Research Article
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Comparison of micronutrient consumption in women with central obesity in the C/D/E versus A/B socioeconomic classes

Abstract

Objective: To estimate the consumption and prevalence of inadequate intake of micronutrients among women with central obesity of socioeconomic classes C/D/E versus A/B.

Method: A cross-sectional study in which a structured questionnaire was answered containing socioeconomic data. The weight and waist circumference (WC) was measured and dietary intake assessed (24hR) in relation to habitual consumption (vitamins A, D,C, calcium and sodium). Dietary analyses were performed using the Nutwin software and statistical analysis on the SPSS 23.0.

Results: There were 79 women with central obesity evaluated in each group (C/D/E vs. A/B), average age of 51.2±(12.2) vs. 49(14.4) years, WC 100.26 ± 11.34 vs. 98.2 ±9.8 cm. With reference to the consumption of nutrients calcium reached 100% of inadequacy for the total sample, independently of the socioeconomic class. When comparing prevalence of inadequacy among the groups, for women of classes C/D/E vs. A/B, emphasis is given to vitamin D (82.4 vs. 57.8), vitamin A (66.2% vs. 31.8%) and vitamin C (76.14% vs. 34.48%) ($p<0.001$). We highlight the excessive consumption of sodium in both groups, although in class C/D/E, the consumption was higher, 84.09% vs. 32.4% in class A/B ($p<0.001$). In essence, there is a higher prevalence of inadequate consumption in class C/D/E for vitamins A, D and C ($p<0.001$).

Conclusion: the results of this research clearly demonstrate the high prevalence of inadequacy of nutrients, in both groups, nevertheless, the markedly inadequacy in class C/D/E emphasize the distinction in the dietary pattern between the groups.

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Izabela Aparecida Rodrigues Ferraz,[1] Manuela Pereira Lima Monteiro,[2] Izabela Gelisk,[3] Maria de Lourdes Lima,[4] Ana Marice Ladeia,[5] Armenio Coast Guimarães[6]

[1]Nutritionist of the Multidisciplinary Teaching Clinic for Overweight/Obese Patients (PEPE PROJECT) at EBMSP, Brazil
[2]Nutritionist, Special student of the Master in Food, Nutrition and Health of the Federal University of Bahia, Brazil
[3]Nutritionist and Master's Degree in Medicine and Human Health by the Bahian School of Medicine and Public Health, Brazil
[4]Endocrinologist Coordinator of the Multidisciplinary Teaching Clinic for Overweight/Obese Patients (PEPE PROJECT) at EBMSP, Brazil
[5]Cardiologist at the Multidisciplinary Teaching Clinic for Overweight/ Obese Patients (PEPE PROJECT) at EBMSP, Brazil
[6]Cardiologist and General Coordinator at the Multidisciplinary Teaching Clinic for Overweight/Obese Patients (PEPE PROJECT) at EBMSP, Brazil

Correspondence: Izabela Aparecida Rodrigues Ferraz, PhD candidate in Human Medicine and Health at Medicine and Human Health by the Bahian School of Medicine and Public Health - EBMSP, Nutritionist of the Multidisciplinary Teaching Clinic for Overweight/Obese Patients (PEPE PROJECT) at EBMSP, Bahia, Brazil, Tel (71) 991301279, Salvador –BA, Brazil, Email izabelaferraz2117@gmail.com

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Introduction

The current nutritional issue with the greatest ascent is obesity, taking a hold of individuals of different ages, genders or social classes.[1] The prevalence of obesity began to increase in the eighties, being gradual in developed countries with high income and subsequently, a sharp increase reached low income countries, which is the case of Brazil, occupying the third place in absolute numbers of obese people in the last thirty years (20 million), behind China (42 million) and the U.S.A. (56 million).[1] Furthermore, in relation to obesity, we emphasize the increase of central obesity, characterized by an increase in waist circumference due to the preferential storage of body fat in the abdomen is associated to an increase in the risk of developing hypertension, dyslipidemia and diabetes, resulting in an increase in morbidity and mortality from metabolic and cardiovascular diseases.[1,2]

