Prevalence of prediabetes in overweight and obese children from the pediatric consultation of a second level hospital.

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Abstract

Introduction: Childhood obesity represents a serious public health problem in Mexico, related to the increase in the prevalence of diabetes mellitus 2 in children.

Objective: To identify the prevalence of prediabetes by means of fasting glucose measurements and glycosylated hemoglobin in children between 5 and 16 years of age, with obesity or overweight from the pediatric consultation of a second level hospital.

Materials and methods: Observational, analytical, comparative, prospective and transversal study. Non-probabilistic sampling, 165 patients between 5 and 15 years old 11 months of age, overweight or obese, fasting plasma glucose and glycosylated hemoglobin were determined. Chi Square statistical analysis to measure association between obesity, overweight, gender and age with abnormal serum glucose levels. Results: No gender predominance. 15% were overweight and 85% were obese. The prevalence of fasting hyperglycemia was 7%, in the elevation of glycosylated hemoglobin was 4%. Both results predominated in adolescent females. Statistically significant association between age and elevation of glycosylated hemoglobin.

Conclusion: It was possible to establish the relationship between adolescence and elevation of glycosylated hemoglobin by means of statistical tests. The relation between obesity, gender and elevation of serum glucose was observed but it was not possible to prove it by means of statistical methods.

Keywords: Obesity, Overweight, Prediabetes, Diabetes mellitus 2, Glycosylated hemoglobin.

Introduction

Childhood obesity represents a global public health problem, with Mexico occupying the first place in the prevalence of this pathological condition. In our country, this combined prevalence: obesity and overweight, is reported by up to 39.4% in adolescents, being the most affected age group [1]. This increase in the prevalence of childhood obesity is associated with an increase in the number of cases of Diabetes Mellitus 2 (DM2) in this population [2-4].

DM2 is a chronic disease, in which damage to the microvasculature conditions as main chronic complications nephropathy, retinopathy and neuropathy. This pathology in the child population has a different evolution from that of the adult, manifesting these chronic complications at an earlier age, causing a lower quality of life and decreasing their life expectancy on average 10 to 15 years [5,6].

Currently, the state of Prediabetes is known, in which the blood glucose levels are not normal, but neither are diagnoses for DM2. Glucose intolerance is determined: serum glucose between 140 mg/dl and 199 mg/dl at 2 h of oral glucose loading of 1.75 g/kg with a limit of 75 g; Fasting basal glucose between 100-125 mg/dl, glycosylated hemoglobin between 5.7-6.4% [7]. The prediabetes is a reversible state, hence the importance of its detection to avoid progression to DM2, the aim of this study being to determine the prevalence of prediabetes with fasting plasma glucose and glycosylated hemoglobin in patients with obesity and overweight in an outpatient service of a second level hospital [7].

Materials and Methods

With the authorization of the local research committee and ethics of health research, an observational, analytical,

prospective, comparative and cross-sectional study was carried out in children between 5 and 16 years old, who attended the pediatric consultation during the period comprised from August to October 2015.

Sampling was performed by consecutive cases. Patients with active infectious conditions or under pharmacological treatment that altered serum glucose levels (oral or inhaled steroids at any dose in the last 3 months) were excluded.

All the parents of the participants gave their consent in writing. In the first part of the study, general data of each participant were collected as age and gender, weight and height measurements were performed. In the same phase of the study, patients were asked for the following laboratory tests: determination of fasting serum glucose and glycosylated hemoglobin.

For the measurement of the weight, a clinical scale brand Nuevo León with sensitivity of 0-160 kg was used, the subject was weighed without shoes, with light clothes, the child placed in the center of the scale, without moving, with the weight distributed on both feet.

The stature was measured on a SECA model 213 stadiometer, was performed standing, without shoes, back to the stadiometer, with the heels together, the body erect, with the chin drawn, so that the inferior line of the orbital cavity was Find horizontal line with the top of the swallow of the ear (Frankfurt plane).

Based on previous measurements, body max Index (BMI) was calculated using the Quetelet formula and was percentile in the corresponding Centers for Disease Control (CDC) tables for age and gender. Classifying as overweight when found on the percentile 85 and obesity when being on the percentile 95 [8].

Blood samples were collected after an 8 h fasting, fasting glucose and glycosylated hemoglobin was measured using an automated system of analysis of the Unicel DXC 600 Backman Coulter, being considered an abnormal test with glucose values between 100-126 mg/dl and glycosylated hemoglobin between 5.7-6.4% [7].

The results were recorded in a database in the Excel program and were processed in SPSS software version 22 for Windows using descriptive statistics Chi Square was used to measure association between obesity, overweight, gender and age with abnormal serum glucose and glycosylated hemoglobin levels. Values of $P \leq 0.05$ were considered statistically significant.

Results

We studied a series of 165 patients, aged between 5 and 16 years old, the male gender represented 50%, with a total of 82 patients, the average age for both genders was 10.8 years. According to the nutritional status, a total of 25 patients were overweight, being the equivalent of 15% of the participants. A total of 140 patients presented obesity, representing 85% of the sample. As for the age group, 31% were schoolchildren, 40% preadolescents and 29% adolescents. The results are detailed in Table 1.

Fasting serum glucose levels were reported in ranges below 95 mg/dl in 69% of cases, 95-100 mg/dl in 24% of cases and only 7% had higher glucose levels of 100 mg/dl without being greater than 126 mg/dl.

The prevalence of Prediabetes, using fasting glucose was 7%. Prediabetes predominated in the group of adolescents, with a total of 6 patients, that is, 50% of the positive cases, compared to 16 and 34% in the groups of schoolchildren and preadolescents, respectively.

Regarding gender, Prediabetes predominated in the female gender, with a prevalence of 66% of the cases, against 44% in the male gender.

