational and cross-sectional study. A binary logistic regression model was estimated to determine risk factors related to glycemic control and occurrence of complications. Results: The present study was carried out from the information obtained from the medical records of 48 patients, where their sociodemographic and clinical characteristics were identified, being able to establish the risk factors related to glycemic control prevalent in this population. It was shown that by increasing the patient's age by 1 year, the probability of being at risk increases by 1.12%, as the weight increases by 1 kg, the probability of being at risk increases by 1.94%, as the patient's time with diabetes increases by one year, the probability of being at risk increases by 11.74%, for patients who follow dietary hygiene measures, the probability of being at risk is 86.75% less than patients who do NOT follow dietary hygiene measures. Conclusions: In the present study, the main main risk factors were determined, such as dietary hygienic measures, consumption of oral antidiabetics, evolution of the disease, age and weight of the patient, thus considering patients at risk those who do not follow dietary hygienic measures or consume oral antidiabetics, as well as those patients over 60 years of age. Taking into account the variable weight, patients with more than 60 kilos present a greater risk of externalizing glycemic alteration, however, patients with more than 6 years of disease who follow dietary hygienic measures, but who do not consume oral antidiabetics are also considered patients at risk to produce complications. Patients who, despite following dietary hygiene measures and consumption of treatment based on oral antidiabetics, but with 12 years of disease evolution are considered patients at risk.

Key words: Type II diabetes mellitus, glycosylated hemoglobin, risk factor, binary logistic regression.

1. Introduction

Type II Diabetes Mellitus is a chronic non-communicable disease that constitutes a public health problem, epidemiological studies indicate a considerable increase in prevalence worldwide, which represents a high morbidity and mortality rate for the general population [(1).]

Epidemiological studies of type II diabetes conducted in recent years have shown a marked increase in its prevalence worldwide, with an estimated 23.5 million between 55 and 68 years corresponding to 7% of the world's adult population. The prevalence of DM2 is higher in developed countries, however, the rate of increase is higher in developing countries, a trend that will continue in the coming years. In Latin America, urban residents have twice the prevalence of the disease compared to rural residents [(2).]

According to the report of the International Diabetes Federation by countries in 2021, in Ecuador the prevalence of Diabetes in a population between 20 and 79 years of age is 4.7%, which is equivalent to 526,000 people living with Diabetes [(3)], taking into account Ecuador is a country for which there are no sources of updated national data on diabetes.

In Ecuador, there has been a significant increase in mortality in recent years due to DM2, with a total of 4895 deaths in 2017, which could increase due to increased risk factors. [(4)].

In our population it is important to identify individuals at risk of developing diabetes mellitus 2, thus reducing the risk of complications and improving quality of life.

Therefore, the main objective of this study is to determine the risk factors related to glycemic control and development of complications in patients diagnosed with type II diabetes mellitus who come to the private medical center "CONSULMED", and in this way improve primary health care and improve the quality of life of each of the individuals.

1.1 Classification and diagnosis of Diabetes.

Diabetes can be classified into the following general categories:

1.1.1 Type 1 diabetes

This form, formerly called "insulin-dependent diabetes" or "juvenile-onset diabetes," accounts for 5 to 10% of diabetes and is due to autoimmune destruction mediated by cells of the pancreas (beta cells) ([5].

1.1.2 Prediabetes and type 2 diabetes

Type II diabetes, formerly referred to as "non-insulin-dependent diabetes" or "adult-onset diabetes," accounts for 90-95% of all diabetics. This form encompasses people who are relatively (rather than absolutely) deficient in insulin and have peripheral insulin resistance. [5].

Type II diabetes mellitus is frequently not diagnosed for many years because hyperglycemia develops gradually and, at first stages, is often not severe enough for the patient to notice the classic symptoms of diabetes caused by hyperglycemia, such as dehydration or unintentional weight loss. However, even undiagnosed patients are at increased risk of developing macrovascular and microvascular complications [5].

Insulin resistance may improve with weight reduction, exercise, and/or pharmacological treatment of hyperglycemia, but is rarely restored to normal. Recent interventions with intensive diet and exercise or surgical weight loss have led to remission of diabetes [5].

1.1.3 Monogenic diabetes syndromes

The diagnosis of monogenic diabetes should be considered in children and adults diagnosed with diabetes in early adulthood with the following findings: diabetes diagnosed within the first 6 months of life (with occasional cases presenting later, mostly INS and ABCC8 mutations), diabetes without typical features of type I or type II (negative) diabetes-associated autoantibodies, without obesity, lacking other metabolic features, especially with a strong family history of diabetes) or mild and stable fasting hyperglycemia (100–150 mg/dL [5.5–8.5 mmol/L]), stable A1C between 5.6% and 7.6% (between 38% and 60 mmol/mol), especially if there is no obesity (5).

1.1.4 Pancreatic diabetes or diabetes against the background of exocrine pancreas disease.

Hyperglycemia due to general pancreatic dysfunction has been termed "Type 3C Diabetes". The risk of microvascular complications appears to be similar to other forms of diabetes. In the context of pancreatectomy, an autologous islet transplant may be performed to retain insulin secretion. In some cases, autologous transplantation can lead to insulin independence [5].

1.1.5 Gestational diabetes mellitus

For many years, GDM was defined as any degree of glucose intolerance that was first recognized during pregnancy, regardless of the degree of hyperglycemia [5].

1.2 Prevention or delay of type 2 diabetes and associated comorbidities

There is considerable time before the development of type 2 diabetes and its complications during which intervention can be performed, and there is an effective means of preventing type 2 diabetes in those determined to have prediabetes with a glycosylated hemoglobin (A1C) of 5.7–6.4% (39–47mmol/mol), impaired glucose, or impaired fasting glucose. The usefulness of A1C screening for prediabetes and diabetes may be limited in the presence of hemoglobinopathies and conditions affecting red blood cell turnover [6].

