

Clinical and sociodemographic characterization Diabetes Mellitus in pediatric patients of the Hospital Regional de la Orinoquía, Yopal, Colombia

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Abstract

Introduction: Diabetes mellitus (DM) is a chronic metabolic disorder that is increasing in the pediatric population and leads to multiple micro and macrovascular complications. It is a public health problem due to the high costs of diagnosis and treatment. According to the International Diabetes Federation (IFD) the annual incidence in the world is increasing, due to an age prevalence between 0-14 years of 98.2% and 0-19 years of 128.9% between 2019 and 2021 with an incidence of 108.3% and 149.5% respectively per 100,000 inhabitants in 215 countries.

Objective: To describe the clinical characteristics of a group of children and adolescents admitted to the emergency department of the Hospital Regional de la Orinoquía (HORO) in Yopal-Casanare in the period 2019 to 2020 with de novo or previous diagnosis of diabetes mellitus.

Methodology: An observational, descriptive, and retrospective study, case series type, where patients under 18 years of age with de novo or previous diagnosis of diabetes mellitus in the period of 2019 -2020 in the Regional Hospital of Orinoquía were included. A total of 15 patients were analyzed.

Results: The classification of the patients according to age group and sex shows a predominance of the male gender with 53.3% of the 15 patients

who met the diagnostic criteria, while the female population was 46.6%. The average age of the pediatric patients was 13 ± 13.2

Conclusions: The study carried out at the Hospital Regional de la Orinoquía showed that the most frequent age group was 11 to 13 years old, with a significant predominance of males, coming from urban areas. It was found that low weight is an alarming fact in addition to altered glycemia values that are related to the complications presented at the time of admission of the patient, which represents a public health problem among children and young adults due to the heterogeneity of the genetic and environmental factors.

Keywords: Diabetes mellitus type 1, Symptomatology, Complications, Associated diseases, Glycemia, Incidence.

Resumen

Introducción: La Diabetes Mellitus (DM) es una alteración metabólica crónica, creciente en la población pediátrica que conduce a múltiples complicaciones micro y macro vasculares. Es un problema de salud pública por los altos costos que conlleva el diagnóstico y tratamiento. Según la Federación Internacional de Diabetes (IFD), la incidencia anual en el mundo está aumentando, debido a que la prevalencia de edad entre 0-14 años es de 98.2% y de 0-19 años es de 128.9% entre el 2019 y 2021 con una incidencia de 108.3% y 149.5%, respectivamente, por 100.000 habitantes en 215 países.

Objetivo: Describir las características clínicas de un grupo de niños y adolescentes que ingresaron al servicio de urgencias del Hospital Regional de la Orinoquía (HORO) de Yopal-Casanare, en el período 2019 -2020 con diagnóstico de novo o previo de diabetes mellitus.

Metodología: Se realizó un estudio observacional, descriptivo y retrospectivo, tipo serie de casos, donde se incluyeron pacientes menores de 18 años con diagnóstico de novo o previo de diabetes mellitus en el período de 2019 - 2020 en el Hospital Regional de la Orinoquía. Se analizaron un total de 15 pacientes.

Resultados: Se muestra la clasificación de los pacientes según grupo de edades y sexo, se encuentra predominio del género masculino con un 53,3% de los 15 pacientes que cumplían con los criterios diagnósticos, mientras que la población femenina fue de 46,6%. La edad promedio de los pacientes pediátricos fue de 13 ± 13.2

Conclusiones: En el estudio realizado en el Hospital regional de la Orinoquía, la edad entre 11 - 13 años es la más frecuente para DM, con un predominio significativo del sexo masculino, provenientes de áreas urbanas. Se halló que el bajo peso es un dato alarmante, además de valores de glicemia alterados que se relacionan con las complicaciones presentadas al momento del ingreso del paciente, lo cual representa un problema de salud pública entre niños y adultos jóvenes debido a la heterogeneidad, del factor genético y ambiental.

Palabras Clave: Diabetes Mellitus tipo 1, sintomatología, complicaciones, enfermedades asociadas, glicemia, incidencia.

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder that is growing in the pediatric population and leads to multiple micro and macrovascular complications. It is a public health problem due to the high costs involved in diagnosis and treatment; it increases when it is not identified in a timely manner, generating frequent admissions to the emergency department for decompensation or de novo diagnosis of diabetes mellitus (DMDN) (1-3).

