International Journal of Medical Science and Clinical Research Studies

ISSN(print): 2767-8326, ISSN(online): 2767-8342

Volume 03 Issue 08 August 2023

Page No: 1685-1688

DOI: https://doi.org/10.47191/ijmscrs/v3-i8-45, Impact Factor: 6.597

Prevalence among Patients with Obesity and Glycemic Dyscontrol in Type 2 Diabetics at the Hospital Issste Irapuato Clinic

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ABSTRACT

Introduction: Diabetes mellitus is a metabolic disease characterized by a defect in blood glucose regulation caused by alterations in pancreatic endocrine function, mainly due to a deficiency in the β-cells of the pancreatic islets that are responsible for insulin secretion, or by loss of sensitivity to this hormone in the effector tissues. Obesity is defined according to the WHO as abnormal or excessive accumulation of fat that can be harmful to health and a body mass index (BMI) > 30 - 34.9 refers to grade I obesity, > 35 - 39.9 to grade II obesity and > 40 to grade III obesity.
The main objective of this study is to know the prevalence among patients with a body mass index > 30 kg/m^2 with poor glycemic control in type 2 diabetics.
Material and methods: A retrospective observational study was carried out at the Clínica Hospital ISSSTE Irapuato, which lasted eleven months, and information was obtained from the database of the Integral Management of Diabetes by Stages (MIDE) program. The sample was taken from 86 patients, in a randomized manner.
Results: 49.69% of the patients presented obesity, being the female sex and the age group > 60 years the most affected; the percentage of patients with obesity who presented glycemic dyscontrol was 45.71%, with the group > 60 years being the most prevalent.
It was observed that patients who do not present obesity have a better glycemic control in 64.70% compared to those who are obese who obtained 54.28%.
Discussion: The study sample was easily evaluated. The difficulties encountered were time and information collection, since several of the files were duplicated and the information had to be unified.
Conclusion: We confirm the hypothesis that the higher the body mass index, the higher the glycemic dyscontrol, since patients with obesity show a glycemic dyscontrol up to 10.4 times more than those with a body mass index < 30 kg/m^2 .

ARTICLE DETAILS

Published On:
21 August 2023

Available on:
https://ijmscr.org/

INTRODUCTION

Diabetes mellitus is a metabolic disease characterized by a defect in blood glucose regulation due to a deficiency in the effect of insulin, caused by an alteration in the endocrine function of the pancreas or by laceration in the effector tissues that lose theirsensitivity to this hormone. Pancreatic islets are made up of four cell types: β, α, δ and PP or F cells, which synthesize and release hormones such as insulin, glucagon, somatostatin and pancreatic polypeptide, respectively.(1)
Diabetes mellitus represents a serious public health problem. Its incidence ranges between 1-2% of the world population. The most frequent type is non-insulin-dependentdiabetes, also known as type 2.(1)
According to INEGI, for the last 10 years diabetes mellitus has been the second leadingcause of death in women and men in Mexico.(1)
The prevalence of type 2 diabetes mellitus is expected to double worldwide from 171 million in 2000 to 366 million in 2030.(6)
Diabetes mellitus is classified into type 1 or also known as insulin-dependent diabetes and type 2. Type 1 DM commonly begins in childhood and is considered a chronic inflammatory disease caused by the specific destruction of β-cells in the islets of Langerhans of the pancreas while type 2 DM has different modifiable (obesity, dyslipidemia, diet rich in carbohydrates, sedentary lifestyle) and non-

Modifiable (polygenic inheritance, arterial hypertension,

family inheritance) risk factors. (1)

Type 2 diabetes is associated with a lack of adaptation to increased insulin demand, aswell as loss of cell mass due to glucotoxicity.

Insulin release is induced in response to increased blood glucose; glucose, amino acids,fatty acids and ketone bodies promote insulin secretion and β2-adrenergic receptor activation, whereas 2-adrenergic receptors inhibit insulin release.(1)

Insulin release is triggered by β-cell depolarization upon uptake of increased plasma carbohydrate concentration, fructose and glucose enter the β-cell through facilitated transport mediated by glucose transport 2 (GLUT2). GLUT2 is a low affinity glucose transporter expressed in liver, kidney, pancreatic β-cells and small intestine, which participates in the regulation of insulin secretion allowing glucose transport when the plasma concentration reaches the affinity threshold (>70 mg/dL) and in response to insulin release. Following entry of glucose (or fructose) into the β-cell via GLUT2, the carbohydrate is phosphorylated to glucose-6-phosphate (G-6-P) by the enzyme glucokinase, this process determines the rate of glycolysis and subsequent oxidative processes culminating in an increase in the ATP/ADP ratio in the cytosol. Finally, depolarization of the cell occurs because of the closure of ATP-sensitive K+ channels, increasing the membrane potential until the opening of L-type voltage-dependent Ca2+ channels is reached. Cytosolic Ca2+ influx induces fusion of exocytic insulin-containingvesicles with the plasma membrane. (1)

The diagnostic criteria for type 2 diabetes mellitus according to the American DiabetesAssociation 2022 (ADA).