1.3 Glycemic goals.

1.3.1 Evaluation of glycemic control.

Glycemic control is assessed by measuring A1C, continuous glucose monitoring (CGM) using time in range (IRR) and/or glucose control indicator (GMI) and blood glucose monitoring (BGM). A1C is the metric used to date in clinical trials demonstrating the benefits of improved glycemic control. Individual glucose monitoring is a useful tool for diabetes self-management, including meals, exercise, and medication adjustment, especially in people taking insulin. People on a variety of insulin regimens may benefit from continuous glucose control with improved glucose control, decreased hypoglycemia, and increased self-efficacy [7].

1.3.2 Glycemic targets.

An A1C target of <7% (53 mmol/mol) without significant hypoglycemia is appropriate for non-pregnant adult women. Depending on provider discretion and patient preference, achieving A1C levels lower than the 7% goal may be acceptable and even beneficial if it can be safely achieved without significant hypoglycemia or other adverse effects of treatment. Less stringent A1C targets (such as <8% [64 mmol/mol]) may be appropriate for patients with limited life expectancy or where the harms of treatment outweigh the benefits ([7].

1.3.3 Hypoglycemia

Level 1 hypoglycemia is defined as a measurable glucose concentration <70 mg/dL (3.9 mmol/L) but ≥54 mg/dL (3.0 mmol/L). A blood glucose concentration of 70 mg/dL (3.9 mmol/L) has been recognized as a threshold for neuroendocrine responses to glucose drop in people without diabetes. Because many people with diabetes show altered counterregulatory responses to hypoglycemia and/or experience unconscious hypoglycemia [7].

Level 2 hypoglycemia (defined as a blood glucose concentration <54 mg/dL [3.0 mmol/L]) is the threshold at which neuroglycopenic symptoms begin to occur and requires immediate action to resolve the hypoglycemic event. If a patient has level 2 hypoglycemia without adrenergic or neuroglycopenic symptoms, they are likely to be unaware of hypoglycemia [7].

Finally, level 3 hypoglycemia is defined as a severe event characterized by impaired mental and/or physical functioning that requires the assistance of another person for recovery [7].

1.4 Pharmacological approaches to the treatment of glycemia.

1.4.1 Drug therapy for adults with type 2 diabetes

First-line therapy depends on comorbidities, patient-centered treatment factors, and management needs, but will typically include metformin and comprehensive lifestyle modification. Drug therapy should be initiated at the time type 2 diabetes is diagnosed, unless there are contraindications. Additional and/or alternative agents may be considered in special circumstances, such as in people at established or increased risk of cardiovascular or renal complications [8]. Insulin has the advantage of being effective where other agents are not and should be considered as part of any combination regimen when hyperglycaemia is severe, especially if catabolic features (weight loss, hypertriglyceridemia, ketosis) are present. It is common practice to initiate insulin therapy for patients who have blood glucose levels ≥300 mg/dL (16.7 mmol/L) or A1C >10% (86 mmol/mol) or if the patient has symptoms of hyperglycemia (i.e., polyuria). or polydipsia) or evidence of catabolism (weight loss) ([8].

1.4.2 Combination therapy

Traditional recommendations have been to use staggered addition of drugs to metformin to keep A1C on target. The advantage of this is to provide a clear assessment of the positive and negative effects of new medicines and to reduce potential side effects and costs [9]. Among the most used treatments are a change in lifestyle, as well as the intake of insulin-sensitizing drugs and drugs for the treatment of obesity. Likewise, it is possible to find drugs that do not directly reduce insulin resistance or visceral adiposity, but provide a cardiovascular benefit, highlighting lipid-lowering and antihypertensive drugs [10].

1.5 Complications

1.5.1 Cardiovascular diseases.

Control of hypertension/blood pressure. - Hypertension, defined as sustained blood pressure ≥140/90 mmHg, is common among patients with type 1 or type 2 diabetes. Hypertension is an important risk factor for both atherosclerotic cardiovascular disease (ASCVD) and microvascular complications ([11]).

1.5.2 Chronic kidney disease

Diabetic kidney disease usually develops after a 10-year duration of diabetes in type 1 diabetes, but may be present at the time of diagnosis of type 2 diabetes [12]. For patients with type 2 diabetes and diabetic nephropathy, the use of a sodium-glucose co-transporter 2 inhibitor is recommended in patients with an estimated glomerular filtration rate ≥25 ml/min/1.73 m2 and urinary albumin ≥300 mg/g creatinine to reduce the progression of chronic kidney disease and cardiovascular events (12).

2. General objective

To determine the risk factors related to glycemic control and development of complications in patients diagnosed with type II diabetes mellitus who attend the private medical center "CONSULMED".

3. Methodology

3.1 Type of study

The present study was descriptive of observational and cross-sectional type, in which risk factors related to glycemic control and the development of complications were determined in patients diagnosed with type II diabetes mellitus who attend the private medical center "CONSULMED", the data taken date from the months of January to March 2022, establishing a total initial sample of 65 patients who attended medical control, of which 48 patients are included in this study according to criteria established within it.

3.2 Determination of sample size and sampling

Population. - was formed by patients who came to consult the medical center "CONSULMED", patients diagnosed with type II diabetes mellitus.

Study population. -It has been conformed by 48 patients who met the inclusion criteria within the proposed study, they present medical care records with results of laboratory tests.

3.2.1 Inclusion criteria

- Patients of both sexes aged 18 years or older and less than 70 years.
- Patients diagnosed with Type II Diabetes Mellitus.
- Patients in whom data are available from an analysis carried out in the last 6 months in which at least the values of glucose, HbA1c, creatinine and lipid profile have been determined.

3.2.2 Exclusion criteria

- Age less than 18 years and over 70 years.
- Undiagnosed patients with Type II Diabetes Mellitus
- Not having analytics in the last 6 months.

