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Calorie and Nutrient Intake in Obese Women With Low-Income

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Abstract

Background: Central obesity is a growing pandemic in developing countries. The aim of this study was to assess the energy intake and nutritional characteristics of low-income obese women.

Methods: A total of 103 obese women, age 46 ± 11 years, 89% nonwhite, monthly income up to US $678.00, 77.0% with BMI ≥ 30 kg/m^2, and 100.0% with waist circumference > 80.0 cm (106.3 ± 14.2 cm), followed at the Obesity Clinic of the Bahiana School of Medicine, at Salvador, Bahia, Brazil, were studied. Nutritional data was collected by direct interview and by a 24 hour recall on two non-consecutive days.

Results: A total of 24 h median energy intake was 1,462 kcal, with a daily median carbohydrate intake of 212.6 g (62.1% within the 55.0-75.0% of the recommended total daily energy intake), with 34.6 g of lipids (> 30%) in 20.4%, and within the daily recommended requirements of 5-30% in 63.1%), 66.7 g of protein (above the 10-15% daily recommended intake in 62.1%), and a low fiber intake (< 21.0 g) in 97.1%. Saturated fat acids daily intake was high (> 7.0% the total recommended intake in 81.6%). In addition, a low intake of Vitamin E (91.2%), D (100%), A (67.96%) and calcium (97.08%), plus excessive sodium intake (29.1%) was also documented.

Conclusion: The obesity of these low-income females was associated with a low median daily total energy intake, mildly elevated protein, elevated saturated fat acids, and low fiber intake. The inadequacies of food consumption are also reflected in a low intake of micronutrients, specially vitamins E and D. The low socioeconomic level of these subjects certainly represents the major factor for these findings.

Keywords: Weight; Central obesity; Women; Calorie; Low-income

Introduction

Overweight/obesity is now global epidemic and a major Public Health problem that affect many countries and people from different social classes [1-4]. In fact, this increase seems to scare as they seem to achieve particularly lower social classes, and the fact of grieving female population [4, 5] makes it even more relevant and although contradictorily such facts are not sufficiently clarified [5-10].

Thus, numerous questions permeate the issues surrounding the development of this disease, for which food intake becomes relevant. On the other hand, although dietary factors and exercise perform fundamental role in that and are extremely complex, they remain poorly studied [11]. Along these lines, studies show that dietary changes have strong positive and negative effects on health throughout life and that there is a minimum amount of daily intake of each nutrient to maintain health of the individual [3]. Thus, the idea that obesity is the result only of excessive intake of calories seems not to be supported by literature in broad aspect, even when dealing with people of low economic class where such facts are not sufficiently elucidated [5-10].

Poor people often know what to consume, however consume what their money can buy, low quality foods; on the other hand they spend most of what they have to buy those foods and fail to achieve an acceptable nourishment, besides consuming few meals a day [12, 13]. Literature remains still

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deficient in this regard, and the studies are still inconclusive; however this hypothesis seems plausible to justify the rising obesity among impoverished and these data expose how complex is the relationship between dietary intake and nutritional status and may be the several common mechanisms that the body disposes of in difficult situations [2, 14, 15].

To better understand the relationship between diet and disease, it is essential to investigate the dietary habits and nutrient intake as well as the occurrence and distribution of obesity in a population. The food, from the point of view of nutrition, aims to constituents of foods (carbohydrates, proteins, lipids, vitamins, minerals and fiber) that are essential to the health and quality of life of individuals [10]. The very intake of vitamins and minerals in appropriate proportions is important for the occurrence of various chemical reactions of the body [15].

Given the magnitude of the problem above, and given the scarcity of information in the city of Salvador, conducting a survey was decided in order to assess food intake, the prevalence of inadequate intake of energy and nutrients in the diet of women with overweight/obesity in a low-income population served by the outpatient at the Unified Health System (SUS) in the city of Salvador. Data was from the master's degree dissertation.

Methods

Study scene

This research took place at the outpatient Obesity Clinic of the Bahia School of Medicine and Public Health, as an arm of the Research Project on People with Excessive Weight (PEPE) attended by the Brazilian Unified Health System (SUS), in 2011. A cross-sectional, descriptive and analytical study was carried out with a convenient sample. Inclusion criteria were met by 103 women aged > 18 years, with body mass index ≥ 25 kg/m^2 [1] and waist circumference > 80 cm [16]. Individuals who showed level of understanding that compromises the accuracy of the answers, and referred income exceeding three times the minimum wage and the use of estrogens or other hormones, and anorexigenic drugs at time of data collection were excluded.

