Cardiometabolic index in overweight and obese pediatric patients: A single-center observational study.

Cardiometabolic index in pediatric patients with overweight and obesity: A single-center observational study.

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Abstract

Introduction: Childhood obesity has become a public health problem since it increases the risk of having chronic non-communicable diseases in children. In adults, the cardio-metabolic index (CMI) is a component that takes into account the relationship between waist circumference (WC), height (H), triglyceride (TG) level, and HDL cholesterol, which is a powerful predictor of long-term diabetes and hypertension. Because there are few studies in children that measure this index, this study was established.

Methods: An analytical cross-sectional study was carried out in children aged 6 to 14 years with overweight and obesity (O&O), treated in 2019 at the Enrique Garcés General Hospital in Quito-Ecuador. The CMI = [(WC/H) / (TG/HDL-c)] was obtained and was associated with the study variables: sex and glucose. A descriptive analysis is done, and the CMI is analyzed by quartiles using the Analysis of Variance.

Results: 250 children entered the study. A higher frequency of O&O was evidenced in patients between 6 and 9 years old, 139/250 (55.6%), and in men, 132/250 (52.8%). There were no statistical differences in anthropometric or biochemical studies between boys and girls. The CMI, the most frequent quartile, was between Q2 to Q3 (0.16-0.21) with 34.8% (n= 87), the Greater quartile of Q3 and Less than Q1, which registered 19.6% (n= 49) respectively. There was no association between diabetes and CMI.

Conclusions: In this study in a population of Hispanic children, the cardio-metabolic index was not associated with the presence of diabetes in children with obesity.

Keywords:

DeCS: Metabolic Syndrome, Body Weights and Measurements, Obesity, Child, Type 2 Diabetes Mellitus.

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Introduction

Statistics refer to a worrisome increase in childhood overweight and obesity consultations in our region. There is a parallel rise in cardiovascular disease and diabetes [1]. During the last decade, the risk of metabolic diseases was considered an adult condition; however, the increasing prevalence of the disease in children and adolescents is associated with a significant increase in obesity and, therefore, an increase in cardiovascular complications and cerebral events, as well as an increased risk of death at earlier ages [2], compared with children without metabolic syndrome [3].

Obesity increases the chances of suffering chronic noncommunicable diseases such as metabolic syndrome, insulin resistance, high blood pressure, dyslipidemia, vascular diseases, cirrhosis, hepatocellular carcinoma, and physical, social, and psychological alterations [4].

At preschool age, the prevalence of overweight and obesity in Ecuador is 8.5% and triples in school age (INEC, 2018) [5]. National data on the combined prevalence of overweight and obesity in adolescents are 23.3% in men and 28.8% in women (INEC, 2018). The exclusive prevalence of obesity in adolescents is 7.1%, and in the Afro-Ecuadorian ethnic group, it is 16.8% [5].

The relationship between waist circumference (WC) and height (H) [WC/H] is an index with a more significant predictive capacity to establish cardiovascular risk compared to body mass index. On the other hand, in Japan, the term "cardiometabolic index" was coined for the ratio of WC/H divided by the ratio between triglycerides (TGs) and HDL cholesterol [6]. Even before the event occurs, patients with a higher cardiometabolic index (CMI) could be identified as diabetic. New studies have shown that the CMI is also useful for predicting the presence of arterial hypertension [7].

This index is not commonly used in daily practice in pediatrics; hence, the objective of this observational study was to determine the CMI in a group of overweight and obese pediatric patients treated in the outpatient clinic of a public reference hospital, Quito-Ecuador.

Population and methods

Design of the investigation

The present study is observational, analytical, and cross-sectional.

Stage

The study was conducted in the pediatric and nutrition outpatient clinic of the Enrique Garcés General Hospital, the Ministry of Public Health of Quito-Ecuador. The study period was from January 1, 2019, to December 31, 2019.

Universe and sample

The population consists of pediatric patients who routinely attend the outpatient clinic. The sample was a nonprobabilistic census type, in which all possible cases of the institution were included.

Participants

With complete and analyzable records, overweight and obese children aged 6 and 14 years participated. Patients diagnosed with type 1 diabetes mellitus were excluded.

Variables

The variables were sex, age, origin, weight, height for age, body mass index for age (BMI/A), glucose, lipids, abdominal circumference, family history of chronic noncommunicable diseases, and CMI.

Data sources/measurement

The data source was the manual selection of medical records. Weight, height, and WC data were recorded by the doctors in the hospital's outpatient clinic using the methods described by the World Health Organization.