The increase in obesity has been associated to insufficient consumption of nutrients,[3] despite the fact that this role has not yet been clarified in literature.[4] Changes in dietary patterns[5] and countless discussions approach dietary issues, whereby the low dietary quality as well as the decrease in the consumption of micronutrients is pointed out as one of the main causes of this scenario.[2] Inadequate consumption of fruit, greens and vegetables has been confirmed in some studies[5] and for this reason a deficiency of nutrients reaches around 2 billion people worldwide. Thus, as in other countries of average income, in Brazil, obesity coexists in parallel with nutrient deficiency with normally varies between 40-100%.[6,7] Nevertheless, presently, we emphasize that the evaluation of the consumption of micronutrients and mainly in obese women has not been sufficient, despite this deficiency being one of the main risk factors for the development of non-communicable diseases.[8] In view of the magnitude of the problem and in the face of the lack of information, mainly in the city of Salvador, the objective of this research was to estimate the consumption and prevalence of inadequate intake of micronutrients among women with central obesity in the socioeconomic classes C/D/E vs. A/B.

Materials and methods

An exploratory, cross-sectional and analytical study, with comparison groups, where the sample comprised women with central obesity (WC>84cm)[9] of ages over 19 years. The women of

socioeconomic class C/D/E were participants of the PEPE Project (Research Project with Overweight Patients) at the Outpatient Teaching Clinic of Escola Bahiana de Medicina (EBMSP), attending to patients of the Public Health System (SUS) and the women of socioeconomic class A/B were attended at a Private Clinic, in Salvador. Income was classified as follows: class E (up to 2 minimum wages), class D (2 to 4 minimum wages), class C (4 to 10 minimum wages), class B (10 to 20 minimum wages) and class A (over 20 minimum wages), in accordance with the classification criteria of the IBGE (Brazilian Institute of Geography and Statistics).[10] Accordingly, income was the main criteria for the division of the groups. Women with difficulties in expressing themselves, pregnant or breast feeding, under hemodialysis, using chemotherapy, using anorectics/appetite suppressants and/or with psychiatric disorders were excluded. The criteria adopted for calculating the sample size were SD (677.04),[11] significance level of 5% and study power of 95%. It was detected that a minimum of 74 women would be necessary in each group (N=148), and this study included 89 women in each group, totaling 198.

Data collection was performed after signing the Informed Consent Form, using a structured questionnaire to comply with the objectives of the outpatient follow-up. The studied variables included age (years), skin color (self-referred), schooling level and income. The weight was measured (kg) using bioimpedance scales (In Body 520–Biospace® equipment), with capacity for up to 250kg height was measured using a portable stadiometer (Altura Exata TBW, São Paulo, Brazil) with limits of 2.1m and precision of 1.0 cm. The women were guided to remain facing backwards, in an erect position, barefoot, with the feet parallel, heels together, calves, hip, shoulders, scapular region and head against the stadiometer. Waist circumference (WC) was measured using an inelastic tape measurer, with scales of 0.5cm, on a horizontal plane, having as reference the central point between the last rib and the right iliac crest. This measurement was considered as increased when greater than or equal to 84cm.[9] For evaluation of dietary consumption three 24-hour recalls (24hR) were used, two collected during the week (Tuesday and Thursday) and another in relation to the consumption on Sunday, with seven-day intervals to contemplate dietary variations that could occur during the week, describing exactly the consumption, types of meals, preparation, home measures consumed, including intake of macronutrients, micronutrients (vitamins and minerals) in accordance with the Multiple Pass Method.[12] Collections were structured to obtain all pertinent information in relation to consumption, and the data obtained was converted into energy and nutrients using the *Nutwin*®[13] program, performed by means of double entry to certify that the data was correctly included. Supporting tables[14,15] were used for the inclusion of food or ingredients not available in the *Nutwin*® program. The nutrients were adjusted by energy in accordance with the residual method, proposed by Willet[16] to eliminate the influence of calories in the consumption of nutrients, and the calories considered as independent variables, whereas the nutrients as dependent variables, thus the "adjusted" nutrient represents the actual value of each nutrient ingested without the influence of total energy consumed. All the variables were analyzed continuously considering the recommendations of the Institute of Medicine (IOM) for each nutrient.[17–21] The prevalence of inadequacy of nutrients was estimated using the Estimated Average Requirement (EAR) method as a cut-off proposed by IOM for the U.S.A. and Canada population.[17–20] The estimated average requirement is defined by the EAR, whereby the prevalence of inadequacy of nutrients is estimated by the proportion of individuals that consume below this value. For Sodium, the calculation of prevalence of inadequacy of consumption considered value above the Tolerable Upper Intake Level-UL, in which the value of Sodium considered intrinsic and added values.[21]