Table 1. Description of Variables

Variables	**Description**
Dependent variable	
Risk	Variable that shows if the patient has his diabetes under control. Where 0 indicates under control and 1, at risk

Independent variables	
Area of residence	Variable that shows the area of residence in which the patient lives, where 0 indicates rural area and 1, urban area.
Level of education	Variable that shows the level of education of the patient, where 0 indicates basic education and 1, higher education.
Hypertension	Variable that shows if the patient suffers from hypertension, where 0 indicates that he does not suffer from it and 1, that if he suffers from it.
Hypertriglyceridemia	Variable that shows if the patient suffers from hypertriglyceridemia, where 0 indicates that he does not suffer from it and 1, that if he suffers from it.
Use of oral antidiabetics	Variable that shows if the patient consumes oral antidiabetics, where 0 indicates that he does not consume it and 1, that if he consumes it.
Dietary hygienic measures	Variable that shows if the patient follows dietary hygienic media, where 0 indicates that he does not follow it and 1, that if he follows it.
Time with illness	Variable that shows the time in years that the disease was detected in the patient.
Age	Variable that shows the age in years of the patient.
Size	Variable that shows the patient's height in meters.
Weight	Variable that shows the weight in kg of the patient.
Current glycemia	Variable showing the patient's blood glucose level in mg/dL.
Creatinine	Variable showing the patient's creatinine level in mg/dL.
Triglycerides	Variable showing the patient's triglyceride level in mg/dL.
Cholesterol	Variable showing the patient's cholesterol level in mg/dL.

Source: Authors.

3.3 Materials and methods

3.3.1 Data collection techniques

Data collection was carried out through the review of medical records of the 48 patients in the study, where data were obtained regarding sociodemographic, habit, clinical, and therapeutic variables.

- Sociodemographic: sex, age, area of residence, level of education.

- Clinics: body mass index taken into account the weight and height taken in the medical check-ups established in the month of January to March 2022, serum levels of triglycerides, total cholesterol, HbA1c, fasting blood glucose, creatinine, report of systolic blood pressure and diastolic blood pressure taken during your medical check-up as a screening for hypertension in patients with diabetes mellitus II, pre-existing comorbidities such as thyroid disorder.

3.3.2 Data collection instrument

The indirect method for data collection that allowed us to identify glycemic control, as well as existing or pre-existing complications was through data that exist in the medical records of each of the cases included in the present study, as well as collection of information on analysis of blood samples (venous blood) on glucose values, glycosylated hemoglobin, urea, creatinine, lipid profile, the same recorded in each of the medical records.

3.3.3 Tools for data processing:

The analysis was carried out based on the comparison of two groups according to their main variable such as glycosylated hemoglobin, in which it was called as a group with adequate glycemic control that which presents glycosylated hemoglobin less than 7%, and the group with poor glycemic control which presents glycosylated hemoglobin greater than 7%. A bivariate analysis of the associated variables in relation to poor control of type II diabetes mellitus was performed, the binary logistic regression model was adjusted to determine the factors that influence glycemic control and the appearance of complications in patients diagnosed with type II diabetes.

The descriptive variables analyzed were summarized with measures of central tendency and dispersion in the case of quantitative variables; Percentages for qualitative variables.

Once all the information has been collected, the Microsoft Excel 2019 program and R studio program were used as tools for data processing.

4. Results

This study included 48 patients of whom 54.1% (n = 26) are female, of which 65.5% (n = 17) were less than or equal to 65 years. As for the area of residence, 75% (n = 36) of the total resides in rural areas, with a predominant level of secondary education with 41.6% (n = 20).

Regarding the clinical characteristics, fasting blood glucose values predominated in patients with hyperglycemia (> 110 mg / dl), being present in 56.2% (n = 27) of the total population. Regarding the lipid profile, 62.5% (n = 30) presented normal values of cholesterol and triglycerides together (total cholesterol < 200 mg / dl – triglycerides < 150 mg / dl); As for creatinine levels that help us assess renal function, 91.6% (n = 44) have normal levels (creatinine < 1.1 mg / dl). For the years of evolution, 85.4% (n = 41) present less than 10 years, and 72.9% (n = 35) receive combined therapy in relation to their treatment. Data shown in Table 2.

Board 1
Sociodemographic variables, habits, clinical and therapeutic variables.

VARIABLE			**n**	**%**
PARTNER-MOGRAFICAS	Sex	Female	26	54,1
		Male	22	45,8
	Age	Less than or equal to 65 years	35	72,9
		Over 65 years old	13	27,0
	Area of residence	Rural	12	25,0
		Urban	36	75,0
	Level of education	No	1	2,0
		Primary	9	18,7
		High school	20	41,6
		Third Level	18	37,5
HABITS	Diet	Yes diet for diabetic patient	19	39,5
		No diet for diabetic patient	29	60,4
	Physical activity	If you do physical activity	19	39,5
		Does not engage in physical activity	29	60,4
CLINICS	Body mass index	Insufficient: less than 18	0	0,0
		Normal weight: between 18 – 25	21	43,7
		Overweight: between 25 – 30	25	52,0
		Obesity: greater than 30	2	4,1
		Morbid obesity: greater than 40	0	0,0

	High blood pressure	Normal-optimal 120-129 and/or 80-84 mmHg	38	79,1
		Normal-high 130-139 and/or 85-89 mmHg	6	12,5
		Stage/grade 1 140-159 and/or 90-99 mmHg	1	2,0
		Stage/grade 2 160-179 and/or 100-109 mmHg	2	4,1
		Stage/grade 3 ≥180 and/or ≥110 mmHg	1	2,0
	Current blood glucose	Normal glucose: 75 - 100 mg/dl	18	37,5
		Prediabetes: 100 - 110 mg/dl	3	6,2
		High glucose: greater than 110mg/dl	27	56,2
	Glycosylated hemoglobin HbA1c	Normal: less than 7%	21	43,7
		High Value: greater than or equal to 7%	27	56,2
	Creatinine	Normal: less than 1.1 mg/dl	44	91,6
		High Value: greater than 1.1 mg/dl	4	8,3
	Triglycerides	Normal: up to 150 mg/dl	30	62,5
		High value: greater than 150 mg/dl	18	37,5
	Cholesterol	Normal: up to 200 mg/dl	30	62,5
		High Value: greater than 200mg/dl	18	37,5
	Years of evolution of type II diabetes mellitus	Less than or equal to 10 years	41	85,4
		Older than 11 - 20 years	7	14,5
THERAPEUTIC	Use of oral antidiabetics	Monotherapy	13	27,0
		Combination therapy	35	72,9

