

Relationship among macronutrient intake and overweight/obesity in school children from Celaya, Mexico.

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Abstract

Objective: Excessive intake of macronutrients in schoolchildren is associated with obesity and then with early development of chronic degenerative diseases and young death.

Methods: 225 school-age children were evaluated in Celaya, Guanajuato. Anthropometric measures were performed and individual interviews with parents and children were conducted to collect information on the frequency of food consumption using a validated questionnaire (SNUT) from which the intake of macronutrients (carbohydrates, proteins and fats) and fat subtypes. Chi squared, and p value was calculated to identify the association of macronutrient intake with overweight/obesity in schoolchildren.

Results: There are not relationship between macronutrient intake (proteins, carbohydrates and lipids) and overweight/obesity in this sample of schoolchildren from Celaya, Mexico.

Conclusion: It is possible that there are other strong factors in relationship with overweight/obesity as physical activity.

Keywords: Macronutrients, Carbohydrates, Proteins, Lipids, Childhood overweight, Childhood obesity, Body mass index.

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Introduction

Currently, overweight and childhood obesity represent a public health problem, because since 1998 when the World Health Organization (WHO) considered obesity as a worldwide epidemic, this has been increasing; obesity covers the whole world and is a health problem in developed countries, as well as those that are developing [1].

Although the causes of this disease are of multiple origins, in general we can say that the excess body fat that is what characterizes this disease is mainly due to a sedentary lifestyle, [2] but also, due an excessive intake of calories.

Elevated levels of body fat in children can lead to develop different diseases associated with obesity and psychosocial disorders such as non-alcoholic liver disease, sleep apnea, asthma, type 2 diabetes, cardiovascular disease, metabolic syndrome, different skin abnormalities, irregular menstruation, orthopedic problems and poor learning skills [3].

It is known that the incidence of overweight and obesity in school age children (6-12 years) is very high in different countries, but it was estimated that the prevalence in Mexico is higher, as indicated by the system of classification of the international working group on obesity, and likewise the United Nations Children's Fund said that Mexico ranks first in the world in childhood obesity [4].

According to the National Health and Nutrition Survey in Mexico [5], school-aged children 5 to 11 years old showed a tendency where 3 out of 10 children are overweight or obese, with a combined prevalence of 33.12%.

The importance of childhood obesity is not only the frequent association with the development of different chronic non-transmissible degenerative diseases, but the fact that an obese child has a high prevalence of becoming an obese adult and increasing the risk of young death [6].

One cause of obesity is the high intake of foods with high caloric density high in fat [6], and the objective was to analyze the relationship of macronutrient intake in overweight / obese compared with non-obese school age children from Celaya, Guanajuato, Mexico.

Materials and Methods

The protocol was approved by Bioethics Committee from Division of Health Sciences and Engineering of Campus Celaya Salvatierra, University of Guanajuato.

Study design

It was a cross-sectional, observational, quantitative and analytic study.

Place and university of the study

The study was conducted in institutions of public primary

education in the city of Celaya, Guanajuato registered in the Secretary of Education of the State of Guanajuato. The study population was schoolchildren of both sexes registered in the primary education institutions.

Selection of school age children

Inclusion criteria: School children, both sexes, enrolled in an Institution of public primary education registered in the Secretary of Education of the State of Guanajuato, whose parents agree to participate in the study, signing the consent form and the schoolchildren from 8 years or more signed the announce to participate.

Exclusion criteria: Schoolchildren whose parents did not agree to participate in the study or schoolchildren who did not sign the announcement to participate.

Variables

Socio-demographics: It was measured age, gender, socioeconomic level, weight, high, body mass index.

Independent

Intake of proteins: It is a quantitative variable; is the mean of intake proteins from meals in the last year, accord SNUT survey [7,8], it is measured in g/day and converted in percentage of the daily diet; adequate (15%), elevated (>15%) or low (<15%) [9]; it was presented as mean and percentages.

Intake of carbohydrates: It is a quantitative variable; is the mean of intake carbohydrates from meals in the last year, accord SNUT survey; [7,8] it is measured in g/day and converted in percentage of the daily diet; adequate (50-55%), elevated (>55%) or low (<50%) [9]; it was presented as frequencies and percentage.

Intake of lipids: It is a quantitative variable; is the mean of intake lipids from meals in the last year, accord SNUT survey [7,8]; it is measured in g/day and converted in percentage of the daily diet; adequate (31% to 35%), elevated (>35%) or low (<31%) [9]; it was presented as frequencies and percentages.

Dependent

Overweight/obesity: It is a binary categorical variable; it is if the children had BMI from percentile 75th or higher for age and gender, accord CDC Curves 2000 [10]; it is measured as yes if the BMI is in percentile 75th or higher; no if the BMI is less than percentile 75th. It is presented as frequencies and percentages.

Sampling: Probabilistic sampling by conglomerate was carried out, where all the members of the selected schools will be invited to participate. From 168 elementary public schools in Celaya were selected 4, and all school age children in them were invited to participate. The design factor was fixed in 1.5.

Sample size: Assuming that 65% of overweight/obese students consume more than 55% of carbohydrates and only 40% of non-obese, the minimum sample size is 140 plus the design factor of 1.5, the sample size is of 210 schoolchildren with 95% confidence and 80% power (EpiInfo 7.0, 2013, CDC, Atlanta, GA, USA).