Data collection

It began through the answer to a structured pretested questionnaire constructed by the researcher to evaluate the economic and anthropometric profile, and dietary intake of nutrients, through face to face interview. It was applied in three steps: the first one to assess demographic and socioeconomic characteristics, such as age, self-reported skin color, socioeconomic status, and schooling; the second one to measure anthropometric variables, such as weight (kg), height (cm), and waist circumference (WC), and to calculate the body mass index (BMI); the third one to apply a 24 h recall (24HR) at two non-consecutive days. Body weight (kg) was determined with subjects standing with arms parallel to the body, using minimal clothing and barefoot, with a digital scale, Body In 520 - Biospace®), capacity limit of 250 kg and 100 g precision. The height (cm) was measured using a portable 2.1 m stadiometer , with a 1.0 cm precision (TBW, Sao Paulo, Brazil), with the individual standing upright on his back, barefoot, with her feet parallel, heels together, and calf, hip, shoulder, scapular region and head touching the stadiometer with the head in the Frankfort horizontal plane [17]. During the measurement, the individual was instructed to remain in apnea and measurement was obtained with a one centimeter precision, and the final result representing the average of three measurements according to standardized criteria [18]. The BMI was then calculated by dividing the weight in kg by the height in square centimeters ((kg/m^2), and used to classify individuals as normal weight (BMI < 25 k/m^2), excessive weight (≥ 25 and < 30 k/m^2), and obesity (> 30 k/m^2) according the criteria proposed by WHO (2000) [1]. Waist circumference (cm) was measured with a non-elastic flexible scale, with the individual standing, abdomen relaxed, arms in parallel to the sides and feet together [19]. To ensure the reliability of the measures, examination was made whether the scale was not compressing the skin and was situated parallel to the ground, taking as a reference point the superior border of the right iliac crest, with a 1 mm precision reading, during normal expiration, and classified according IDF proposed cutoff point [16]. The 24hR was conducted according to the methodology proposed by FISBERG [20]. Two recalls were used to minimize errors in the variability of daily intake, collected on alternate days, one day of the weekend (Sunday) and one weekday (Tuesday), without prior notice to the respondent, in order to keep their feeding habits unchanged [21]. Total energy and macronutrients (carbohydrates, lipids and proteins), fiber and micronutrients (vitamins A, E, D and Calcium minerals and sodium) intake were determined. The criteria of suitability for macronutrients were calculated according to the recommendations proposed by the World Health Organization (WHO) [22], and for saturated fatty acids according to the National Heart Lung and Blood Institute (EUA) [23]. The adequacy of micronutrients was based on the Dietary Reference Intakes (Dietary Reference Intakes - DRI's) of the Institute of Medicine/ Food and Nutrition Board having a cut off EAR ((Estimated Average Requirement), AI (Adequate Intake-)/UL (Tolerable Upper Intake Level) [24].

Ethical aspects

Study was approved by the Research Ethics Committee of the Bahia Foundation for Science Development (FBDC), and an Informed Consent was signed by all the participants.

Table 1. Demographic, Clinic and Anthropometric Characteristics of Women Followed at the Obesity Clinic, PEPE PROJECT*, EBMSP ** Salvador, BA, 2011

Variables	Frequency (n)	Percentage (%)	Mean (DP)	Minimum	Maximum
Age (years)			46.08 (11.08)	19	78
Color of Skin (self-reported)					
White	11	10.7			
Non white	92	89.3			
Scholarity					
Analphabet	1	1			
Up to fundamental incomplete	43	41.7			
Fundamental completed / High School incomplete	51	49.5			
High School completed	8	7.8			
Family Income (Us dollars)					
0 - ≤ 272.50 **	31	30.09			
1.5 - 2 (408.75 - 545)	55	53.39			
2.5 - 3 (681.35)	17	16.51			
Height (cm)			1.59 (0.07)	1.44	1.8
Weight (kg)			87.47 (19,01)	60.6	158.4
IMC[1]					
25 - 29.9 kg/m^2	17	16.5	34.68 (7.08)	25.64	68.56
> 30 kg/m^2	79	76.7			
CC[2]					
> 80 cm			106.29 (14.15)	80	156

*PEPE: Research Project on Overweight/obese females, ** Bahiana School of Medicine and Public Health. ** Wage: values are US dollars, effective in 2011; N: number of participants; SD: standard deviation; BMI: body mass index (criterion proposed by WHO) (2004), 2 - CC: waist circumference (cutoff recommended by the IDF).