Source: medical records of the Medical Center "CONSULMED"

Board 2 *Frequency measures for categorical variables*

Independent variables	**Low Risk n: 21 (43.75%) (HbA1c < 7%)**	**High Risk n: 27 (56.25%) (HbA1c > 7%)**
Sex	Male (42.9%) Female (57.1%)	Male (48.1%) Female (51.9%)
Area of residence	Rural (14.3%) Urban (85.7%)	Rural (33.3%) Urban (66.7%)
Level of education	None (0%) Primary (4.8%) Secondary (42.9%) Third Level (52.4%)	None (3.7%) Primary (29.6%) Secondary (40.7%) Third Level (25.9%)
Hypertension	No (95.2%) Yes (4.8%)	No (63.0%) Yes (37.0%)
Hypertriglyceridemia	No (85.71%) Yes (14.29%)	No (92.6%) Yes (7.4%)
Use of oral antidiabetics	No (9.5%) Yes (90.5%)	No (18.5%) Yes (81.5%)
Hygienic - dietary measures (diet and physical activity)	No (61.9%) Yes (38.1%)	No (85.2%) Yes (14.8%)

Source: medical records of the Medical Center "CONSULMED"

According to Table 3, our population is classified into two groups, the first called low risk group, which is made up of patients with glycated hemoglobin less than or equal to 7%, it is made up of 21 patients, of which 42.9% are men and 57.1% are women while in the high risk group (HbA1c > 7%) It is made up of 27 patients who have glycosylated hemoglobin greater than 7%, of which 48.1% are men and 51.9% are women. Likewise, of the

control group, 14.3% live in rural areas and 85.7% in urban areas, while in the risk group 33.3% live in rural areas and 66.7% live in urban areas. Regarding the level of education, in the group at risk it presents: None (0%), primary (4.8%), secondary (42.9%) and third level (52.4%); while in the risk group None (3.7%), primary (29.6%), secondary (40.7%) and third level (25.9%). On the health history side, in the low risk group 95.2% do not suffer from hypertension and 4.8% suffer from hypertension while in the low risk group 63.0% do not suffer from hypertension and 37.0% suffer from hypertension. Added to the above, in the group at low risk 85.7% do not suffer from hypertriglyceridemia while 14.3% do suffer while in the risk group in 92.59% do not suffer from hypertriglyceridemia while 7.41% do.

Regarding the medical treatments received by patients, in the group with glycosylated hemoglobin equal to or less than 7%, 9.5% do not consume oral antidiabetics and 90.5% if they consume it, while in the risk group 18.5% do not consume oral antidiabetics and 81.5% if they consume them. On the other hand, in the low risk group 61.9% do not have the habit of dietary hygienic measures and 38.1% if they do, while in the risk group 85.2% do not have the habit of dietary hygienic measures and 14.8% do. Regarding the quantitative variables, Table 4 shows that in the low-risk group patients were diagnosed as diabetic 3.3 years ago on average while in the risk group the diagnosis time was 7.9 years on average. Regarding the age of the patients, the average for the low risk group was 51.3 years while in the risk group it was 62 years. As for height and weight in the group at risk was 1.6 m and 61.7 kg while in the group at risk were 1.6 m and 64.5 kg.

Board 3 *Descriptive measures of quantitative variables*

Independent variables	**Low Risk n: 21 (HbA1c < 7%)**	**High risk n:27 (HbA1c > 7%)**
Years of evolution of type II diabetes mellitus	Average 3.29; Median 2; Minimum 1; Maximum 8.	Average 7.85; Median 5; Minimum 1; Maximum 40.
Age	Average 51.29; Median 46; Minimum 37; Maximum 83.	Average 62.48; Median 59; Minimum 40; Maximum 88.
Size	Average 1.58; Median 1.58; Minimum 1.47 Maximum 1.75.	Average 1.58; Median 1.6; Minimum 1.4; Maximum 1.75.
Weight	Average 61.73; Median 62; Minimum 45; Maximum 81.	Average 64.48; Median 65; Minimum 43; Maximum 93.
Fasting glycemia	Mean 90.48; Median 87; Minimum 70; Maximum 125.	Mean 169.65; Median 160; Minimum 101; Maximum 268.
Creatinine	Average 1; Median 1; Minimum 0.8; Maximum 1.2.	Average 0.9; Median 0.9; Minimum 0.57; Maximum 1.3.
Triglycerides	Average 135.95; Median 115; Minimum 81; Maximum 309.	Mean 146.26; Median 126; Minimum 83; Maximum 350.
Cholesterol	Average 192.57; Median 205; Minimum 115; Maximum 253.	Mean 178.33; Median 168; Minimum 102; Maximum 347.

Source: medical records of the Medical Center "CONSULMED"

Regarding the clinical characteristics in the low risk group, patients presented an average of 90.5 mg/dL for fasting glycemia, 1 mg/dL for creatinine, 135.95 mg/dL for triglycerides and 192.57 mg/dL for cholesterol, while in the risk group patients presented an average of 169.65 mg/dL for fasting glycemia, 0.9 mg/dL for creatinine, 146.26 mg/dL for triglycerides and 178.33 mg/dL for cholesterol.

4.2 Model estimation

With the independent variables, a logistic regression model was estimated. According to Table 5, it is found that the variables weight, years of evolution of type II diabetes mellitus, dietary hygienic measures and consumption of oral antidiabetic drugs influence the level of risk considering a significance level of 10%.