According to the International Diabetes Federation (IDF), the annual incidence in the world is increasing, due to an age prevalence between 0-14 years of 98.2% and between 0-19 years of 128.9% between 2019 and 2021, with an incidence of 108.3% and 149.5%, respectively, per 100,000 inhabitants in 215 countries (4).

Type I DM is an autoimmune disease characterized by the loss of beta cells and insulin production deficit that generates hyperglycemia. The pathogenesis consists of the destruction of beta cells by the action of T lymphocytes associated with environmental and genetic factors. The antigen-antibody mechanism targeting insulin, 65 kDa glutamic acid decarboxylase, insulinoma-associated protein 2 and zinc transporter 8, are proteins related to beta-cell secretion, which end up being markers of autoimmunity in DM I (5-6).

Type 2 DM is a multicausal, heterogeneous disease of multiple molecular defects such as decreased insulin production, insulin resistance to glucose transport and absorption, and incretin response mechanisms that

«Diabetes mellitus (DM) is a chronic metabolic disorder that is growing in the pediatric population and leads to multiple ...



result in hepatic glucose production and dysregulation of fat metabolism (lipotoxicity) (7-8). The main associated mechanism is through inflammation and the response of inflammatory mediators produced in response to elevated blood glucose levels, with consequent insulin dysfunction (9-10). The risk factors are sociodemographic and environmental, including obesity, overweight, female sex, polycystic ovarian syndrome (PCOS), acanthosis nigricans, ethnicity, poor eating habits, sedentary childhood and youth, and low socioeconomic status (10-11).

The clinical spectrum can be nonspecific in initial phases or present the typical symptoms and signs of diabetes such as polyuria, polydipsia and polyphagia, accompanied by some degree of dehydration and even neurological alterations in advanced phases (12). The development of complications is determined by the inability of target organs to regulate the low absorption of glycemia and together with hyperglycemia causes excessive production of mitochondrial superoxide and oxidative stress, including microvascular and macrovascular complications (12-13).

The aim of this study is to describe the clinical characteristics of a group of children and adolescents admitted to the emergency department of the Hospital Regional de la Orinoquía (HORO) in Yopal-Casanare in the period 2019 to 2020 with de novo or previous diagnosis of diabetes mellitus.

Methodology.

We conducted an observational, descriptive and retrospective study, case series type, which included patients under 18 years of age with novo or previous diagnosis of diabetes mellitus in the period from 2019 to 2020 in the Hospital Regional de la Orinoquía; these were identified by ICD 10 codes and included children or adolescents with glucose on admission by emergency with a value $>150\text{mg/dl}$ and also those who were seen by outpatient clinic with the same result. Those with incomplete clinical history, previous diagnosis of diabetes secondary to drug use, diabetes insipidus and gestational diabetes were excluded.

The data collection was carried out by one of the researchers of the study. The data were collected in the Excel program version 2013, in a database containing the list of variables of importance for the study. Patients were first identified by disease codes, then the clinical histories were reviewed and those who met the diagnostic criteria for diabetes were included.

The variables included and reviewed in the corresponding medical records were gender, age, municipality of residence, diagnosis, admission, his-

tory, glycemia, BMI, symptoms, associated diseases, management, complications, outcome and follow-up of each patient.

The database was recorded in Excel version 2013 and analyzed in the SPSS version 22 statistical package. A univariate analysis was performed by determining the absolute and relative frequencies of the categorical variables; for the quantitative variables, the measures of central tendency (mean and median) and measures of dispersion (interquartile range and standard deviation) were calculated.

The biases that occurred in the research are the selection bias, which is why the inclusion and exclusion criteria were described in order to select them appropriately. The second bias that can occur is that of information, since some clinical histories were incomplete, for which reason they were excluded.

The study was developed in accordance with the norms established in Resolution 8430 of 1993 of the Ministry of Health. According to article 11, this study is classified as “risk-free” research, since no intervention or intentional modification of the biological, physiological, psychological, or social variables of the individuals participating in the study was performed. Participation was voluntary and those who agreed to take part in the study signed an informed consent form.

Results

1. Sociodemographic characterization of pediatric patients with Diabetes mellitus

The classification of the patients according to age group and sex is shown below. There was a predominance of the male gender with 53.3% of the 15 patients who met the diagnostic criteria, while the female population was 46.6%.