Statistical analysis

Variables of interest were demographic and anthropometric data, and daily intake of total energy and of macro, micronutrients, and fiber. Categorical variables were expressed as percentages and continuous variables as mean ± SD or median (MD) and interquartile range (IQ) according their normal or non-normal distribution, respectively, assessed by the Kolmogorov Smirnov test. Correlation between BMI and waist circumference, respectively, with the daily intake of nutritional variables was obtained by the Spearman's test. Association between demographic, anthropometric and nutrition variables with BMI obesity was obtained by bivariate and multivariate logistic regression analysis.

Table 2. Daily Energy Intake and Distribution of Macronutrients Consumed by Women Followed at the Outpatient Obesity, PEPE PROJECT* EBMSP, Salvador, BA, 2011

Nutritional Variables	N	%	Mean	MD	Q_1	Q_3	$Q_3 - Q_1$	DP	Min	Max
Energetic Value (kcal)			1,642.07	1,423.01	1,048.26	1,913.72	865.46	677.03	520.35	3,754.54
Macronutrients										
Carbohydrates (g)**			245.09	212.61	164.73	279.63	114.9	90.87	43.19	450.96
< 55%	36	35								
> 75%	3	2.9								
55-75%	64	62.1								
Lipids (g)**			44.15	34.62	23.96	58.8	34.84	29.78	6.52	146.78
< 15%	17	16.5								
> 30%	21	20.4								
15-30%	65	63.1								
AG Saturated (g) **			16.98	13.4	8.3	19.5	11.2	13.4	0.3	532
> 7% do TEV	84	81.6								
≤ 7% do TEV	19	18.4								
Protein (g)**										
< 10%	16	15.5	65.28	66.7	43.59	78.6	35.01	33.11	13.1	193.9
> 15%	64	62.1								
10-15%	23	22.3								
Fibers (g)***			12.35	12.4	8.9	14.6	5.7	5.58	1.09	27.3
> 21 g	3	2.9								
< 21 g	100	97.1								

*PEPE- Research Project in excess Weight of Bahia School of Medicine and Public Health ** Recommended values for macronutrients for a balanced diet *** Minimum daily recommendation of fiber in accordance with the Brazilian Society of Cardiology SBC. (21 g Abbreviations: Q_1-Q_3: Interquartile interval, SD: standard deviation, N: number; % frequency.

Results

Table 1 illustrates demographic and anthropometric characteristics of the 103 obese women studied. Mean age was 46.08 ± 11.08 years, they were predominantly non-white, 92 (89.3%), and only 51 (49.5%) had the complete first grade of education. Monthly income goes up to US $678.00 dollars, varying, in the great majority, 86 (83.5%), from US $35.00 dollars plus donations, 31(30.1%), up to US $545.00 dollars, 55 (53.4%). Overweight (BMI 25.0 kg/m^2 to < 30.0 kg/m^2) was present in 17 (16.5%), and obesity (BMI ≥ 30.0 kg/m^2) in 79 (76.7%). WC ≥ 80.0 cm was present in 103 (100.0%), with mean of 106 ± 14.2 cm.

As illustrated in Table 2, the median total daily energy intake (TDEI) was 1,423.0 kcal (1,048.3 - 1,913.7), due to a median carbohydrate intake of 212 g, in 64 (62.1%) within the recommended 55-75% of the TDEI, and in 36 (35.0%) lower than 55.0%; for lipids the median intake was 34.6 g, in 65 (63.1%) within the recommended 15-30% of the TDEI, and in 21 (20.4%) above that; of note also was the high saturated fat intake (> 7% TDEI) in 84 (81.9%); the median protein intake was 66.7 g, with 64 (62.1%) above the recommended 15-30% of the TDEI. Fiber intake was below the recommended 21 g per day in the great majority, 100 (97.1%), with a median very low intake of 12.4 g per day.

