



Comunicación breve

Anthropometric and biochemical parameters in adolescents and their relationship with eating habits and household food availability

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Abstract

Objectives: To evaluate the per capita availability of energy and macronutrients in the home and frequency of food consumption by adolescents and to relate them with anthropometric and biochemical variables, as well as verify if the eating habits of parents are associated to the children.

Methods: We evaluated the weight, height, body fat (%BF), glucose, insulin, triglycerides, total cholesterol (TC) and fractions of 120 adolescents. We evaluated also the eating habits of adolescents and their parents.

Results: Adolescents with more than 35% of available lipids had 9.1-fold higher chances of presenting alterations in TC. Those who replaced the main meals for snacks had 3.66, 4.66 and 2.82 higher chances of presenting alterations in %BF, insulin and triglycerides, respectively. The daily consumption of fruit was considered as a protective factor in relation to hyperinsulinemia. There was a similar feeding behavior among adolescents and their mothers.

Conclusion: The results suggest the importance of specific attention to adolescent health, focused on family education.

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Key words: *Adolescents. Nutritional status. Food consumption. Parents.*

PARÁMETROS ANTROPOMÉTRICOS Y BIOQUÍMICOS EN LOS ADOLESCENTES Y SU RELACIÓN CON LOS HÁBITOS ALIMENTARIOS Y LA DISPONIBILIDAD DOMICILIAR DE ALIMENTOS

Resumen

Objetivos: Evaluar la disponibilidad per cápita de energía y macronutrientes en el hogar y la frecuencia de consumo alimentario en los adolescentes y relacionarlos con las variables antropométricas y bioquímicas, así como verificar si los hábitos dietéticos de los padres se relacionan con los de los hijos.

Métodos: Evaluamos el peso, la talla, la grasa corporal (% GC), la glucosa, insulina, triglicéridos, colesterol total (CT) y sus fracciones de 120 adolescentes. También evaluamos los hábitos dietéticos de los adolescentes y sus padres.

Resultados: Los adolescentes con más de un 35% de lípidos disponibles tenían una probabilidad 9,1 superior de presentar alteraciones del CT. Aquellos que sustituían las comidas principales por aperitivos tenían 3,66, 4,66 y 2,82 más probabilidades de presentar alteraciones del % GC, insulina y triglicéridos, respectivamente. El consumo diario de fruta se consideró un factor de protección en relación con la hiperinsulinemia. Hubo un patrón alimentario similar entre los adolescentes y sus madres.

Conclusión: Los resultados sugieren la importancia de una atención específica a la salud de los adolescentes, centrada en la educación familiar.

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Palabras clave: *Adolescentes. Estado nutricional. Consumo alimentario. Padres.*

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Abbreviations

%BF: Percentage of Body Fat.

AMDR: Acceptable Macronutrient Distribution Range.

CI: Confidence Interval.

EER: Estimated Energy Requirement.

FFQ: Food Frequency Questionnaire.

HBS: Household Budget Survey.

HDL: High density lipoprotein.

INEP: Anísio Teixeira National Institute of Educational Studies and Research.

IOM: Institute of Medicine.

LDL: Low density lipoprotein.

OR: Odds Ratio.

TC: Total Cholesterol.

WHO: World Health Organization.

Introduction

Adolescence is a period where there is strong growth, maturation and psychosocial development.¹ Changes in nutritional and health status that begin at this stage tend to remain or worsen with advancing age.²

It is known that disorders such as obesity, dyslipidemia and changes in carbohydrate metabolism are the result of genetic and environmental interference, especially the poor eating habits.

The individual food preference is influenced by genetic predisposition and begins to develop in children through both personal experience and social interaction.³ Preferences and food availability of the children usually are related to their parents. Beliefs of parents about which foods are healthy have been related to the intake of children and adolescents. Therefore, to promote healthy eating patterns requires approach involving not only the children but also parents and family in general.⁴

Thus, emphasizing the importance of the theme discussed, this study aimed to evaluate the per capita availability of energy and macronutrients in the home and frequency of food consumption by adolescents and to correlate them with anthropometric and biochemical variables, as well as check if the eating habits of parents are associated to the children.

Methods

This is a cross-sectional study that assessed 120 adolescents from 10 to 13 years old of both genders, coming from public schools of urban zone in the city of Viçosa-Minas Gerais, Brazil.