Procedures

After an informative session with parents explaining the

objectives of the study and answering the parents' questions, they signed informed consent and the children 8 years of age or older signed the announce to participate.

Subsequently, the food frequency questionnaire (SNUT) was filled out, whose answers were placed in the software of the same survey to obtain the average daily amount of proteins, carbohydrates and fats intake and anthropometry was performed.

To obtain the percentage of the macronutrients, the total of proteins, carbohydrates and lipids were added, being 100% and from that the percentage of each macronutrient was obtained.

Statistical analysis

For socio-demographic variables it was used descriptive statistics.

It was calculated Chi squared-test and P-value to identify relationship among macronutrients intake and status of overweight/obesity in schoolchildren. It was calculate Z for two independent proportions of high macronutrients and status of overweight/obesity and P-value.

To show significance statistical the P-value was fixed in 0.05.

All analysis was performed in STATA 13.0 ® (Stata Corp., College Station, TX, USA).

Results

The study sample consisted of 225 students from 1st to 6th grade. The distribution by gender was similar and for socioeconomic level it was predominantly high and just over 50% were overweight/obese (Table 1).

In Table 2, we can see that the standard deviations are smaller than the means, which gives an idea of Normality in the distribution.

Table 3 shows the relationship between overweight / obesity macronutrient intake and no association between overweight / obesity protein intake (P=0.19), nor between carbohydrate intake and overweight / obesity (P=0.18). For the relationship

Table 1. Distribution of categorical Sociodemographic characteristics of the subjects in the sample (n=225).

	Variable	f	%
Gender	Male	113	50.22
	Female	112	49.78
Socioeconomic level	Regular	16	7.11
	High	209	92.89
Status of overweight/obesity	Yes (≥ percentile 75 th BMI)	120	53.33
	No (< percentile 75 th BMI)	105	46.67

Table 2. Distribution of quantitative sociodemographic characteristic of the subjects in the sample (n=225).

Variable	Range	Mean	Standard deviation
Age (years)	6 to 13	8.80	1.95
Weight (kg)	18.35 to 70.30	35.43	12.23
High (m)	1.07 to 1.58	1.30	0.12
Body Mass Index (kg/m ²)	14.21 to 32.87	19.90	4.29
Intake of proteins (%)	4.7 to 40.69	17.20	3.30
Intake of carbohydrates (%)	12.22 to 79.36	61.30	7.38
Intake of lipids (%)	1.44 to 79.74	21.50	6.78

Table 3. Tabulation between intake of macronutrients and overweight/obesity (n=225).

Variable	Values	Without overweight/obesity		With overweight/obesity		X ²	degree of freedom	P-value
		f	%	f	%			
Intake of carbohydrates (%)	50-55	5	4.76	13	10.83	3.47	2	0.18
	>55	95	90.48	104	86.67			
	<50	5	4.76	3	2.50			
Intake of proteins (%)	15	4	3.81	11	9.17	3.36	2	0.19
	>15	14	13.33	20	16.67			
	<15	87	82.86	89	74.17			
Intake of lipids (%)	31-35	1	0.95	0	0.0	1.07*	-	0.28
	>35	4	3.81	3	2.50	0.56*	-	0.57
	<31	100	95.24	117	97.50	-0.91*	-	0.36

between lipid intake and overweight/obesity it was not possible to calculate Chi square and Z was calculated for two proportions and no differences were found between obese and non-obese.

It is important to note that both overweight/obese children and those who did not reported high carbohydrate intake higher than 55% of the daily diet (90.48% for those who are overweight / obese and 86.67% for those who are not overweight/obesity), although the differences were not significant ($Z=0.89$, $P=0.37$) (Table 3). In contrast, the average daily intake of proteins and lipids was low for both groups, but also did not show statistical significance (Table 3).

Discussion

The sample of 225 schoolchildren is 40% of the children represented by their parents in the briefing, so the participation rate was 40%. None schoolchildren refused to participate and all completed the SNUT survey and anthropometry.

The sample being randomized gave similar distribution by gender and the distribution of the quantitative variables was Normal.

There was no statistically significant association between dietary intake ($P=0.18$), carbohydrate ($P=0.19$) and lipid ($P>0.05$) overweight/obesity (Table 3), although it should be noted that children with and without overweight / obesity, consume more than 55% of their daily carbohydrate diet, unlike proteins and lipids that consume it below the recommended percentage (Table 3) [9].

According to Liberona et al. [11] obese schoolchildren, on average ate less carbohydrates, proteins and fats than non-obese children; although it would be important to note that the macronutrient measurement was based on a 24-hour reminder. In the study of Celaya there were no differences between the intake of macronutrients and the state of overweight/obesity.

Martín-Calvo et al. [12] did not find statistically significant associations between macronutrient consumption and obesity; similar to that found among schoolchildren in Celaya.

The level of physical activity should be measured because it may affect the relationship between diet and obesity. Padilla et al. [13] found no correlation or linear relationship between calorie consumption and body mass index in adults over 60 years of age in Mexico. It is possible that the same thing happens among schoolchildren.

Conclusion

In conclusion the obese and no obese children, intake more carbohydrates that recommended (55% from the diet), and the intake of proteins and lipids is below of recommendations (15% and 30%, respectively).

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Conflict of Interest

The authors declare: No conflict of interest.

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