The average age of the pediatric patients was 13 ± 13.2 ; most of the cases were from the city of Yopal with 66.6%, followed by Aguazul with 13.3% and with an equal percentage of 6.6% Hato Corozal, Paz de Ariporo and Villanueva; of which 73.3% were admitted to the emergency department. The characteristics found can be seen in Table 1.

«The main associated mechanism is through inflammation and the response of inflammatory mediators produced in response to elevated blood glucose levels, with consequent insulin dysfunction ...»



Table 1. Sociodemographic characteristics of pediatric patients with a diagnosis of Diabetes mellitus treated in the period of 2019-2020.

| Variable | n | % |
|-----------------------------------|----|-------|
| Gender | | |
| Female | 7 | 46,7% |
| Male | 8 | 53,3% |
| Age | | |
| 10 | 1 | 6,6% |
| 11 | 3 | 20% |
| 12 | 3 | 20% |
| 13 | 3 | 20% |
| 15 | 2 | 13,3% |
| 16 | 1 | 6,7% |
| 17 | 2 | 13,3% |
| Municipality of residence | | |
| Aguazul | 2 | 13,3% |
| Hato Corozal | 1 | 6,7% |
| Paz de Ariporo | 1 | 6,7% |
| Villanueva | 1 | 6,7% |
| Yopal | 10 | 66,7% |
| Admission | | |
| Emergencies | 11 | 73,3% |
| Outpatient Consultation | 3 | 20% |
| Referred | 1 | 6,7% |
| Glycemia value | | |
| < 150 | 3 | 20% |
| 150 - 300 | 3 | 20% |
| 300 - 450 | 4 | 26,7% |
| > 450 | 5 | 33,3% |
| IMC | | |
| Underweight | 9 | 60% |
| Normal | 5 | 33,3% |
| Overweight | 1 | 6,7% |
| Pharmacological management | | |
| Short-acting insulin | 13 | 86,7% |
| Intermediate-acting insulin | 1 | 6,7% |
| Long-acting insulin | 7 | 46,7% |
| Oral hypoglycemic agent | 3 | 20% |
| Unknown | 3 | 20% |
| Follow-up | | |
| Pediatric Endocrinology | 8 | 53,3% |

| | | |
|---------------|---|-------|
| Pediatrics | 4 | 26,7% |
| PICU Referral | 2 | 13,3% |
| Morgue | 1 | 6,7% |

At admission, the patients presented glycemia figures higher than 450 g/dL, which is equivalent to 33.3% of the population, although 66.6% had no associated diseases, and when looking at the BMI variable, 60% were underweight at the time of diagnosis.

The management scheme used in pediatric patients was short-acting insulin 86.6% with respect to long-acting insulin 46.6%; oral hypoglycemic agents monotherapy represented only 20% of the management, associated with low weight and altered glycemia values.

Of the total population analyzed, 20% were referred to the intermediate care unit; 26.6% equivalent to 4 patients, of which only one patient had comorbidity acute lymphoid leukemia in palliative therapy whose outcome was death, and only 73.3% were discharged with subsequent follow-up to pediatric endocrinology and pediatrics.

2. Clinical characteristics of pediatric patients with Diabetes mellitus

An important element to highlight at the time of diagnosing the patients was the clinical manifestations, presenting with signs of dehydration 40%, followed by nausea and vomiting with 33.3%, polyuria, polydipsia, asthenia and adynamia represented 26.6% each; 20% of the patients presented polyphagia of the clinical triad of DM and of the total number of patients admitted 13.3% presented fever associated with urinary tract infection (UTI) and pneumonia.

The complications presented in the pediatric population were ketoacidosis and hyponatremia 20% each, one case of hypokalemia 6.7%; other types of complications such as pneumonia, UTI, pancreatitis and arterial hypertension 20%; however, patients who did not develop any complication predominated 33.3%, as shown in Table 2 and graphs 1 and 2.