- Glycosylated hemoglobin ≥ 6.5%.
- Fasting plasma glucose ≥ 126 mg/dL.
- Plasma glucose at 2 hours ≥ 200 mg/dL during an oral glucose tolerancetest using a glucose load containing the equivalent of 75 grams of glucose.

Diagnosis requires two abnormal test results from the same sample or from two differentsamples, except when there are unequivocal signs of DM2 in which case a random blood glucose ≥ 200 mg/dl, is sufficient. (2) Glycemic control is assessed by measurement of HbA1c, continuous glucose monitoring (CGM) using time in range (TOR) and/or the glycemic management indicator (GMI) and glycemic self-monitoring (SGM).(2)

The time in range indicates the percentage of time blood glucose is within the target range, the blood glucose management indicator indicates the average HbA1c level that would be expected based on the average glucose measured.(2)

A 14-day assessment of continuous glucose monitoring of TER and IGG can serve as a surrogate for HbA1c.(2)

The recommendations for glycemic control are as follows(2)

- HbA1C < 7.0%.

Regarding HbA1C the target should be personalized based on age, evolution ofdiabetes, life expectancy, comorbidities and concomitant diseases.

In patients with no risk of hypoglycemia or at the onset ofof microalbuminuria HbA1C < 6.5% is recommended.

In elderly with few diseases and intact cognition, HbA1C < 7.5% is recommended.

In long-standing disease, associated comorbidities, tendency to hypoglycemia, micro and macrovascular complications, HbA1C < 8% is recommended.

Capillary plasma glucose - preprandial 80 - 130 mg/dl

Postprandial peak capillary plasma glucose < 180 mg/dl, measurements should betaken one hour to two hours after the onset of the glucose spike.

Obesity is defined according to WHO as an abnormal or excessive accumulation of fatthat may be harmful to health and a body mass index (BMI) of

> 30 - 34.9 indicates grade I obesity, ≥ 35 - 39.9 grade II obesity and ≥ 40 grade III obesity. (3)

This disease is considered one of the main social and health problems we face in the XXI century, since it is currently estimated that the number of obese people in the worldis more than 300 million, with a wide global distribution and a higher prevalence in developed and developing countries. This increase in prevalence is closely related to dietary factors and an increase in sedentary lifestyle.(4)

It is a chronic disease of multifactorial origin, due to several predisposing factors: age, sex, genetics, ethnicity, hormonal factors, diet, level of physical activity/exercise, pharmacological agents, and other factors such as smoking and stress.(3)

It has been studied that more than 50% of the population has an unfavorable lifestyle, elevated abdominal perimeter, elevated hyperglycemia, elevated C-LDL, decreased C-HDL and increased triglycerides, all of which are associated with poor metabolic control.(5) The increase in total body fat is associated with increased health risk mainly the increase in the amount of visceral abdominal fat also known as central adiposity, leadsto the secretion of inflammatory bioactive peptides (adipokines) from adipose tissue. These adipokines have crucial effects on glucose and lipid metabolism, insulin resistance, diabetes, atherosclerosis, vascular endothelium, inflammation and cardiovascular function which has been associated with increased risk of comorbidity and mortality.(3,8)

The risk of sudden death in obese patients is three times higher than in non-obese patients, and is twice as high for the development of congestive heart failure (CHF), cerebrovascular disease (CVD) and ischemic heart disease (IHD), while the possibilityof developing diabetes mellitus

(DM) is 93 times higher when the body mass index (BMI) exceeds 35.13. Obesity is closely related to insulin resistance and has important pathophysiological effects in the development of DM, metabolic syndrome and systemicarterial hypertension.(4)

Omentin is a protein 313 amino acids long, it has been identified in two homologous isoforms, omentin 1 and omentin 2, where omentin 1 is the main omentin present in human blood and is an anti-inflammatory adipokine that is expressed mainly in human omental adipose tissue, specifically in visceral tissue, not in subcutaneous tissue. It plays an important role in the modulation of insulin sensitivity by paracrine and endocrine factor where it enhances insulin sensitivity by accelerating only insulin-mediated glucose transport and has no effect on basal glucose transport.(8)

A significant decrease in serum omentin 1 levels has been found in obese patients withtype 2 diabetes mellitus compared to healthy subjects. Serum omentin 1 levels are inversely related to obesity, insulin resistance and systolic blood pressure therefore abnormalities in circulating omentin 1 can be used as a biomarker of obesity and associated metabolic and vascular disorders.(8)

As mentioned above, obesity is a modifiable risk factor for the development of type 2 diabetes mellitus; there is evidence from many prospective studies that weight reductionthrough lifestyle modifications, including dietary changes and regular physical activity, reduces the risk of diabetes in high-risk groups.(6) Implementing preventive measures from early childhood will have far-reaching benefits.(6,7)