On basis of median values, carbohydrates provided 850.4 kcal, lipids 311.58 kcal and proteins 266.8 kcal, corresponding to 59.8%, 21.9% and 18.7% of the TDEI, respectively. Although in the recommended range, carbohydrates stood in the first quartile of its recommended range, lipids in the second quartile and proteins near the lower limit of the first quartile above the recommended range. Therefore, there was a total caloric intake slightly below 1.500 kcal, with caloric intake of carbohydrates and lipids in the bottom of the recommended range, and protein slightly above the recommended, associated with a low fiver intake (Table 2).

Regarding the consumption of Vitamins and Minerals, a high prevalence of low daily intake (> 20%) was observed in all studied vitamins and minerals. Of note, however, was the low prevalence of vitamin D in all (100.0%), of vitamin E (tocopherol) in 91.3%, and vitamin A in 68.0%. Also of note was the high prevalence of a low calcium intake in 97.1%, and excessive sodium intake in only 29.1% (Table 3).

When you consider the association of demographic, clinical and anthropometric variables with obesity, bivariate regression analysis showed that afro-descendents were more prone to be obese (OR = 2.89, CI 2.45 to 3. 93 P = 0.041). On the other hand, those with a monthly income between 2.5 to 3 minimum wages (OR-0.60, 95% CI 0.23 - 0.96 P = 0.047), a daily fiber intake > 21g (OR 0.60, CI 0.05, 0.89; P = 0.053) and of vitamin E > 12 mg (OR 0.20, CI 0.05 to 0.83 P = 0.03) and of saturated fat < 7% of TDEI (OR 0.39 CI 0.07 to 0.95 P = 0.01) were less prone to be obese. Further multivariate logistic regression analysis showed that all these variables,

Table 3. Daily Intake of Vitamins and Minerals With Median Values and Prevalence of Inadequate Intake Among Women Followed at the Outpatient Obesity PEPE Project * EBMSP, Salvador, Bahia, 2011

Vitamins	EAR[a]/ AI[b]/UL[c]	Mean	Median	Q_1	Q_3	Q_3-Q_1	DP	Min	Max	Prev/Inad %
A (mg)[a]	500	495.73	273.4	132	678	546	1,115.34	0	1,099.3	67.96
D(µg)[a]	5	4.06	1.7	0.3	4.5	4.2	6.2	0	36	100
E (mg)	12	5.557	3.8	1.7	7.5	5.8	5.52	0.4	34,5	91.26
Calcium (mg)	1,200	355.51	316.6	144.2	509.3	365.1	245.97	0.2	1,244,5	97.08
Sodium (mg)	2,400	1,633.16	2,187.4	679.9	2,806.8	2,126.9	1,285.74	101	5,327.6	29.1

* PEPE- Research Project on Overweight/obese females, ** Bahiana School of Medicine and Public Health; EAR Estimated Average Requirement-(Application Medium); AI: Adequate Intake; UL: Tolerable Upper Intake Level (maximum tolerable intake level). The data presented in columns nutritional recommendations is based on the average value of Requirement (EAR) except in cases of AI (adequate intake) and UL - maximum tolerable intake level.

Table 4. Factors Associated With Obesity in Women Followed in the Clinic of Obesity, PEPE PROJECT * EBMSP, Salvador, BA, 2011. Bivariate and Multivariate Analysis

Risk factors	Odds (IC)	Odds (IC)
Skin Color		
Black	2.89 (2.45; 3.93)	1.74 (1.77; 3.91)
Family Income		
2.5 - 3 SM	0.60 (0.23; 0.96)	0.69 (0.41; 1.1)
Intake of Fibers		
> 21 g	0.60 (0.05; 0.89)	0.57 (0.49; 0.71)
Intake of Vitamin E		
> 12 mg	0.20 (0.5; 0.83)	0.23 (0.5; 0.97)
Intake of de Saturated Fat		
< 7% VET	0.39 (0.07;0.95)	0.33 (0.08; 0.96)

* PEPE: Research Projetc on Overweight/obese females, ** Bahiana School of Medicine and Public Health; Abbreviations: P < 0.05; OR: Odds Ratio; IC 95%: Confidence Interval; SM: Minimum Wage.

but monthly income between 2.5 to 3 minimum wages, were independently associated with obesity, as shown in Table 4.