Board 4 *Estimation of binary logistic regression model.*

Predictor	*B*
Intercept	-8.2933
Sex	-0.0366

Age	0.0554
Level of education	-0.8583
Residence	0.7339
Hypertension	-0.3697
Hypertriglyceridemia	-0.3403
Weight	0.1046 **.**
Time with diabetes	0.6868 *****
Dietary hygienic measures	-5.8766*****
Oral antidiabetics	-4.2603**.**

Source: medical records of the Medical Center "CONSULMED"

For the process of selecting variables, the "Stepwise" methodology was used, in which the variables that jointly and individually contribute to better explain patients at risk are selected. As a result, the variables age, weight, time with diabetes, dietary hygienic measures and consumption of oral antidiabetic drugs are identified as variables that minimize the Akaike Criterion.

Board 5 *Estimation of the final logistic model.*

Predictor	***B***	***Exp(b)***
Intercepto	-7.83	---
Age	0.0576	1.0596
Weight	0.1009 **.**	1.1061
Time with diabetes	0.6091 *****	1.8388
Dietary hygienic measures	-5.3684 ******	0.0047
Oral antidiabetics	-3.5935 .	0.0275

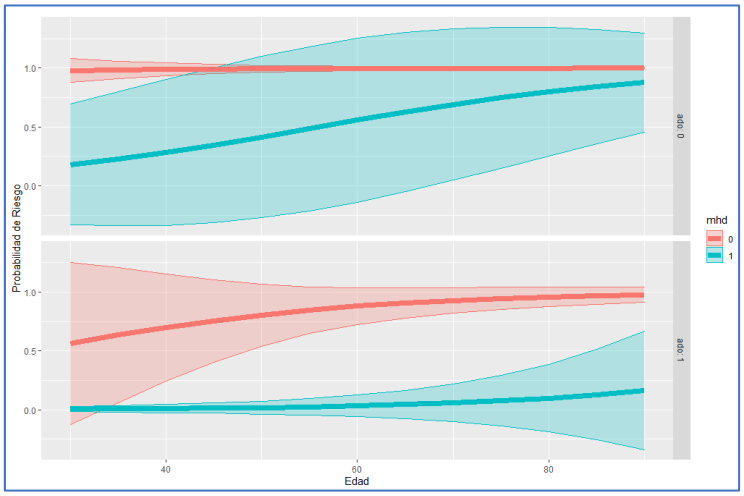
Source: medical records of the Medical Center "CONSULMED"

The effect of the variables is then interpreted according to their influence on risk:

- Age: When the patient's age increases by one year, there is a 5.96% greater possibility of being at risk while keeping the rest of the variables constant.
- Weight: When the patient's weight increases by one kg, there is a 10.61% greater possibility of being at risk while keeping the rest of the variables constant.
- Time with diabetes: When the patient's time with diabetes increases in one year, there is 83.88% more possibility of being at risk keeping the rest of the variables constant.
- Dietary hygienic measures: Patients who follow dietary hygienic measures are 99.53% less likely to be at risk than patients who do NOT follow dietary hygienic measures, keeping the rest of the variables constant.
- Oral antidiabetics: Patients who consume oral antidiabetics are 97.25% less likely to be at risk than patients who do NOT consume oral antidiabetics, keeping the rest of the variables constant.

As can be seen in Figure 1, the curves that show the effect of the age of the patients is increasing, that is, the passage of the years increases the probability of being a patient at risk. For patients who do not consume oral antidiabetics or follow dietary hygienic measures, the increase is not noticeable since it is practically 1. For patients who do not consume oral antidiabetics, but if they follow dietary hygienic measures, a linear growth is found where from 60 years the probability of risk is greater than 0.5. For patients who consume oral antidiabetics, but do not follow dietary hygienic measures, there is an exponential growth where from 30 years the probability of risk is greater than 0.5. Finally, for patients who consume oral antidiabetics and follow dietary hygienic measures, there is a slow exponential growth where the risk probabilities are less than 0.5, that is, it is certain that you are not a risk patient.

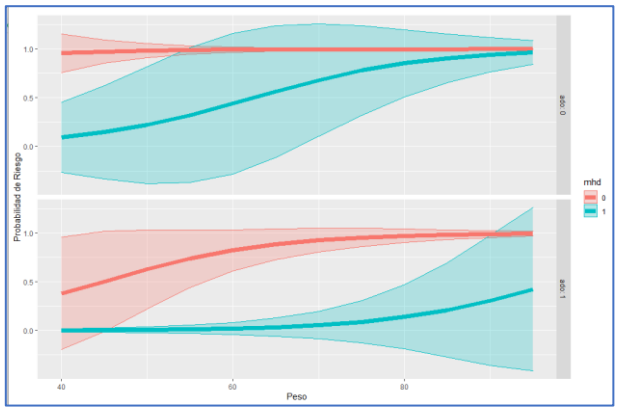
Figure 1
Effect of age on the probability of risk.



Source: medical records of the Medical Center "CONSULMED"

As shown in Figure 2, the curves that show the effect of patients' weight is increasing, that is, the increase in weight increases the probability of being a patient at risk. For patients who do not consume oral antidiabetics or follow dietary hygienic measures, the increase is not noticeable since it is practically 1. For patients who do not consume oral antidiabetics, but if they follow dietary hygienic measures, an almost linear growth is found where from 60 kg the probability of risk is greater than 0.5. For patients who consume oral antidiabetics, but do not follow dietary hygienic measures, there is a potential growth where from 45kg the probability of risk is greater than 0.5. Finally, for patients who consume oral antidiabetics and follow dietary hygienic measures, there is a slow exponential growth where the risk probabilities are less than 0.5, that is, it is certain that you are not a risk patient.

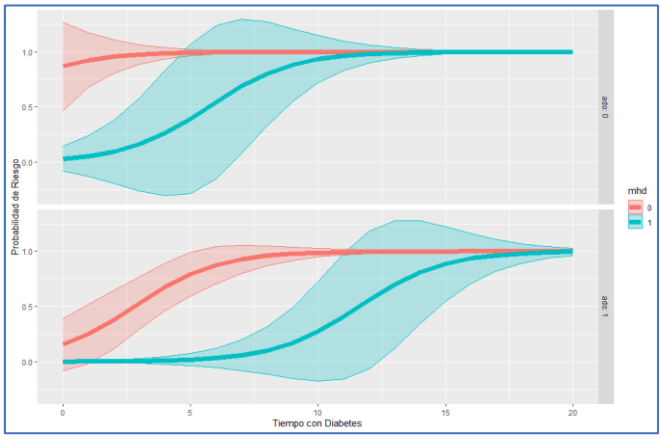
Figure 2
Effect of weight on the probability of risk.