As previously mentioned, it is important to monitor childhood overweight since it was positively associated with the risk of type 2 diabetes. Were stronger at older overweight ages and at younger ages at diagnosis. Men who had had overweight remission before age 13 years had a risk of having type 2 diabetes diagnosed between 30 and 60 years of age similar to that of men who had never been overweight in contrast an increase in body mass index between age 7 years and early adulthood was associated with an increased risk of type 2 diabetes. (9)

One of the main pillars for the management of glycemic control and obesity is lifestyle changes, which encompasses diet, physical activity and behavioral therapy.(2)

The Mediterranean diet has been studied since the beginning of the sixties and its main characteristics are: high consumption of fats (even higher than 40% of total energy); mainly in the form of olive oil; high consumption of unrefined and whole grains preferably, fruit, vegetables, legumes and nuts; moderate - high consumption of fish; moderate low consumption of white meat (poultry and rabbit) and dairy products preferably skimmed, mainly in the form of yogurt or fresh cheese; low consumption of red meat and meat products, and moderate consumption of wine with meals. (10)

It was demonstrated that adherence to the Mediterranean diet is related to better glycemic control, decrease in glycosylated hemoglobin, decrease in cardiovascular risk,and in patients at high risk of developing type 2 diabetes mellitus, a 23% reduction in risk was observed.(10)

The other point of great importance is exercise, a study was analyzed where it was shown that low intensity exercise such as walking, which is easy to master and easy tointegrate into daily life, achieved a daily energy consumption of 300 - 400 Kcal with more than 10,000 steps; Which proved in patients with diabetes a good effect on the control of blood glucose levels and reduction of glycosylated hemoglobin, but it is important to mention that the effect was not evident for patients with severe diabetes.(11)

It is important to emphasize nutrition and physical activity in addition to medicaltreatment, since poor glycemic control in patients with type II diabetes mellitus is closely related to macrovascular and microvascular complications, as well as to evolution timesgreater than 20 years after the onset of the disease.(12)

MATERIAL AND METHODS

A retrospective observational study was conducted at the Clínica Hospital ISSSTE Irapuato from August 2021 to June 2022, obtaining the information through the database of the Integral Management of Diabetes by Stages (MIDE) program, having 1000 active enrolled patients, epiinfo mathematical formula is performed to perform a study with a confidence level of 97.6% with a acceptability of 3.1%; which suggests a sample size of 86 to 103 patients. This study was carried out by taking 86 patients in a randomized manner to obtain the prevalencebetween a BMI ≥ 30 with glycemic dyscontrol in patients with type 2 diabetes mellitus.

RESULTS

This study was carried out in 86 patients already diagnosed with type 2 diabetes mellitus, taking into account sex, age, BMI and glycemic control, HbA1C, fasting and postprandial glycemia.

Two main groups were made, the first group called patients with obesity (those with a BMI ≥ 30); the second group called patients without obesity (BMI 18.5 - 29.9). Each of these groups has two subgroups, one depending on BMI and the other depending on glycemic dyscontrol, each with their respective classifications and subclassifications which are: age (under 40 years, 40 to 59 years and over 60 years); sex (male or female);glycemic control and glycemic dyscontrol. Glycemic control was defined as HbA1C <7.0%, fasting glucose of 80-130 mg/dl and postprandial glucose <180 mg/dl, and glycemic dyscontrol as one or more figures obtained outside the aforementioned goals.

The results obtained in this study were as follows: 49.69% of the patients presented obesity (belonging to group one); the female sex presented a higher frequency of obesity in 57.14% compared to the male sex with 45.71%; the most affected age groupwas ≥ 60 years; the percentage of patients with obesity who presented glycemic dyscontrol was 45.71% while those who showed glycemic control was higher with 54.28%. Of the obese patients with metabolic dyscontrol, the male sex presented greater metabolic dyscontrol (62.50%) than the female sex (37.50%) and the age group with the greatest glycemic dyscontrol was ≥ 60 years with 62.50% .The patients who did not present obesity (59.30%) were greater than those who did; despite not having presented obesity, 35.29% showed data of metabolic dyscontrol, with the sex with the highest prevalence being female (61.11%) and the most affected age group was ≥ 60 years old (55.55%).

It was observed that patients who are not obese have a better glycemic control of 64.70% compared to those who are obese, who obtained 54.28%.

DISCUSSION

The main objective of this research protocol was to establish the prevalence between aBMI >30 with glycemic dyscontrol in patients with type 2 diabetes mellitus in the hospitalissste irapuato clinic, the study sample was easily evaluated, since this research was based on data collection from the MIDE program.

The main difficulties in preparing this study were time and the compilation of the information, since several of the files were duplicated and the information had to be unified. One of the advantages is that the data collection for the years 2021 and 2022 was electronic.

CONCLUSION

The hypothesis that the higher the body mass index, the greater the increase in glycemic dyscontrol is confirmed, since patients with obesity show up to 10.4 times more glycemic dyscontrol than those with a body mass index < 30 kg/m^2 Something important to highlight about the MIDE program is that it has a higher prevalence of patients with a BMI < 30 kg/m^2 and in those patients with a BMI ≥ 30 kg/m^2 it was observed that more than 50% have adequate glycemic control.

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