To calculate the sample size, the present study, used the total number of adolescents between 10 and 13 years in the city (4,815);⁵ the frequency of overweight of 10%,⁶ with acceptable margin variation of 2% and

confidence level of 99%, totaling 92 adolescents to be studied. Foreseeing the possible sample losses that could jeopardize the statistical force results a percentage 20% was added over the calculated sample, and thus estimating a minimum sample of 110 adolescents. The schools were visited and all the students who showed interest in participating were subjected to a random selection.

All adolescents included in the study lived with at least one of their biological parents in the urban area of the city. They were considered pubertal, according to the Tanner⁷ classification, after being examined by a pediatrician. The presence of chronic diseases and/or drugs that alter lipid metabolism and glucose constituted exclusion criteria.

The research was conducted in two stages: a home visit, in which dietary data were obtained and an outpatient evaluation in the Health Division of the Federal University of Viçosa, to obtain anthropometric and biochemical data.

To obtain the dietary data we used the family's shopping list, the food frequency questionnaire (FFQ) and a structured questionnaire on eating habits to assess adolescents and their parents.

The family shopping list was used to assess the per capita food availability in households of adolescents and contained information about the monthly amount of food purchased. The estimated calculation of food available daily per capita was achieved by dividing the monthly amount of available food at home by the number of residents and the number of days of that month.⁸ The food composition was established by the Diet Pro[®] 4.0 software.

The Estimated Energy Requirement (EER) was calculated from equations for predicting total energy expenditure defined for adolescents and compared with that recommended by the Institute of Medicine (IOM).⁹ The amounts of available macronutrients for consumption were evaluated using the Acceptable macronutrient Distribution Range (AMDR).

The FFQ used was developed considering the foods consumed by adolescents in the city, based on data relating to the use of 24 hour dietary recalls in adolescents assisted by a Health Care Program for Adolescents.

Adolescents and parents were questioned about habit to have regular meals at established schedules, if they have the habit to substitute them by snacks, as well as the number of daily meals they have during week days.

To perform the anthropometric measurements, the adolescents wore light clothes. The height was determined using a stadiometer fixed in the wall. The weight was affixed in an electronic digital scale positioned in a plain surface. The adolescents were evaluated using the WHO AnthroPlus software and classified according to the cut-off points of the WHO.¹⁰

The body composition was estimated by means of electrical tetrapolar bioimpedance and the percentage of total body fat classified according to Lohman.¹¹

We collected 10mL of venous blood, after fasting for 12 hours, and measured total cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL), triglycerides, glucose and insulin. The results of the lipid profile and insulin were assessed according to the I Guideline for Prevention of Atherosclerosis in Childhood and Adolescence¹² and glucose were classified according to the parameters of the American Diabetes Association.¹³

The data was analyzed using the programs Epi Info 3.5.3 and Sigma Stat 3.1. First, the variable distribution was verified through the Kolmogorov-Smirnov test. We used Student's t test and Pearson correlation (parametric variables) or Mann Whitney and Spearman correlation (nonparametric variables). We carried out the chi-square to measure associations between variables and odds ratio (OR) for risk estimation. The probability inferior to 5% was considered as level of statistical significance.

The study was approved by the Ethics Committee in Research with Humans of the Federal University of Viçosa. All Participants presented informed consent term signed by their parents.

Results

We included 120 adolescents in this study. Of these, 114 responded to the FFQ and 95 gave the family shopping list. Also participated in the study 186 parents (104 mothers and 82 fathers), who responded to questionnaires about their eating habits in order to compare them to those of their children.

The nutritional status of adolescents was detected at 8.4%, 70.0% and 21.6% of underweight, normal weight and overweight/obese, respectively, and 17.5% high body fat percentage. TC was the biochemical variable that showed a higher percentage of inadequacy (54.2%), followed by fractions, LDL (26.7%), HDL (25.8%) and triglycerides (20.0%). Inadequacy was observed in 8.3% and 1.7% over the insulin and glucose, respectively.

The value of EER was calculated for each teen and met an average EER 2018.64 ± 237.53 and 2363.90 ± 301.05 for girls and boys, respectively.

Of all adolescents who filled the family shopping list, 31.6% reported availability above his EER. Considering the distribution of total energy value, according to the acceptable macronutrient distribution range, we observed that 18.9 (n = 18) and 23.2% (n = 22) of the individuals studied were in their homes, availability of lipids and carbohydrates, respectively, higher than recommended.

