



Original article

Adherence to the Mediterranean diet in children: Is it associated with economic cost?

G. Albuquerque^a, P. Moreira^{a,b,c}, R. Rosário^{d,e}, A. Araújo^a, V.H. Teixeira^{a,b},
O. Lopes^f, A. Moreira^{g,h}, P. Padrão^{a,c,*}

^a Faculty of Nutrition and Food Sciences, University of Porto, Porto, Portugal

^b Research Centre in Physical Activity, Health and Leisure, University of Porto, Porto, Portugal

^c EPI Unit – Institute of Public Health, University of Porto, Porto, Portugal

^d Education School, Child Study Centre, University of Minho, Braga, Portugal

^e Nursing School, University of Minho Braga, Portugal

^f Erdal Association, Guimarães, Portugal

^g Department of Immunology, Faculty of Medicine, University of Porto, Porto, Portugal

^h Department of Immunoallergology, Hospital of São João, Porto, Portugal

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ABSTRACT

Objective: To assess how the diet cost is associated with socio-demographic factors and adherence to Mediterranean diet in children.

Methods: Data were obtained from a community-based survey of children selected from public elementary schools in Portugal. Of a total of 586 children attending these schools, 464 (6–12 years), were studied. Dietary intake was assessed by a 24 hour recall and the adherence to Mediterranean diet was evaluated through the KIDMED index. The cost of the diet was calculated based on the collection of food prices of a national leader supermarket, and expressed as Total Daily Cost (TDC) and Total Daily Cost-Adjusted for Energy (TDEC). Anthropometric measures were taken and socio-demographic data were gathered from a questionnaire filled by parents. Logistic regression was used to quantify the association between diet cost, socio-demographics and adherence to Mediterranean diet.

Results: The average TDC was 4.58€ (SD = 1.24). Most children (69.1%) reported medium adherence to Mediterranean diet, and 4.6% rated the higher score. TDC was higher for children with highest adherence to Mediterranean diet, compared to those with lowest adherence [TDC: OR = 5.70 (95% CI 1.53, 21.33), *p* for trend = 0.001; TDEC: OR = 2.83 (95% CI 0.89, 8.96, *p* for trend 0.018)]. No meaningful variation in the diet cost with age and parental education was observed.

Conclusion: Higher adherence to Mediterranean diet was associated with higher diet cost in children.

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Introduction

The Mediterranean Diet has been object of study since the 1950s¹ and is nowadays recognized for its numerous health benefits, namely protection against weight gain, obesity and diabetes mellitus type 2, cardiovascular diseases, certain tumors and other oxidative stress-related diseases.^{2,3}

However, its original defining-characteristics do not fully correspond to the diet practiced nowadays among populations living

in the Mediterranean region.⁴ This dietary pattern was firstly characterized by a high consumption of fruits, vegetables and grains; moderate consumption of dairy products and wine and low consumption (and amount) of red meat. Olive oil would be the main source of dietary lipids.¹ Regrettably, this dietary pattern is being replaced by unhealthier choices,^{5,6} similarly to what is happening around the world. A low consumption of fruits and vegetables⁷ parallel to a growing consumption of high-density energy foods – such as snacks, sugar-rich food, fast food and soft drinks – is well documented and associated with lifestyle changes.⁸ These dietary modifications contribute to poorer diet quality and have been indicated as a significant explanation for the rising obesity rates, specially concerning in children.⁸ The same phenomenon has been also documented in Portugal.⁹

* Corresponding author.

E-mail address: patriciapadrao@fcna.up.pt (P. Padrão).

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Changes in the physical environment and food supply have been pointed recently as major causes of the Obesity epidemic,¹⁰ which is becoming to be perceived from an economic perspective. In fact, substantial research on diet cost has been performed in recent years, in the U.S.A. and some European countries. The results consistently show that the cost of food is a primary determinant of food choice^{11,12} and that higher energy density foods, which are less nutrient-rich, are associated with lower prices. On the other hand, low-energy-dense foods such as fruits and vegetables appear to be more expensive.^{11,13,14} In this context, healthier diets are associated with higher costs.¹⁴⁻¹⁷

Taking into account the benefits of the Mediterranean diet, its health promoter potential, as well as the importance of price as food choice determinant, we aimed to estimate the cost of children's diet according to the degree of adherence to Mediterranean diet. To the best of our knowledge, this is one of the first European studies on this topic in children, which may provide new information to health professionals and policy makers so they can better educate and act toward the availability of healthy eating at low cost to the common citizen. The objectives of this study were to estimate the daily cost of diet and to quantify its association with socio-demographic factors and the degree of adherence to the Mediterranean diet in children.