Source: medical records of the Medical Center "CONSULMED"

As can be seen in Figure 3, the curves that show the effect of the age of the patients is increasing, that is, the passage of the years increases the probability of being a patient at risk. For patients who do not consume oral antidiabetics or follow dietary hygienic measures the increase is not noticeable which is practically 1. For patients who do not consume oral antidiabetics, but if they follow dietary hygienic measures, a linear growth is found where from 60 years the probability of risk is greater than 0.5. For patients who consume oral antidiabetics, but do not follow dietary hygienic measures, there is an exponential growth where from 30 years the probability of risk is greater than 0.5. Finally, for patients who consume oral antidiabetics and follow dietary hygienic measures, there is a slow exponential growth where the risk probabilities are less than 0.5, that is, it is certain that you are not a risk patient.

Figure 3
Effect of the time of evolution of the disease on the probability of risk.



Source: medical records of the Medical Center "CONSULMED"

Board 6 *Marginal effects.*

Predictor	***b***
Age	0.0112
Weight	0.0194 .
Time with diabetes	0.1174 ***
Dietary hygienic measures	-0.8675 ***
Oral antidiabetics	-0.3573 **

Source: medical records of the Medical Center "CONSULMED"

According to Table 7, the effect of each variable is interpreted as:

- Age: As the patient's age increases by one year, the probability of being at risk increases by 1.12%
- Weight: When the patient's weight increases by one kg, the probability of being at risk increases by 1.94%
- Time with diabetes: As the patient's time with diabetes increases by one year, the probability of being at risk increases by 11.74%
- Dietary hygienic measures: For patients who follow dietary hygienic measures, the probability of being in a risk condition is 86.75% less than patients who do NOT follow dietary hygienic measures.
- Oral antidiabetics: For patients who consume oral antidiabetics, the probability of being at risk is 35.73% less than patients who do NOT consume oral antidiabetics.

Goodness of fit

To verify that the model fits the data adequately, the Deviance test and the Hosmer and Lemeshow test were used. The first contrasts the following hypotheses:

$$H_0 = \beta_{edad} = \beta_{peso} = \beta_{tiempo} = \beta_{mhd} = \beta_{ado} = 0$$

$$H_1 = Al\ menos\ un\ \beta_i \neq 0$$

As can be seen in table No. 8, the statistic for this test is with a value of 0.000014. This result is evidence to reject H0, that is, the variables under study influence whether a patient is at risk. $\chi^2 = 30.018$

Board 7 *Model fit tests.*

Test	Statistical χ^2	P – value
Deviance	30.018	0.000014

Hosmer Lemeshow	9.315	0.3164

Source: medical records of the Medical Center "CONSULMED"

As a complementary test to the previous result, it is the Hosmer and Lemeshow test contrasts the following hypotheses:

H0: The multiple logistic regression model fits the data.

H1: The multiple logistic regression model does NOT fit the data.

For this test, the statistic for this test is , with a pvalue of 0.3164. This result is evidence not to reject H0, i.e. the multiple logistic regression model fits the data.$\chi^2 = 9.315$

Board 8 *Confusion matrix.*

		Observed		
		No risk	Risk	Total
Predicted	No risk	15	2	17
	Risk	6	25	31
	Total	21	27	48

Source: medical records of the Medical Center "CONSULMED"

Based on the previous result, it is found that the model classified 15 patients without risk out of a total of 21 and 25 classified them with risk status out of a total of 27. On this basis, it was estimated:

- Precisión $= \frac{15+25}{48} = 0.833$, that is, the model correctly predicts the risk status (with risk or without risk) of 83.3% of patients.

Board 9 *Goodness of fit measures.*

McFadden	Cox Snell	*Nagelkerke*
45.63%	46.49%	62.32%

Source: medical records of the Medical Center "CONSULMED"

Finally, Table No. 10 presents the relative importance of the variables used in the model. It highlights the participation of dietary hygienic measures, and time with diabetes as the main variables.

Board 10 *Importance of variables.*

Predictor	***Score***
Age	1.43
Weight	1.95
Time with diabetes	2.56
Dietary hygienic measures	2.75
Oral antidiabetics	1.85

Source: medical records of the Medical Center "CONSULMED"

2 DISCUSSION

In the present study, we sought to identify the risk factors, whether clinical or sociodemographic, in a population made up of patients diagnosed with type II diabetes mellitus, who attend medical controls at the private medical center "CONSULMED" during the months of January to March 2022.

Our population presents the following particularities, with respect to the sociodemographic characteristics that were taken in the present study, the female sex predominated with 54.17%, different from other studies, where

the male sex predominates [13]. The level of education is additionally taken into account, studies in which it is evident that most of the study participants have a low level of education [12], in our study there is a higher prevalence of patients with third level of education, people with risk or poor control of diabetes that is represented by 56.25%, that is, greater than 50% which differs from results of studies related to diabetes control in which their poor control group is represented by 24% [14].

In our study, the etiology of type II diabetes mellitus is taken into account, stating that it is a chronic pathology which is characterized by alteration in the metabolism of carbohydrates, lipids and proteins, its origin is multifactorial where genetic, environmental and behavioral factors play important roles in the appearance of it [15]. especially those related to lifestyle, diet, sedentary lifestyle and obesity.

A triggering factor of insulin resistance is dyslipidemia, thus increasing the risk 4.57 times for the development of the disease and its complications [16], within our study there is no evidence of alteration in the control of triglycerides and cholesterol which is covered by dyslipidemia.