Table 1. Demographic characteristics of the population (n=165)

		Gender		Total n (%)=165 (100)
		Female n (%) 83 (50)	Male n (%) 82 (50)	
Age group	School children	30 (18)	22 (13)	52 (31)
	Pre-teen	31(19)	34(21)	65(40)
	Teen	22 (13	26 (16	48(29)
Nutritional diagnosis	Over weight	14 (8)	11 (7)	25 (15)
	Obesity	69(42)	71(43)	140(85)
Prediabetes	Positive	8 (5)	4 (2)	12 (7)
	Negative	75 (45)	78 (48)	153 (93)
Glucose Serum Fasting	<95 mg/dl	56 (34)	58 (35)	114 (69)
	95-100 mg/dl	19 (11)	20 (13)	39 (24)
	>100 mg/dl	8 (5)	4 (2)	12 (7)
Glycosylated hemoglobin	<5%	9 (12)	11 (15)	20 (27)
	5-5.69 %	27 (36)	25 (33)	52 (69)
	$\geq$ 5.7%	2 (3)	1 (1)	3 (4)

N: number; %: percentage; <: less; $\geq$: Greater or equal, mg/dl: milligram/deciliter

As for glycosylated hemoglobin values, only 4% was found in levels above 5.7%, which is considered as high normal limit, while 69% of cases remained between 5 and 5.69%, the remaining 27% Reported at levels below 5%.

The elevation of glycosylated hemoglobin predominated in the group of adolescents, with 100% abnormal levels in this group. As for gender, this alteration predominated in women in a 2:1 ratio.

The association between overweight, obesity, gender and age with hyperglycemia and glycosylated hemoglobin elevation was performed by calculating Chi square with values between 0.023-0.57. Being statistically significant for female gender and elevated glycated hemoglobin. The results are detailed in Table 2.

Discussion

Obesity and overweight in the pediatric age represent a serious public health problem in Mexico, with a progressive increase in its prevalence in the last years, being a pathology in which multiple factors interfere for its development, both characteristics of the individual but also of the environment in which he performs [8-10].

In this study we found a total prevalence of Prediabetes in children with obesity or overweight of 7%, predominating in adolescent women, as described in the literature. The results showed the relationship between obesity, adolescence and female gender with hyperglycemia, but it could not be demonstrated by statistical tests. Other investigators have found higher prevalence: Haemer et al. [5] describe alterations of serum glucose in obese children up to 15%; Gonzalez et al. [11] found 13% prevalence in a group of 46 obese children aged 4 to 16 years in 2007. Valle-Leal et al. [12] found in 2014 a prevalence of hyperglycemia of 4% in children aged 6 to 12 years; Torres et al. [13] found a prevalence of 4.43% in 2006 in 1006 obese children between 6 and 13 years old.

The multiple pathological conditions associated with this disease are well known, including glucose a disorder, which was studied in the present research project. With the present study, the association between adolescence and elevated levels of glycosylated hemoglobin was p: 0.023, by chi square. We did not find statistically significant results when associating the rest of the variables, but in the results we observed a relationship between obesity, adolescence and female gender with hyperglycemia and glycosylated hemoglobin elevation.

In this study a total of 14 subjects with fasting hyperglycemia and/or glycosylated hemoglobin elevation have been detected, which before the reported levels would meet criteria for prediabetes; These patients will continue their follow-up in the pediatric service as they have been channeled to the nutrition service, Coronado et al. [6] found a rate of progression in adults to diabetes mellitus 2 of 25% in the following 5 years, without however, there are not enough studies to carry out this monitoring in the pediatric population, which is an area for new research studies.

Although 93% of the subjects studied obtained normal results, the data found in the determination of HbA1c is noteworthy, since in 69% of the cases the report was in the range of 5-5.6%, which translates to normal levels High in this test but that when correlating with the estimated values of serum glucose, this would be found in average in ranges between 100-122 mg/dl, in spite of reporting normal fasting glucose.

The above mentioned contrasts with fasting plasma glucose levels, since 69% of the subjects were reported with levels below 95 mg/dl, which shows that it is a momentary value and that it can vary with multiple factors

As for the age group, the highest levels of glucose were reported in the preadolescents and adolescents, as described in the literature, which has been associated with the characteristics of puberty and the period of development for which they study, In which growth hormones, steroid hormones, can cause insulin resistance during this stage, which has also been reflected in the study, since in the female gender was where the abnormal results predominated [14].

Table 2. Association between gender, age group and BMI with hyperglycemia and elevation of glucosylated hemoglobin (n=165)

		Elevation of Fasting Glucose (≥ 100 mg/dl) n (%)	p	Elevation of glycosylated hemoglobin (≥ 5.7%) n (%)	p
Gender	Feminine	8 (66)	0.23	2 (66)	0.57
	Masculine	4 (44)		1 (44)	
Age Group	School children	2 (17)	0.226[&]	0	0.023[&*]
	Preteen	4 (33)		0	
	Teen	6 (50)		3 (100)	
Nutritional diagnosis	Over weight	3 (25)	0.323	0	0.397
	Obesity	9 (75)		3 (100)	

N: number; %: percentage; P: Chi cuadrada; *: Statistical significance; [&]: Exact fisher test; mg/dl: milligram/deciliter

Conclusion

It is becoming more frequent to attend to the various pediatric services to patients with excess adiposity, whether due to diseases associated or not to this pathological condition, which should be recommended healthy habits: balanced eating, regular physical activity, aimed at avoiding Complications associated with obesity. The monitoring of the metabolic status of the overweight or obese patient should not be narrow to detect alterations at an early stage. I believe that it would be interesting to carry out other studies, with a larger number of patients, but especially to carry out a longitudinal study, which would follow up over time on the metabolic behavior of these patients.

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