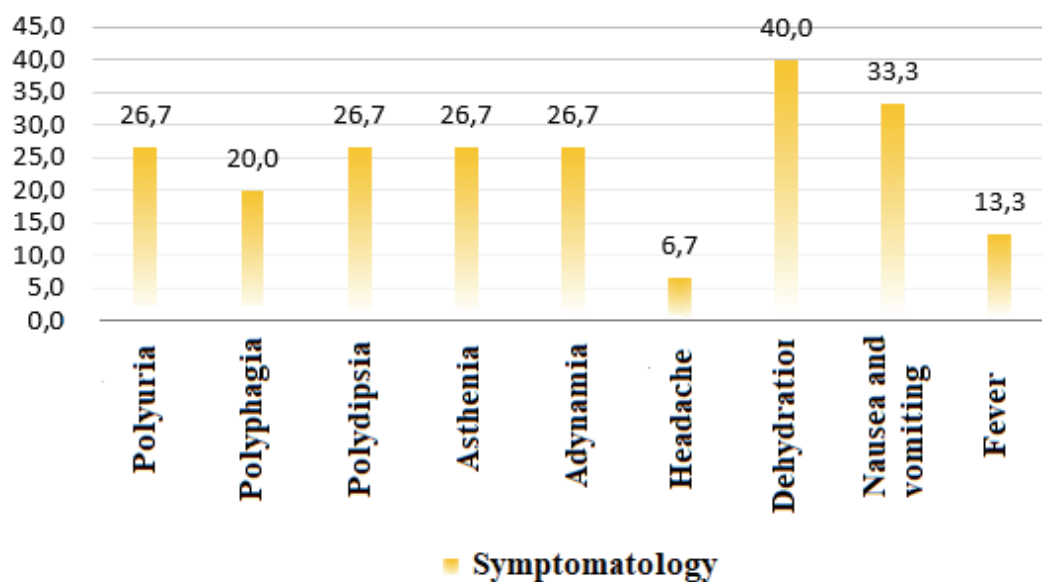
«An important element to highlight at the time of diagnosing the patients was the clinical manifestations, presenting with signs of dehydration 40%, followed by nausea and vomiting with 33.3% ...»



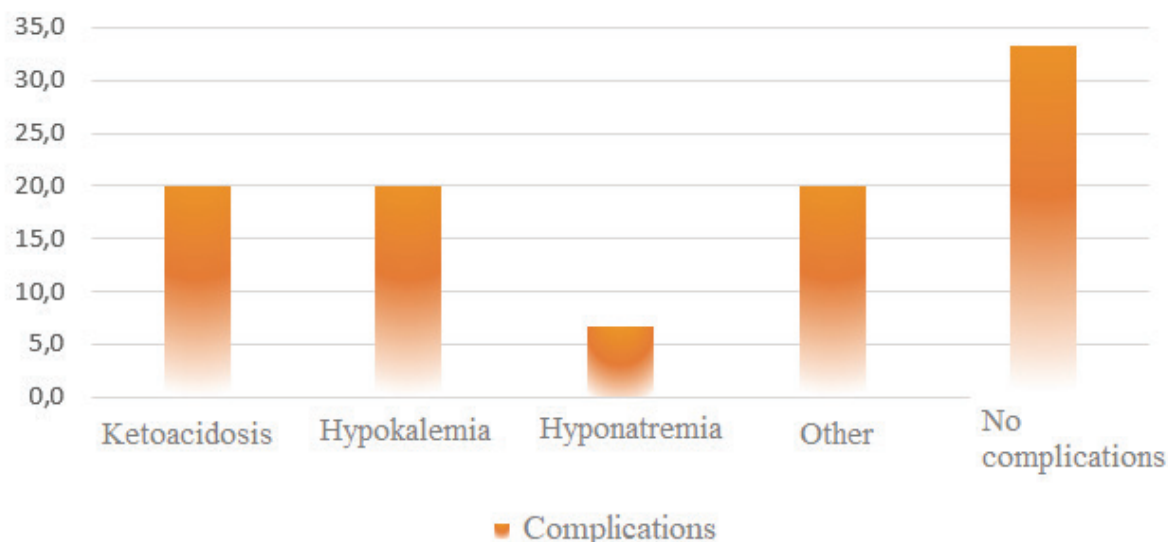
Table 2. Percentages of DM variables and complications

| Variables | n | % |
|-----------------------|---|-------|
| Symptomatology | | |
| Dehydration | 6 | 40% |
| Nausea and vomiting | 5 | 33,3% |
| Polyuria | 4 | 26,7% |
| Polydipsia | 4 | 26,7% |
| Asthenia | 4 | 26,7% |
| Adynamia | 4 | 26,7% |
| Polyphagia | 3 | 20% |
| Fever | 2 | 13,3% |
| Headache | 1 | 6,6% |
| Complications | | |
| Ketoacidosis | 3 | 20% |
| Hypokalemia | 3 | 20% |
| Hyponatremia | 1 | 6,7% |
| Other | 3 | 20% |
| No complications | 5 | 33,3% |