The association between Overweight or Obesity and type II diabetes mellitus is explained by insulin resistance. It is based on a complicated disorder that is based on having an excessive amount of body fat, increasing the risk of diseases and health difficulties, such as heart disease, hypertension and DM2, among others [17], in our study there is evidence of a higher prevalence of overweight patients which is considered a risk factor however in the case-control study on risk factors for type II diabetes mellitus in The ratio between DM2 and nonDM2 is 1.57 times higher in patients who are overweight or obese (possibility of occurrence). The association is positive (1.57), that is, the presence of Overweight or Obesity is associated with the higher occurrence of DM2, but considering that its confidence interval (CI) does include value 1 (0.95 to 2.58), the type of association is not statistically significant and therefore is not considered a risk factor [18].

It is possible to identify that the most influential variable was the practice of adequate dietary hygienic measures that covers both physical activity and adequate nutrition, similar to the study carried out in 2018 called Association between type II diabetes mellitus and physical activity in people with a family history of diabetes in which it is determined that there is a strong association between physical activity, family history of type II diabetes mellitus and subsequent development of the disease [19].

The following figures 1, 2 and 3 show the evolution of the probability of risk according to the patient's age, weight and time with the disease. In the figures mentioned it is evident that patients who do not follow dietary hygienic measures or consume antidiabetics have the probability of being in a risk zone is practically 1, that is, it is certain that a patient who does not receive any of these treatments is a risk patient. On the contrary, when the patient follows dietary hygienic measures and consumes antidiabetics, the probability of being in the risk zone is less than 0.5, that is, it is certain that a patient who these treatments is not a risk patient. Likewise, the consumption of antidiabetic drugs reduces the probability of being a patient at risk, as promoted by José Fernando Mora in his study Treatment adherence in people with type II diabetes mellitus in Mexico (20), where adherence to treatment is considered a predictor of the control and management of type II diabetes mellitus [20].

The effect of the treatments is measured by marginal effects, finding that patients who follow dietary hygiene measures are 99.5% less likely to enter the risk picture than patients who do not follow it, similar characteristics are identified in the study in which it is identified that physical activity is associated with a lower prevalence of type II diabetes mellitus, even in patients with high genetic predisposition, it suggests that dietary hygienic measures influencing physical activity are a protective factor of type II diabetes mellitus [21]. It is also found that patients who consume oral antidiabetics have 97.25% less chance of being at risk than patients who do NOT consume oral antidiabetics keeping the rest of the variables constant.

Finally, according to the above conditions and the risk probability graphs, there are circumstances that give a probability greater than 0.5 to identify patients at risk according to figures 1, 2 and 3. Among these we have patients over 60 years of age who follow dietary hygienic measures but do not consume oral antidiabetics; patients weighing more than 60 kg who follow dietary hygiene measures but do not consume oral antidiabetics; patients over 6 years of age who have been diagnosed with the disease who follow dietary hygienic measures but do not consume oral antidiabetics; and patients with 12 years who have diagnosed the disease who follow dietary hygienic measures and consume oral antidiabetics. These situations allow to generate clinical alarms for a better control of the disease.

3 SCOPE AND LIMITATIONS OF THE STUDY.

Within our study, the limitations given by: the secondary information obtained since there are measurement errors were evidenced, since it was not possible to verify measurement of the variables such as the taking of blood pressure, weight, height that their measurements are usually dependent operator, there is also evidence limitation within this information since there was missing information for which the studied sample was reduced.

4 CONCLUSIONS.

From the present research it is concluded that:

- The probability of risk condition of a diabetic patient can be estimated by a binary logistic regression model from variables age, weight, number of years with the disease, dietary hygienic measures and consumption of oral antidiabetics. Of these, the variable age, weight and number of years with the disease increase the level of risk while following dietary hygiene measures and consumption of oral antidiabetics decrease the level of risk.
- Patients in risk condition found are: patient who do not follow dietary hygienic measures or consume oral antidiabetics, over 60 years or patients with more than 60 kg or patients with 6 years with the disease who follow dietary hygienic measures, but do not consume oral antidiabetics; and patients with 12 years who have diagnosed the disease who follow dietary hygienic measures and consume oral antidiabetics.

With the information extracted from the study, it is recommended at the clinical level:

- Encourage the habit of dietary hygiene measures and the consumption of oral antidiabetic drugs in diabetic patients to keep this disease under control.
- Generate strategies to control the weight of patients from the age of 60 who do not follow dietary hygienic measures that consume oral antidiabetics.
- Maintain studies of the evolution of risk according to the time of the disease diagnosed.

5 DECLARATION OF CONFLICT OF INTEREST.

As an author I declare that there is no conflict of interest in any kind, neither real nor potential on the results presented.

REFERENCES

1. M Palacios, J Hernández, "Epidemiological behavior of type 2 diabetes mellitus and its risk factors in adult patients in the outpatient clinic of the Basic Hospital of Paute, Azuay – Ecuador", Rev. Lat. H, vol. 13, no. 2, pp. 89 – 96, 2018.
2. Rovalino Castro, M. I., & Betancourt Constante, M. V. (2022). Literature review on diagnosis and treatment of type 2 diabetes mellitus in patients with metabolic syndrome. RECIMUNDO, 6(suppl 1), 319-330. https://doi.org/10.26820/recimundo/6. (suppl1).June.2022.319-330.
3. International Diabetes Federation, IDF Diabetes Atlas 2021 – 10th edition | Disponible en: www.diabetesatlas.org
4. Zavala Calahorrano A, Fernández E. Type 2 diabetes mellitus in Ecuador: epidemiological review. MedicienciasUTA [Internet]. 1 December 2018 [cited 30 April 2023];2(4):3-9. Available in: https://revistas.uta.edu.ec/erevista/index.php/medi/article/view/1219
5. Aschner P. New IDF clinical practice recommendations for managing type 2 diabetes in primary care. Diabetes Res Clin Pract. 2017;132:169–70. Codigo DOI: 10.1016/j.diabres.2017.09.002. Disponible en: https://pubmed.ncbi.nlm.nih.gov/28962686/
6. Classification and diagnosis + ostico of diabetes: standards of medical care in diabetes – 2022. American Diabetes Association Professional Practice Committee. *Diabetes Care* 2022;45(Suplemento_1):S17–S38 DOI: https://doi.org/10.2337/dc22-S002 Available from: https://diabetesjournals.org/care/article/45/Supplement_1/S17/138925/2-Classification-and-Diagnosis-of-Diabetes.
7. American Diabetes Association Professional Practice Committee; 6. Glycemic Targets: *Standards of Medical Care in Diabetes—2022*. *Diabetes Care* 1 January 2022; 45 (Supplement_1): S83–S96. https://doi.org/10.2337/dc22-S006. Disponible en: 6. Objetivos glucémicos: Estándares de atención médica en diabetes: 2022 | | de Cuidado de la Diabetes Asociación Americana de diabetes (diabetesjournals.org))