Comparing the adolescents who had lipid availability per capita/day above and below the EER, we observed differences in median values of TC (164; 141-214 vs. 147; 93-259, $p = 0.007$) and LDL (90.3; 77.8-145.8 vs. 82.6; 39.8-181.0, $p = 0.04$) and mean values of HDL (58.9 ± 13.6 vs. 51.1 ± 13.8 , $p = 0.03$).

Most adolescents performed four or more meals a day (83.3%, n = 100). We observed correlation between the number of meals by adolescents and their mothers ($r = 0.253$, $p = 0.006$), while the same was not observed among adolescents and their fathers ($r = 0.195$, $p = 0.06$).

The adolescents were asked, also, about the habit of having meals at regular times, 37.5% (n = 45) of them said "do not have set times to make the meals." This habit was associated between mother and child ($p = 0.005$), however, there was no such association between father and adolescent ($p = 0.141$).

The replacement of main meals for snacks was performed for 34.2% of adolescents. The replacement was made mainly for bread, biscuit, coffee and chocolate.

The tables I and II show the results obtained by the odds ratio between dietary factors and anthropometric and metabolic variables in adolescents.

Discussion

Important changes such as excessive weight, body fat and dyslipidemia were observed, as well as poor dietary habits practiced by adolescents with their parents. Also reported the presence of large number of families with caloric availability above recommended levels.

The Household Budget Survey (HBS),¹⁴ conducted in 2008-2009 in Brazil, indicated greater satisfaction of the population with the amount of food consumed, 64.5% of families report to always have enough food at their homes, a percentage that is higher than the presented in 2002-2003 (53.0%). This fact may show that the Brazilian population is having access to a larger amount of food, which may explain the high caloric availability in the present study.

There was no association between caloric availability and carbohydrate availability with anthropometric, body composition and biochemical variables. This can be explained, partly, by the errors inherent to dietary assessment. The discrepancies may be explained by the fact that the family shopping list to infer consumption, but not necessarily predict the actual food consumption. However, the shopping-list allows us to learn about food availability in the context in which the individual belongs, which is a prerequisite in the identification of dietary habits, the planning of effective intervention and nutritional guidance.

This study, as well as the HBS, did not take into account the food purchased outside the home environment, components of snacks or meals taken elsewhere by adolescents. Probably, this fact confirms the justification of the difficulty in relating the data presented. It is assumed that, by not considering such foods, consumption might be underestimated, making the availability inefficient at predicting nutritional changes. It is suggested that the inclusion of products purchased outside of the family of the adolescent would be a useful resource to complement the data.

Table I
Odds ratio and confidence interval between dietary factors and changes in anthropometric variables and hyperinsulinemia in adolescents from 10 to 13 years old. Viçosa-Minas Gerais, Brazil

Variables	Odds ratio (confidence interval) p value		
	Overweight	Excess body fat	Hyperinsulinemia
Caloric availability (> EER)	0.29 (0.07-1.07) 0,05	0.80 (0.25-2.49) 0,6	0.70 (0.13-3.70) 0,5
Availability of carbohydrates (≥ 65%)	0.73 (0.21-2.45) 0,4	0.35 (0.07-1.68) 0,1	0.44 (0.05-3.86) 0,4
Availability of lipids (≥ 35%)	2.06 (0.66-6.40) 0,2	0.82 (0.21-3.22) 0,7	0.58 (0.06-5.10) 0,5
Number of meals (< 3)	1.20 (0.39-3.70) 0,7	0.45 (0.09-2.13) 0,2	0.51 (0.06-4.30) 0,4
Replacement of main meals for snacks	2.06 (0.85-5.02) 0,1	3.64 (1.36-9.73) 0.007	4.66 (1.13-19.15) 0.02
Adolescents does not make meals at established schedules	1.29 (0.51-3.22) 0,5	1.22 (0.46-3.25) 0,6	0.70 (0.16-2.96) 0,4
Daily consumption of fruits	0.67 (0.26-1.70) 0,4	1.70 (0.56-5.14) 0,3	0.20 (0.05-0.85) 0.02
Daily consumption of vegetables	0.55 (0.22-1.35) 0,1	0.45 (0.16-1.23) 0,1	2.50 (0.50-12.37) 0,2
Daily consumption of sweets	4.08 (0.86-19.17) 0,04	2.19 (0.57-8.37) 0,1	1.27 (0.23-6.73) 0,5

EER: Estimated Energy Requirement.