Graph 1. Representation of signs and symptoms of pediatric patients with a diagnosis of DM treated in the period 2019-2020



Graph 2. Representation of the complications of pediatric patients with a diagnosis of DM treated in the period 2019-2020



Discussion

The data presented in relation to age agree with the literature considering that the frequency of type 2 diabetes mellitus (DM2) is after the onset of puberty or after 10 years of age, whichever occurs first, in overweight children and adolescents who have one or more additional risk factors for diabetes (14), but in our research overweight or obesity is not an increased data, on the contrary, underweight is found in 60%. For this reason, children/young people who do not show a continuous increase in BMI should not be excluded.

A study presented by Serbis et al. (15) shows how DM2 in children and adolescents can present with typical symptoms of hyperglycemia, such as polyuria, polydipsia and nocturia, as in patients with DM1. Recent weight loss may also be present as in our population sample, but it is generally less severe than in DM1 (15).

Meanwhile, Graves et al. (16) found that adolescents aged 10 to 17 years already had complications and demonstrated this in a group of young people with type 1 diabetes with a mean age of 15.1 years and a mean duration of type 1 diabetes of 1.8 years. Seventy-two percent had evidence of some complication of diabetes. This included hypertension (19 %), albuminuria (19 %), heart rate variability abnormalities (54 %), peripheral nerve abnormalities (19 %), retinopathy (7 %), and abnormal lipid profile (48 %) (16).

The prognosis is proportional to the timely identification of metabolic

disruption and early initiation of hypoglycemic therapy, according to the International Society of Pediatric and Adolescent Diabetes (ISPAD), type 1 diabetes is becoming more common and represents a significant proportion of juvenile diabetes in certain populations at risk, it is determined that the greatest risk found is obesity, a fact that does not coincide in the present investigation (17). This could be associated with lack of knowledge, lack of nutritious foods and low socioeconomic environments.

In conclusion, in the study conducted at the Hospital Regional de la Orinoquía, the age between 11 and 13 years is more frequent for DM, with a significant predominance of the male sex, coming from urban areas. It was found that low weight is an alarming fact, in addition to other altered glycemia values that are related to the complications presented at the time of the patient's admission, which represents a public health problem among children and young adults due to the heterogeneity, genetic and environmental factors.

Ethical considerations: This research project has the informed consent signed by the patient, where he/she authorizes the writing and publication of the manuscript. Likewise, the investigators signed the letter of confidentiality, commitment, and compliance with research activities.