Statistical method

The quantitative data analysis was performed with the statistical program SPSS version 24 (IBM Corp., Armonk, NY).); the results were obtained according to the type of variable:

- For the quantitative variables, measures of central tendency, mean, minimum, maximum, and standard deviation were used. For qualitative variables, relative and absolute frequencies were calculated. The association between quantitative variables was analyzed through inferential analysis, comparing the proportions for the difference in means.
- Qualitative and quantitative variables were analyzed with Student's t test, and the chi-square test was used to compare qualitative variables. The values obtained were considered statistically significant if the P value was <0.05.

Results

This study included 250 children.

Descriptive analysis

Characteristics of the patients participating in the study

The age of the patients was 9.17 ± 2.81 years. The predominant age group was 6 to 9, with 55.6% (n= 139). The majority of children were men (n=132, 52.8%). All patients came from urban areas.

The WC presented a mean of 69.01 ± 8.43 cm, with a minimum of 51 to 89 cm. Height for age had a mean of 130.73 (SD ± 13.90), with a minimum of 100 to a maximum of 165 cm, and weight was 38.23 ± 12.95 kg, with a minimum of 19 to a maximum of 71 kg.

Of the patients, 38.4% (n = 96) were obese, and 61.6% (n = 134) were overweight. The CMI presented a mean of 0.1731 (SD ± 0.0598), a minimum of 0.08, and a maximum of 0.65 (Table 1). It was shown that 76.4% (n= 191) stated they had a family history of diabetes mellitus, 80.8% (n= 202) a history of arterial hypertension and 47.6% (n= 119) of dyslipidemia (Table 1).

Table 1. Demographic characteristics of the population

Variable		Frequency n = 250	percentages
Age	6 to 9 years	139	55.6%
	10 to 14 years	111	44.4
Sex	Men	132	52.8%
	Women	118	47.2%
Nutritional condition	Obesity	96	38.4%
	Overweight	154	61.6%
FPA: type 2 diabetes	Yes	191	76.4%
	Do not	59	23.6%
FPA: AHT	Yes	202	80.8%
	Do not	48	19.2%
FPA: Dyslipidemia	Yes	119	47.6%
	Do not	131	52.4%

FPA. Family pathological antecedents. AHT: Arterial hypertension.

Regarding the cardiometabolic index of the participants, the most frequent quartile was between Q2 and Q3 (0.16-0.21), with 34.8% (n= 87) participants, followed by the greater quartile of Q3 and less than Q1, which registered 19.6% (n= 49), respectively.

Anthropometric measures

There were no significant differences between men and women regarding WC, height, weight, and body mass index averages (Table 2).

Table 2. Anthropometric measurements discriminated by sex in the population studied.

Variable	Sex	Measurement	P
WC (cm)	Men	68.42 ±7.57	0.248
	Women	69.66 ±9.29	
H (cm)	Men	129.89 ±13.47	0.314
	Women	131.67 ±14.36	
Weight (kg)	Men	37 ±12.12	0.134
	Women	39.53 ±13.76	
BMI (kg/m2)	Men	21.30 ±2.84	0.085
	Women	21.97 ±3.29	

WC: waist circumference. H: height. BMI: body mass index.

Fasting glucose and lipid values presented by patients

The mean fasting TG was 137.41 ± 37.79, with a minimum value of 76 and a maximum of 271 mg/dl; mean HDL of 41.66 ± 5.39, a minimum value of 30 and maximum of 94 mg/dl, and mean glycemia of 98.83 ± 12.81 mg/dL, minimum value 71 and maximum value of 145 mg/dl.

Relationship between CMI and the anthropometric variables and serology of the patients.

There were no distribution differences between the CMI quartiles of the WC, weight, BMI, HDL, and glucose variables. Triglycerides had a higher median between quartiles 1 and 2 of the CMI (P<0.001). (Table 3). There were no differences between family history of type 2 diabetes, hypertension, and dyslipidemia (Table 3).

Discussion

The predominant age group was patients between 6 and 9 years old with 55.6%; these figures are under those indicated by the INEC (2018) [5], an institution that registers overweight and obesity in preschool-age that triples in patients when they reach school age.

Regarding sex, male patients presented a higher frequency with 52.8% than women, a proportion contrary to the INEC records (2018) [5]; in obesity and overweight, the prevalence in the general population is higher in women.