Discussion

The subjects here studied showed socioeconomic characteristics similar the those low income populations already reported, as a higher frequency of non-white (black or brown), and low schooling level, allowing us to infer are important contributors to this type of overweight/obesity [25-29]. One importante point related to our study population is its connection with an obesity clinic from a medical school, what certainly may have hade some influence upon its nutrition habits without, however, affect the basic mechanisms leading to obesity. The energetic value found features insufficient food in accordance with the recommendations [24] which is an important marker of nutritional problems [30] independently from nutritional status. Those findings are consistent in the literature that women in lower socioeconomic classes have a compromised energy intake by income [2, 31]. Actually, some studies found no difference between energy intake among eutrophic individuals and obese/overweighed [2, 31], and other expose curious findings in relation to individuals with low intake with overweight/obese [32, 33]. Data that strengthen the relevance of these findings and allows to infer that in this kind of overweight/obesity, as presented by these females, only caloric intake is not enough and determining to understand intake and nutritional status, nor is the only responsible for such pandemic evolution where the less fortunate are found. Some hypotheses are illustrated in the literature, in this case regulatory mechanisms in the body seem to participate in the control of energy savings allowing adjustment of energy expenditure in face of reduced energy intake and also the greater the amount of body fat the lower energy expenditure [2, 14, 15, 32, 34]. In addition, the imbalance in the composition of intestinal microflora seems to contribute to the development of overweight/obesity [35], because a decrease of bacteria bacterioidetes and increase of Firmicutes favors caloric extraction mechanism [35-40] making it more efficient and contributing to increased adiposity, such as that these signals can be an advance in the treatment of obesity [37]. This data strengthen the relevance of these findings and allows to infer that in this kind of overweight/obesity, as presented by these females, only caloric intake is not enough and determining to understand intake and nutritional status, nor is the only responsible for such pandemic evolution where the less fortunate are found.

Regarding the intake of carbohydrates, most is according to the values recommended for a balanced diet [22] similar to other studies of Brazil [41-43]; however, in this group prevalent intake was observed of refined carbohydrates and low in fiber. The low fiber intake in general has been observed in some studies, a fact associated with poor intake of whole grains, fruits and vegetables [41-43]. The fibers play a prominent role due to action of beneficial changes in intestinal microbiota and body weight maintenance. Above all, these findings are relevant, thus for the lack of research that

evaluate fiber intake in women of low socioeconomic status with overweight/obesity. Regarding lipids, the intake of saturated fatty acids, appeared high standing in studies conducted in various regions of Brazil [41-44]. This habit favors the accumulation of adipose tissue, contributes to the nutritional status and increases serum lipids and cardiovascular risk [45-48]. The high protein intake, presented by the group is consistent with the literature although not only observed in individuals with the same characteristics [28, 41-43]. Thus it becomes evident the adequacy committed in the nourishment of the group, by high intake of protein and lipid (saturated fat), reduced intake of fibers which is certainly related to overweight/obesity.

In this study, a low intake of nutrients (vitamins and minerals) was observed. Indeed, the data found here point put that there is evidence that women who are overweight/obese in low socioeconomic classes suffer from lack nutrients which could worsen their health situation. Similar results were found in a representative sample of adolescents and elderly at Sao Paulo in the lower income strata as well as in individuals who were overweight/obese [49]. Micronutrients have a basic role in metabolism, participating of metabolic reactions; however some nutrients are further explored in the literature which does not make them more important, but by having yet clarified part of their functions in relation to obesity. Inadequate intake for vitamin A (retinol), vitamin E and calcium was observed as well as in other studies [48-52]. A study of a representative sample of adolescents and elderly in Sao Paulo showed inadequate intake of nutrients in the lower income strata as well as in individuals who are overweight/obese [49]. Studies conducted in the USA, Canada and Mexico found inadequate intake of nutrients even in low socioeconomic classes [48, 50, 51]. Although these studies were conducted on populations of different characteristics from those of this group, the data found here point out that there is evidence that women who are overweight/obese in the low socioeconomic classes suffer from a lack of nutrients which could worsen health situation. Caution must be taken to the low calcium intake, which was verified in other works not only with individuals of low socioeconomic status [49, 53]. Highlighted in literature have been some studies suggesting the involvement of calcium in the control of metabolic abnormalities commonly present in obesity [54], calcium which is able to inhibit the increase of fat cells [22]. Today the discussion is about the amount of vitamin D available in foods and the amount that the individual is able to synthesize by the skin due to sun exposure, and in addition some factors such as age, ethnicity and obesity could interfere with the availability in vitamin [55]. It is believed that the increased weight is related to vitamin D deficiency, as it occurs in obese individuals a greater deposit of that in the adipocytes, which consequently reduces its bioavailability and activates the hypothalamus to start a series of reactions that result in decreased basal metabolic rate [55]. Moreover, the high sodium intake has been observed frequently [49, 53, 56], and associated with cardiovascular diseases, chronic diseases and hypertension [57]. In this sample, the black skin color appears as an independent factor suggesting a possible genetic race predisposition. However, this association remains far from clear. In Brazil, in this regard the study of Gigante et al (2009) [58] analyzing data reported by VIGITEL [52], found a higher prevalence of overweight/obesity among black women, and yet according to a cohort study conducted in Rio de Janeiro between 1999 - 2001 found BMI ≥ 30 kg/m^2 in 46.6% of nonwhites (26.4% of black women), and 13% of white [59]. However, it should be emphasized that those studies also included middle and upper classes subjects what makes more expressive the highest percentages of obesity in black women.