Methods

Participants

The data were derived from a community-based survey of children selected from 7 of the eighty public elementary schools in the city of Guimarães, Portugal, between October 2007 and March 2008. Letters were distributed to all parents or guardians outlining the aims of the study along with a consent form. From the total of 586 children attending these schools, 464 (225 boys and 239 girls) between 6 and 12 years accepted to participate in the study. Anthropometric measurements and dietary data were collected from all consenting children and questionnaires surveying sociodemographics and lifestyle information were distributed among parents or educational guardians, of which 405 have answered (87%).

The study was approved by the University of Porto Ethics Committee, the schools where the study was carried out and the Portuguese Data Protection Authority (CNPD-Comissão Nacional de Protecção de Dados, process number 7613/2008).

Assessments

Height and weight were measured by previously trained health professionals or students, following international standardized procedures.^{18,19} Children wore light indoor clothing and were bare-footed. Weight was measured in an electronic scale, with an error of ± 100 g (Seca®, Model 703, Germany), and height was measured using a stadiometer, with the head in the Frankfort plane. BMI was calculated as weight (kg)/height² (m)²⁰ and children's weight status was categorized using the IOTF criteria and cut-points for BMI, defined specifically for sex and age.²¹ Only three categories were considered in analysis of results: normal, overweight and obesity.

Dietary intake information was assessed by a 24 hour recall, in which children were asked to recall all food and beverages consumed in the previous 24 h. A photographic manual of portion sizes and household measures (Manual of Food Quantification) was used²² as an auxiliary tool to estimate sizes of foods and beverages consumed.

KIDMED index⁵ was applied to verify the adherence level to the Mediterranean diet. This index was created according to the

Table 1
Kidmed index used to access the adherence to the Mediterranean diet.

Scoring	
+1	Eats a fruit or drinks fruit juice
+1	Eats a second fruit
+1	Has vegetables once
+1	Has vegetables a second time
+1	Eats fish
-1	Goes to a fast-food restaurant
+1	Eats pulses
+1	Eats rice and or pasta
+1	Has Breakfast
+1	Has a dairy product for breakfast
+1	Eats bread or cereals at breakfast
+1	Has at least 2 yoghurts or 40 g of cheese
-1	Eats pastries at breakfast
+1	Eats nuts
+1	Diet includes olive oil
-1	Eats sweets and candy

Mediterranean diet principles and provides a score ranging from 0 to 12 according 16 questions. Questions denoting a negative connotation with respect to the Mediterranean diet were assigned a value of -1 and those with a positive aspect, +1. This score was applied according to the food consumption in the previous 24 h, as described in Table 1. In accordance with the sum obtained, 3 classes were created: >8, high adherence to the Mediterranean diet; 4-7, medium adherence to the Mediterranean diet and ≤ 3 , low adherence to the Mediterranean diet (Table 1).

The socioeconomic information and family characteristics were collected from the survey distributed to the parents or educational guardians. It contained questions about gender and age of children and parents' education, recorded in five categories of years: 0, 1-4, 5-9, 10-12, and more than 12 years of formal education. This information was further grouped for analysis into four categories: up to 5 years, between 5 and 9 years, 10-12 years and more than 12 years of education.

Estimation of diet cost

The estimation of diet cost was divided in two tasks. Firstly, the collection of food prices, that took place between March and April of 2011. The source was an online supermarket, belonging to a Portuguese leader supermarket chain. Price data was obtained by gathering mean prices of correspondent food or package size, as well as the price per kilogram. Measurements were taken on regular prices, excluding discounts. In the case of composed dishes, diet costs were calculated using recipes available in Food Processor Plus® database (most of them previously adapted from traditional Portuguese recipes) and from a Portuguese website of traditional recipes.²³ The price of the drinking water was estimated by the median price of the bottled natural mineral water and of the municipal water.

After this procedure, food items were assigned into different groups according to the staple food that was in its origin, and the median price per gram was computed. For example, the price of rice was obtained by calculating the median of the prices of the various brands and types available in the supermarket webpage. The choice for using the median rather than the average price was based on the fact that it better represents the central values, minimizing the effect of the very high and very low prices for each group. Finally, the cost of each meal was calculated according to the contribution of each and every food ingredient taking into account its proportion.

At dietary level, two variables were created: "Total daily cost" (TDC), representing the cost of each individual's diet and obtained by summing the cost of each meal, and "Total daily cost adjusted for energy" (TDEC) which eliminated the possible differences in

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