Table II
Odds ratio and confidence interval between dietary factors and changes in serum lipid profile in adolescents from 10 to 13 years old. Viçosa-Minas Gerais, Brazil

Variables	Odds ratio (confidence interval) p value			
	↑Triglycerides	↑Total cholesterol	↑LDL	↓HDL
Caloric availability (> EER)	1.0 (0.33-2.94) 0,6	0.97 (0.41-2.33) 0,9	0.77 (0.28-2.12) 0,6	0.68 (0.25-1.85) 0,4
Availability of carbohydrates (≥ 65%)	0.56 (0.14-2.14) 0,3	0.30 (0.11-1.84) 0,1	0.82 (0.26-2.55) 0,7	2.11 (0.77-5.76) 0,1
Availability of lipids (≥ 35%)	1.73 (0.53-5.64) 0,3	9.60 (2.06-44.64) 0.0006	1.07 (0.34-3.40) 0,8	0.67 (0.19-2.25) 0,3
Number of meals (< 3)	0.96 (0.28-3.19) 0,6	0.65 (0.24-1.71) 0,3	0.63 (0.19-2.08) 0,3	0.86 (0.28-2.60) 0,7
Replacement of main meals for snacks	2.82 (1.10-7.18) 0.02	2.17 (0.98-4.77) 0,05	1.41 (0.60-3.30) 0,4	2.14 (0.91-5.02) 0,07
Adolescents does not make meals at established schedules	0.40 (0.14-1.11) 0,07	1.01 (0.46-2.16) 0,9	0.62 (0.26-1.51) 0,2	0.64 (0.26-1.54) 0,3
Daily consumption of fruits	0.84 (0.32-2.16) 0,7	0.76 (0.35-1.66) 0,5	0.74 (0.31-1.77) 0,5	1.02 (0.43-2.43) 0,9
Daily consumption of vegetables	1.11 (0.42-2.91) 0,8	0.71 (0.33-1.55) 0,4	0.83 (0.35-1.96) 0,6	1.75 (0.69-4.40) 0,2
Daily consumption of sweets	0.48 (0.16-1.38) 0,1	0.64 (0.25-1.61) 0,3	0.45 (0.17-1.15) 0,09	1.79 (0.63-5.07) 0,2

EER: Estimated Energy Requirement; LDL: Low density lipoprotein; HDL: High density lipoprotein.

Despite the shopping list has not been able to relate the availability of calories and availability of carbohydrates at home with the anthropometric and metabolic variables of adolescents, there was the association between availability of lipids and the CT. Adolescents who had more than 35% fat available for consumption were 9.11-fold more likely (95%CI 1.81-61.74) to present changes in TC than the adolescents with adequate or low availability.

In this study, daily consumption of fruit by adolescents was considered a protective factor in relation to hyperinsulinemia, which is an abnormality detected many years before the onset of type 2 diabetes. Consumption of diet rich in vegetables and fruits is associated with a healthier metabolic profile, with low concentrations of TC and LDL, with reduced risk of developing diabetes and improvement glycemic control and insulin sensitivity.¹⁵

There was similar feeding behaviors among adolescents and their mothers, as the number of meals and the habit of not doing them on a regular schedule, which was not observed with the paternal habits. Usually, the maternal dietary habits tend to be adopted into the family, since the mother is more involved with the preparations and food choices at home.

The factor that had the largest number of associations with studied changes was the replacement of main meals to snacks. This habit was related to excess body fat, hyperinsulinemia and elevated triglycerides. Other studies,^{16,17} which assessed Brazilian adolescents, found the presence of this feeding practice. In this study, foods high in simple carbohydrates were cited as substitute foods, which may explain the associations found between replace main meals for snacks and nutritional changes.

In conclusion, this study suggests that eating habits practiced by the mothers tend to be adopted by children and that the increased availability of lipids for use in households is a factor that may be related to total cholesterol levels higher in adolescents. The replacement of main meals for snacks can increase the chances of changes in levels of triglycerides, insulin and body fat percentage. The daily consumption of fruit may constitute itself as a protective factor in relation to hyperinsulinemia. Since adolescence is a critical period for installation of changes in nutritional status, which tends to remain in adulthood and is associated with increased morbidity and mortality, is very important programs specific attention to adolescent health, especially family-oriented, which could prevent or minimize problems in the short and long term.

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