From the socioeconomic standpoint, household income above 2.5 minimum wages does not appear as a protective factor; it loses significance in the multivariate analysis which may have been influenced by the small percentage of women with this income. However, the protective influence of higher income may be evidenced by asymmetric 95% CI (0.49, 1.1). Regarding the feeding pattern it was evident the preventive importance of a daily fibers intake greater than 21 g, vitamin E over 12 mg and saturated fat lower to 7% of energetic full value (VET). It is worth emphasizing that the intake of all those three types of nutrients has to do with nutritional guidance and purchasing power, higher when related to the two micronutrients, whose intake was insufficient due to low intake of whole grains, fruits and vegetables, opposing to the excessive intake of low price saturated fat. The findings of this study are consistent with the literature on studies that included people with low incomes [59-63]. Intervention study conducted with 275 women with a mean age of 40 years showed that adequate intake of fiber, reducing the risk of weight gain BMI (OR: 0.66; CI 95%: 0.58 to 0.74), and noting that increase in fiber intake is related to decreased intake of simple carbohydrate [63]. Insufficient intake of micronutrients is among the ten main leading risk factors for the total global disease burden worldwide, and is considered the third risk factor of foreseeable non-transmissible disease aggravation [22]. Those nutrients are coming from foods which are not usually consumed by women in this study, and having as the most likely cause the high price attached to these products. Particularly related to vitamin E, some studies show that its low intake appears associated between the high values of subclinical inflammatory activity, as measured by CRP. Indeed, it is worth mentioning that a study of 2,045 women aged 25 - 74 years, found that the intake of vitamin E was significantly associated with lower inflammatory activity in obese, as measured by CRP in obese OR 0.57 (95% CI: 0.37 - 0.89), suggesting a possible association between the intake of this nutrient and subclinical inflammatory activity in obese individuals [54]. The high intake of saturated fat direct association with obesity has also

been found in large prospective studies, including men and women [62, 63]. In a prospective cohort study lasting three years, with 826 women a positive association was found between fat intake and weight gain (obesity) [62], a cohort study conducted with 17,369 individuals (men and women) found that fat intake significantly predicts weight gain (OR = 1.75 95% CI 1.01 to 3.06) [63]. On the other hand, it is noteworthy research study involving 90.000 with men and women found no association but it must be noted that the post-observation weight was self-mentioned and feed evaluation consisted of an Attendance questionnaire presented at the beginning of the study [64].

Conclusion

In this low income women population followed at a specialized clinic, obesity is maintained with a low daily energy intake. This energy is supplied by a proportion of carbohydrate and lipids, at the low normal recommended level, and by protein at a slight high level. The lipids, however, included an excessive amount of saturated fatty acids replacing poly and monounsaturated fatty acids. In addition, the intake of vitamins and fiber is insufficient.

This nutrition pattern is a consequence of dietary habits secondary to a low income and to a low education level leading to the selection of low price and tasteful industrialized foods for consumption. It is worth to emphasize that these nutritional risk factors are modifiable allowing the control of obesity by appropriate preventive measures. A better understanding of the mechanisms related to this type of low energy intake obesity would help to prevent this pandemic.

Conflicts of Interest

The authors declared no conflicts of interest.

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