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Research report

Understanding the correlates of adolescents' dietary intake patterns. A multivariate analysis

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ABSTRACT

We investigated dietary intake patterns (DIP) in adolescents (14–18 year-olds) and the association with demographic and socioeconomic characteristics and lifestyle variables. This school-based survey was carried out among high school students from the city of Maringá in the state of Paraná (PR), Brazil (2007). The sample included 991 students (54.5% girls) from high schools. DIPs were investigated by the frequency of weekly consumption of each food group: vegetables, fruit, rice, beans, fried food, sweet food, milk, soda, meat, eggs, alcoholic drinks. Independent variables were: demographic and socioeconomic characteristics and lifestyle variables. DIPs were identified using principal component analysis with orthogonal rotation (varimax). Three components were extracted. Component 1 (fried foods, sweets and soft drinks) was positively associated with not having breakfast for girls and dinner for boys. Moreover, component 2 (consumption of fruit and vegetables) was positively associated with having breakfast at home for boys and number of meals for girls. Component 3 (beans, eggs and meat) was positively associated with having lunch, employment and sedentary behavior level for girls. However, it was negatively associated with having lunch and dinner for boys. Adolescents who have healthier eating patterns also had other healthier behaviors regardless of gender. However, factors associated with dietary patterns differ between boys and girls.

Introduction

It is well known that there is a relationship between eating habits and the development of several non-communicable diseases (Popkin, 2001; Yach, Hawkes, Gould, & Hofman, 2004). A healthy eating pattern in adolescence can prevent the incidence of such diseases in adulthood (Twisk, Kemper, Van Mechelen, & Post, 2001).

However, several studies suggest that adolescents have developed poor eating habits in recent decades (Kourlaba et al., 2009; Prochnik Estima, da Costa, Sichieri, Pereira, & da Veiga, 2009; Song, Park, Paik, & Joung, 2010). It is therefore important to determine the factors underlying such behavior in order to develop and implement strategies to improve diet. Recent studies have found that eating behavior is a function of individual and environmental influences such as age, gender (Pedrozo et al., 2008), anthropometric variables (Prochnik Estima et al., 2009), food preferences (Nago et al., 2010), lifestyle (Vereecken et al., 2009), parental influences (Pearson, Atkin, Biddle, Gorely, & Edwardson, 2009) and socioeconomic level (Kourlaba et al., 2009).

The low-income and middle-income countries are in the process of nutritional transition. In Brazil (Sichieri, Chiuve, Pereira, Lopes, & Willett, 2010) and other Latin American countries (Rivera, Barquera, González-Cossío, Olaiz, & Sepúlveda, 2004), there are data for adults showing a reduction in the consumption of cereals, legumes, roots and tubers and increased consumption of the ultra-processed foods. Dietary pattern analysis has now emerged as an approach to evaluate the association between diet and health outcomes, rather than the analysis of individual nutrients or food items. Principal component analysis (PCA) has been used as a statistical technique to evaluate dietary patterns (Kourlaba et al., 2009; Northstone & Emmett, 2008; Romaguera et al., 2008). The aim of this study is to investigate the dietary intake patterns (DIP) of Brazilian adolescents (14–18 year-olds) and their relationship with socio-economic and lifestyle characteristics.

Methods

The present study was carried out in the city of Maringá, located in the northwest of Paraná state (PR), Southern Brazil, which has a

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population of approximately 330,000 (51,428 adolescents, 50.1% female). The city presents a high Human Development Index (HDI = 0.84, above the score for Brazil of HDI = 0.79) (UN, 2007). The fieldwork started in August and ended in October, 2007 (from the end of winter to the beginning of spring). The schools involved in this study were classified into two groups. Public schools were defined as those funded by the national government. Private schools were defined as not being funded by the national government. A cross-sectional school-based survey was then designed to assess the health status of a representative sample of adolescents.

A formal request to conduct this survey was sent to and subsequently accepted by the school boards of several schools in the city. This study was also approved by the Ethics Committee in Research involving Human Participants of the University Center of Maringá and authorized by the Ethics Committee in Research Projects of the University of São Paulo in accordance with Brazilian laws.

Sample size

The complete methodology of this study has been described in an earlier study (de Moraes, Delaporte, Molena-Fernandes, & Falcão, 2011). Briefly, the population included 14–18 year-old adolescents of both sexes who were enrolled in public or private high schools in Maringá, PR in 2007. The populations of both public and private schools were included in the sampling process; data were obtained from the State Department of Education of Paraná and the Union of Private Schools of Maringá/PR (Secretaria de Estado Educação do Paraná, 2007).