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References

1. Fornari E, Barbetti F, Iafusco D, Lombardo F, Miraglia Dal Giudice E, Rabbone I, et al. Diabetes tipo 2 en pediatría. *Minerva Pediatr (Torino)*. 2021;73(6):549–62. Disponible en: <http://dx.doi.org/10.23736/S2724-5276.21.06530-7>
2. Alustiza E, Perales A, Mateo-Abad M, Ozcoidi I, Aizpuru G, Albaina O, et al. Tackling risk factors for type 2 diabetes in adolescents: PRE-START study in Euskadi. *An Pediatr (Barc)*. 2021 [cited 2022 Feb 5];95(3):186–96. Available from: <https://www.analesdepediatria.org/es-abordaje-factores-riesgo-diabetes-tipo-articulo-S169540332030480X>
3. Lawrence JM, Divers J, Isom S, Saydah S, Imperatore G, Pihoker C, et al. Tendencias en la prevalencia de diabetes tipo 1 y tipo 2 en niños y adolescentes en los EE. UU., 2001-2017. *JAMA*. 2021;326(8):717–27. Disponible en: <https://jamanetwork.com/journals/jama/fullarticle/2783420>
4. Ogle GD, James S, Dabelea D, Pihoker C, Svensson J, Maniam J, et al. Global estimates of incidence of type 1 diabetes in children and adolescents: Results from the International Diabetes Federation Atlas, 10th edition. *Diabetes Res Clin Pract*. 2022 [cited 2022 Feb 11];183(109083):109083. Available from: [https://www.diabetesresearchclinicalpractice.com/article/S0168-8227\(21\)00442-3/fulltext](https://www.diabetesresearchclinicalpractice.com/article/S0168-8227(21)00442-3/fulltext)
5. Katsarou A, Gudbjörnsdóttir S, Rawshani A, Dabelea D, Bonifacio E, Anderson BJ, et al. Type 1 diabetes mellitus. *Nat Rev Dis Primers*. 2017 [cited 2022 Feb 10];3(1):17016. Available from: <https://www.nature.com/articles/nrdp201716DiMeglio LA, Evans-Molina C>
6. Oram RA. Type 1 diabetes. *Lancet [Internet]*. 2018 [cited 2022 Feb 10];391(10138):2449–62. Available from: <https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC6661119/>
7. Valaiyapathi B, Gower B, Ashraf AP. Pathophysiology of type 2 diabetes in children and adolescents. *Curr Diabetes Rev*. 2020 [cited 2022 Feb 10];16(3):220–9. Available from: <https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC7516333/?report=reader>
8. Castro-Juárez CJ, Ramírez-García SA, Villa-Ruano N, García-Cruz D. Epidemiología genética sobre teorías causales y patogenia de la diabetes mellitus tipo 2. *Gac Med Mex*. 2019 [citado el 5 de febrero de 2022];153(7). Disponible en: https://www.gacetamedicademexico.com/frame_eng.php?id=87
9. Berbudi A, Rahmadika N, Tjahjadi AI, Ruslami R. Type 2 Diabetes and its Impact on the Immune System. *Curr Diabetes Rev [Internet]*. 2020 [cited 2022 Feb 10];16(5):442–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/31657690/>
10. Ros P, Barrio R. Diabetes tipo 2 en la infancia y adolescencia. *An Pediatr Contin*. 2009 [cited 2022 Feb 5];7(3):127–35. Available from: <https://www.elsevier.es/es-revista-anales-pediatria-continuada-51-articulo-diabetes-tipo-2-infancia-adolescencia-S1696281809711163>
11. Ros P, Barrio R. Diabetes tipo 2 en la infancia y adolescencia. *An Pediatr Contin [Internet]*. 2009 [cited 2022 Feb 5];7(3):127–35. Available from: <https://www.elsevier.es/es-revista-anales-pediatria-continuada-51-articulo-diabetes-tipo-2-infancia-adolescencia-S1696281809711163>
12. Koren D, Levitsky LL. Type 2 diabetes mellitus in childhood and adolescence. *Pediatr Rev*. 2021[cited2022Feb5];42(4):16779. Available from: <https://publications.aap.org/pediatric-sinreview/article-abstract/42/4/167/180698/Type-2-Diabetes-Mellitus-in-Childhood-and?redirectedFrom=fulltext>
13. Hamilton H, Knudsen G, Vaina CL, Smith M, Paul SP. Children and young people with diabetes: recognition and management. *Br J Nurs*. 2017;26(6):340–7. Available from: <http://dx.doi.org/10.12968/bjon.2017.26.6.340>

14. Arslanian S, Bacha F, Grey M, Marcus MD, White NH, Zeitler P. Evaluation and management of youth-onset type 2 diabetes: A position statement by the American diabetes association. *Diabetes Care*. 2018 [citado el 7 de febrero de 2022];41(12):2648–68. Disponible en: <https://pubmed.ncbi.nlm.nih.gov/30425094/>
15. Serbis A, Giapros V, Kotanidou EP, Galli-Tsinopoulou A, Siomou E. Diagnosis, treatment and prevention of type 2 diabetes mellitus in children and adolescents. *World J Diabetes*. 2021 [citado el 7 de febrero de 2022];12(4):344–65. Disponible en: <https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC8040084/>
16. Graves LE, Donaghue KC. Vascular complication in adolescents with diabetes mellitus. *Front Endocrinol (Lausanne)*. 2020 [cited 2022 Feb 5];11:370. Available from: <https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC7295945/>
17. Mayer-Davis EJ, Kahkoska AR, Jefferies C, Dabelea D, Balde N, Gong CX, et al. ISPAD Clinical Practice Consensus Guidelines 2018: Definition, epidemiology, and classification of diabetes in children and adolescents. *Pediatr Diabetes*. 2018;19 Suppl 27:7-19. Disponible en: <http://dx.doi.org/10.1111/pedi.12773>