8. American Diabetes Association Committee on Professional Practice; 9. Pharmacological approaches to glycemic management: *standards of care in diabetes—2022*. *Diabetes Care* January 1, 2022; 45 (Suplemento_1): S125–S143. https://doi.org/10.2337/dc22-S009. Available in: https://diabetesjournals.org/care/article/45/Supplement_1/S125/138908/9-Pharmacologic-Approaches-to-Glycemic-Treatment
9. Aschner Montoya P, Muñoz Velandía OM, Girón Cardozo DM, García Morales OM, Fernández Ávila DG, Casas L Ángela, Bohórquez Villamizar LF, Arango Toro CM, Carvajal Gutiérrez L, Ramírez De Peña DA, Sarmiento Ramón JG, Colón CA, Correa González NF, Alarcón Robles P, Bustamante Álvaro A. Clinical practice guidelines for the treatment of type 2 diabetes mellitus: Initial management. Univ. Med. [Internet]. 19 October 2017 [cited 22 February 2022];58(4). Available in: https://revistas.javeriana.edu.co/index.php/vnimedica/article/view/20315
10. American Diabetes Association (ADA). Type 2 diabetes guide for clinicians. Redgdps [Internet]. 2022;(Dm):264. Available from: https://www.redgdps.org/gestor/upload/colecciones/Guia DM2_web. .pdf.
11. American Diabetes Association Professional Practice Committee; 10. Cardiovascular Disease and Risk Management: *Standards of Medical Care in Diabetes—2022*. *Diabetes Care* 1 January 2022; 45 (Supplement_1): S144–S174. https://doi.org/10.2337/dc22-S010. Disponible en: 10. Cardiovascular Disease and Risk Management: Standards of Medical Care in Diabetes—2022 | Diabetes Care | American Diabetes Association (diabetesjournals.org)
12. Mazón P, Marín F, Cosín-Sales J, Cordero A, Roldán I, García-Moll X, et al. Comments to the 2018 ESC/ESH guideline on the diagnosis and treatment of arterial hypertension. Rev Esp Cardiol [Internet]. 2019;72(2):104–8. DOI: 10.1016/j.rec.2018.12.005 Available from: http://dx.doi.org/10.1016/j.recesp.2018.11.022
13. Piñeros-Garzón FS, Rodríguez-Hernández JM. Risk factors associated with glycemic control and metabolic syndrome in patients with type 2 diabetes mellitus. Villavicencio, Colombia. Univ Health [Internet]. 2018;21(1):61–71. Available in: http://dx.doi.org/10.22267/rus.192101.140
14. Cuevas Fernández FJ, Pérez de Armas A, Sardinia Rodríguez E, Hernández Andreu M, Iglesias Girón MJ, García Marrero MR, et al. Poor control of type 2 diabetes in a primary care health center: modifiable factors and target population. Aten Primaria [Internet]. 2021;53(9):102066. Available in: http://dx.doi.org/10.1016/j.aprim.2021.102066.
15. Lara, L; Alba, L; Fernandez, F; Cuervo A. Genome-environment interaction in the genesis of type 2 diabetes mellitus. Acta Médica Cent. 2017;11(4):56–69.
16. Latin American Diabetes Association. (2019). ALAD Guidelines on the Diagnosis, Control and Treatment of Type 2 Diabetes Mellitus with Evidence-Based Medicine. ALAD. https://www.paho.org/hq/index.php?option=com_content&view=article&id=2164:2010-guias-alad-diagnostico-control-tratamiento-diabetes-mellitus-tipo-2&Itemid=39447&lang=es
17. Acosta-Andrade, A. D., Solorzano-Solorzano, S. E., Bravo-Bonoso, D. G., Bazurto-García, J.K., Cedeño-Holguin, D. M., & Hurtado-Aponte, R. C. (2019). Risk factors for obesity in public employees. Dom. One hundred, 5(1), 91-117.
18. Sánchez Martínez, Belkis, Vega Falcón, Vladimir, Gómez Martínez, Nairovys, & Vilema Vizuete, Germania Elizabeth. (2020). Case-control study on risk factors for type 2 diabetes mellitus in older adults. *Journal of University and Society*, *12*(4), 156-164. Epub August 02, 2020. Retrieved on April 30, 2023, from http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2218-36202020000400156&lng=es&tlng=es.
19. Petermann F, Díaz-Martínez X, Garrido-Méndez Á, Leiva AM, Martínez MA, Salas C, et al. Association between type 2 diabetes mellitus and physical activity in people with a family history of diabetes. Gac Sanit [Internet]. 2018;32(3):230–5. Available in: http://dx.doi.org/10.1016/j.gaceta.2017.09.008
20. Mora Romo JF. Treatment adherence in people with type 2 diabetes mellitus in Mexico: A meta-analysis study. Psicumex [Internet]. 2022;12:1–20. Available in: http://dx.doi.org/10.36793/psicumex.v12i1.493.
21. Szczerbiński Ł, Gościk J, Bauer W, Wawrusiewicz-Kurylonek N, Paczkowska-Abdulsalam M, Niemira M, et al. Efficacy of family history, genetic risk score, and physical activity in assessing the prevalence of type 2 diabetes. Pol Arch Intern Med [Internet]. 2019;129(7–8):442–50. Disponible en: http://dx.doi.org/10.20452/pamw.14866