The WC presented a mean of 69.01 ± 8.43, with a minimum of 51 to a maximum of 89 cm, which in adolescents is not considered a risk factor for metabolic pathology [7]; however, the patients who reached the maximum limit of 89 are close to the values defined as a risk factor considered to be 90 centimeters.

A total of 38.4% of the patients in this study were obese, all from urban areas. This figure is comparable to the INEC (2018) indicated, at 36.9% for the urban area.

In this study, the mean fasting TG was 137.41 ± 37.79 mg/dL, and the mean HDL was 41.66 ± 5.39 mg/dL; in the first, the values were elevated above what was established as expected, and in the case of HDL, these values are considered usual in children [8, 9]. The triglycerides reported in this study are elevated above the average value, presenting a risk of developing cardiovascular pathologies and type 2 diabetes [7-9].

Fasting blood glucose was 98.83 ± 12.81 mg/dl, and the maximum value recorded was 145 mg/dl. This study did not show an association between CMI and hyperglycemia; however, new studies should carry out a longitudinal analysis at 1, 3, and 5 years to observe the clinical behavior and the presence of diabetes and hypertension in patients located in the risk quartile of CMI.

The family history of chronic noncommunicable diseases of the patients participating in the study was estimated at 76.4% for diabetes mellitus, 80.8% for hypertension, and 47.6% for dyslipidemia; in these cases, these characteristics place the patients under study as individuals at risk of developing metabolic diseases, with a high family predisposition to present hypertension and type II diabetes mellitus in adulthood [10].

Table 3. CMI quartiles and study variables

Variable	<Q1 (<0.13) n= 49	Q1–Q2 (0.13 – 0.15) n = 65	Q2-Q3 (0.16 – 0.21) n=87	>Q3 (> 0.21) n = 49	*P*
WC	23	30	42	27	0.792
Height	27	35	33	22	0.241
Weight	27	36	37	24	0.360
BMI	27	3. 4	40	24	0.745
HDL	14	20	40	23	0.066
GT	48	57	16	1	<0.001
blood	25	28	35	19	0.591
FPA: DM2	35 (71.4%	49 (75.4%)	68 (78.2%)	39 (79.6%)	0.769
FPA: AHT	36 (73.5%)	50 (76.5%)	72 (82.2%)	44 (89.8%)	0.165
FPA: DL	18 (36.7%)	31 (47.7%)	46 (52.9%)	24 (49%)	0.344
Sex (W)	21 (42.9%)	30 (46.2%)	40 (46%)	27 (55.1%)	0.642

WC: waist circumference, BMI: body mass index, FPA: family pathological history. DM2: Type 2 diabetes mellitus. HTA: Arterial hypertension. DL: Dyslipidemia. W: woman

The highest median of anthropometric measurements was related to the CMI between quartiles 2 and 3, and the highest median of height was related to the interval between quartiles 1 and 2. The serological parameters HDL and glucose presented the highest medians. Between quartiles 2 and 3 of the CMI, triglycerides registered the highest median between quartiles 1 and 2 of the CMI. These data can be compared with the findings of Wakabayashi & Daimon (2015) [6], who assessed the predictive capacity of the CMI, showing that the highest blood glucose levels were related to the highest quartile of the CMI, while Acosta & Páez, (2018) [7] found more association with dyslipidemia.

Conclusions

In this study, in a population of Hispanic children, the cardiometabolic index was not associated with the presence of diabetes in children with obesity.

Abbreviations

FPA: Family pathological history
WC: Waist circumference
HTA: Arterial hypertension.
CMI: Cardiometabolic Index.
BMI: body mass index.
INEC: National Institute of Statistics and Censuses (Ecuador)
TG: triglycerides

Supplementary information

Supplementary materials are not declared.

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Author contributions

Andrea Nathaly Jumbo Guayasamín: Conceptualization, Data Conservation, Fundraising, Research, Resources, Software, Writing - original draft.
Carlos Cepeda Mora: conceptualization, data conservation, supervision, fundraising, research, resources, and writing: review and editing.
Carlos Erazo: Data curation, research, fundraising, supervision, methodology.
All authors read and approved the final version of the manuscript.

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Availability of data and materials

The data sets generated and analyzed during the current study are not publicly available due to participant confidentiality but are available through the corresponding author upon reasonable academic request.

Statements

Ethics committee approval and consent to participate

The Bioethics Committee approved the study of the Pontifical Catholic University of Ecuador.

Publication consent

It does not apply to studies that do not publish MRI/CT/Rx images or physical examination photographs.

Conflicts of interest

The authors declare no conflicts of interest.

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