Statistical analysis

For analysis the data was initially organized into excel worksheets, with double entry. Subsequently, for statistical analysis, the data was exported to the SPSS program, version 23.0.[22] For the descriptions of the categorical variables, the data was presented in absolute and relative frequency, using the chi-square test, with confidence level of $p<0.05$ and confidence interval of 95%. The data on continuous variables were expressed in mean and standard deviations, and the t-test used for the analyses. This study was approved by the Research Ethics Committee in Human Beings of Escola Bahiana de Medicina e Saúde Pública (Number 1314942/2015), following the guidance of the National Committee for Ethics in Research (CONEP). This data is the partial data of a PhD Thesis.

Results

The total sample comprised 179 women with central obesity (WC>84cm), with 89 in each group, classified in accordance with the socioeconomic classes C/D/E vs. A/B. The ages varied between 19 and 78 years, with an average of 51.2±12.2 years vs. 49±14.4 years, not having observed significant differences ($p=0.08$). There was a predominance for non-white skin color in both groups, 76 (85%) vs. 77 (86.5%). With reference to schooling levels, we observed predominance in the C/D/E group for incomplete secondary education, 45 (50.56%), on the other hand, in socioeconomic class A/B, we observed total completed higher education ($p<0.001$). Family income, in the socioeconomic class C/D/E varied between 1.5 and three minimum wages (R$788.00 minimum wage), with predominance of 1.5 to 2 minimum wages, in 38 (42.69%). The number of dependents varied from 1 to>6, we observed in class C/D/E, predominance of 1 to 3, 46 (54.12 %) and of 4 to 6, 37 (43.53%), in contrast in class A/B the totality of the sample 89 (100%) presented 1 to 3 dependents, ($p<0.001$). Whilst in group A/B, 100% of income was of over 10 minimum wages (R$7.880.00). In summary, we observed significant differences between the groups for schooling levels and family income ($p<0.001$) (Table 1).

In relation to the intake of micronutrients (Table 2), in both groups a high prevalence of inadequacy was observed for most of the evaluated micronutrients. Furthermore, we emphasize that in relation to the consumption of calcium, the prevalence of inadequacy reached 100% for the total sample, independently of the socioeconomic class. The mean values observed were below the EAR values which fact resulted in a high prevalence of inadequacy for all of the evaluated vitamins. When comparing prevalence of inadequacy between the groups, for women of class C/D/E vs. A/B, emphasis is for vitamin D (82.4 vs. 57.8), vitamin A (66.2% vs. 31.8%) and vitamin C (76.14% vs. 34.48%) ($p<0.001$). We highlight excessive consumption of sodium in both groups, nevertheless in class C/D/E we observed 84.09% vs. 32.4% in class A/B. In brief, we observed high prevalence of inadequate consumption in class C/D/E for vitamins A, D and C ($p<0.001$).

Table 1 Socio-demographic characteristics of women with central obesity of socioeconomic classes C/D/E* vs. A/B*, accompanies at the Outpatient Clinic for Obesity, PEPE** of EBMSP, Salvador, Bahia, 2015-2016

Variables	Group C/D/E				Group A/B				
	N(%)	Average (SD)	Min	Max	N(%)	Average (SD)	Min	Max	p value
Age (years)		51.2 (12.2)	24	78		49 (14.4)	25	70	0.08
Waist circumference***		100.26 (11.34)	100	130.7		98.2 (9.8)	98	105	0.3
Skin color (self-referred)									
Brown and Black	76 (85%)				77(86.5%)				0.457
Schooling									
Illiterate	4 (4.49)				0				<0.001
Incomplete elementary education	35 (39.32)				0				
Complete elementary / incomplete secondary education	45 (50.56)				0				
Higher education	5 (5.61)				89 (100)				
Family income									
0 <1.5**	23 (25.84)				0				< 0.001
1.5-2 MW	38 (42.69)				0				
2.5 -3 MW	28 (31.46)				0				
>10MW	0 (0)				89 (100)				
Number of dependents									<0.001
-3 people	46 (54.12)				89(100)				
4-6 people	37 (43.53)								
>6 people	2 (2.35)								