Sample size calculations were performed. Parameters included a confidence interval of 95%, a power of 80%, a 50% prevalence as most the expected outcome with a margin of error of 5 percentage points and a design effect of 2, since it is considered a complex sample size. Based on these parameters, it was estimated that data from at least 734 adolescents would have to be collected. Because this study was part of a larger health survey including other outcomes requiring larger samples, an extra 10% for possible losses and refusals and an extra 15% for multivariate analysis were added, resulting in a minimum requirement of 918 subjects. This sample size allowed the detection of a prevalence ratio of 1.2 to be statistically significant at 5%, with 80% power for 50% prevalence exposure by age.

The sample was obtained via a classroom selection process divided into two stages: by school categories (primary sampling unit) and by classes. Schools were classified into two categories: public and private. In the first stage, in which eight public and four private schools were selected, schools were randomly selected with respect to the proportional probability of population in each high school stratum. In the second stage, classes were selected by simple random sampling; their number was proportional to the population of students in each grade (10th through the 12th grade).

Data collection

Data were collected in the classroom by a team of four interviewers who were trained for a period of 40 h prior to data collection by author ACdeM to standardize the questionnaires and anthropometric assessments. Two pilot studies, 1 week apart, were then performed for this training at schools that were not part of the final sample. These pilot studies were carried out with the following objectives: (a) to perform a final test of the questionnaire; (b) to organize field data collection; (c) to evaluate the performance of each interviewer in real data collection situations.

Dietary intake patterns (DIPs)

DIPs were verified by using a food consumption frequency questionnaire recommended by WHO for epidemiology research in adolescents (World Health Organization, 2004). The questionnaire was translated and modified for Brazilian dietary habits (Government, 2007), after being submitted for a reliability study among Brazilian adolescent students (Romanzini, Reichert, Lopes, Petroski, & de Farias Júnior, 2008). For example, the question "How often do you usually ingest fruit in a habitual week?" assessed fruit consumption. No specific amount was recorded, therefore only data collected were used to assess the frequency of weekly consumption of each food group. The food groups assessed were: vegetables, fruit, rice, beans, fried food, sweet food (i.e. energy-dense foods such as candies and chocolate), milk and milk products, soda, meat, eggs, and alcoholic drinks. According to the frequency of weekly consumption, food groups were assigned scores: 7 d/week = 4; 5–6 d/week = 3; 4–3 d/week = 2; 1–2 d/week = 1; no consumption = 0. In this study, we used the Kappa coefficient to verify the agreement and reproducibility of the questionnaire. Results observed were high (vegetables: $k = 0.83$; fruit: $k = 0.85$ rice: $k = 0.75$; beans: $k = 0.87$; fried food: 0.92; sweet food: 0.91; milk and milk products: $k = 0.76$; soda: $k = 0.82$; meat: $k = 0.93$; eggs: $k = 0.90$ and alcoholic drinks: $k = 0.95$).

Independent variables

Independent variables included in this study were: age, socioeconomic level (Brazil Criterion of Economic Classification (ABEP, 2006), which divides families into five income groups, where "A" is the wealthiest and "E" the poorest taking into consideration – among other aspects – consumer goods available at home), whether the mother is employed (yes or no), whether the adolescent is employed (yes or no), living with parents (yes or no – including grandparents, alone, hostel, husband and/or wife), eating behavior [number of makes meals; number of meals at home; which makes meals at home; on diet (no performing diet; yes, for loss weight; yes, for increase weight)], smoking habits (those who reported smoking at least one cigarette in a typical week were considered to be smokers), physical activity level (min/d, physical activity data collected by questionnaire for adolescents (Arvidsson, Slinde, & Hulthèn, 2005)), insufficient physical activity (was defined as <300 min/week of moderate to vigorous-intensity physical activity practice (Strong et al., 2005)), sedentary behavior (h/d spent in front of the television/computer/games) and waist circumference (WC) (measured in cm with a non-elastic metal tape at the midpoint between the lowest rib cage and the top of the iliac crest, with the average of two measurements recorded (World Health Organization, 1995)).

Statistical analysis

The PCA was used to identify the dietary patterns. This technique is necessary to explain variables in terms of smaller number of factors or components which usually account for the variance of more than one variable (Norman & Streiner, 2003). From the entire database, eleven food groups were entered into factors or components retained through the Kaiser criterion, i.e. eigenvalues >1, confirmed by a 'knee' in the scree plot. An orthogonal rotation (varimax) was used and loadings factors $\geqslant 0.4$ were necessary to identify whether a food group was contributing in a component and then it was named according to foods entered. Scores of each component were used as outcomes.

The multiple linear regression models were fitted to assess the relationship between each component obtained through the principal component analysis and independent variables. The p-values