*Classification in accordance with the IBGE; **Research Project on excess weight; *** Weight Circumference

P value: quantitative variable; t-test **categorical value: chi-square test

Table 2 Daily intake of vitamins and minerals by women with central obesity in socioeconomic classes C/D/E* vs. A/B*, accompanies at the Outpatient Clinic for Obesity, PEPE** of EBMSP and in a Private Clinic in Salvador, Bahia, 2015-2016

Vitamins and Minerals	EAR/	Class C/D/E			Class A/B			***p
	AI/UL	Average (SD)	Min-Max	Prevalence inadequacy (%)	Average (DP)	Min-Max	Prevalence inadequacy (%)	
A (mg)	500[a]	176.44 (319.87)	2-1298	66.28	443.75 (326.62)	24-1578	31.82	<0.001
D (mcg)	5[a]	3.2 -8.7	0-29	82.43	14.46 -10.3	0.20-29	57.89	<0.001
Ascorbic acid (mg)	60[a]	46.59 (14.78)	4.7-356.1	76.14	159 -112.4	8-356.1	34.48	<0.001
Calcium (mg)	1200	154.47 (248.01)	75.5-767	100	356.01 (243.76)	75.5-768	100	<0.001
Sodium (mg)****	2400	2027.86 (1083.7)	270-4285.1	84.09	1437.5 (899.67)	178-2488.3	32.41	< 0.001

*Classification in accordance with the IBGE; **PEPE- Research Project on Excess Weight; ***p value = t-test;

EAR, Estimated Average Requirement; AI, Adequate Intake; ****UL, Tolerable Upper Intake Level

The data presented in the columns of nutritional recommendation is based on the estimated average requirement (EAR) except in cases of adequate intake (AI) and UL – tolerable upper intake level.

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Discussion

According to our understanding, this is the first study proposing the investigation and evaluation of the prevalence of inadequacy of nutrients in women with central obesity presenting as a main distinguishing factor socioeconomic aspects. We highlight the similarity between the groups in relation to age, WC and skin color. Such similarities permit us to infer that it is a homogeneous population in relation to these characteristics. On the other hand, we emphasize the heterogeneity in relation to schooling levels, number of dependents and income, with the latter being the main distinction between the groups. Predominance for low schooling levels in class C/D/E, coincides with a higher number of dependents which could favor the choice of food, once the availability of resources for the purchase of food would be compromised by the quantitative of people[23], and thus such factors could contribute towards dietary routine. On the other hand, the group with higher income presents higher schooling levels and lower number of dependents, permitting the availability of a larger part of income for the consumption of more food considered as being more nutritive. Although relevant, prior studies have demonstrated that income is a determining factor in the choice of food, although other factors should be taken into account.[11,24,25] According to Defante & collaborators,[26] in low income populations, most of the time, due to the resources available for food, it is necessary to consider what to buy for food. Nevertheless, when evaluating the increase in income in relation to consumption, it was observed that this factor may increase the quantity and not the quality of the food consumed, once the inclusion of healthy food depends on information and guidance enhancing life styles considered as being healthier or prior knowledge.[26,27] Even in the face of the gravity of this pathology, studies evaluating the consumption of micronutrients are scarce in literature, and moreover, methodological differences hinder the comparison of results. This dietary mismatch characterized by the insufficient intake of micronutrients is the third preventable risk factor for non-communicable diseases and illnesses.[28] In this study, based on the nutrients investigated, the consumption is demonstrated as being insufficient, reflecting in a high prevalence of inadequacy throughout the sample, independently of the socioeconomic class. More specifically, in class C/D/E we observed prevalence of inadequacy of over 70% for all evaluated nutrients, and due to this, it is possible to infer that this group, when compared to class A/B, presents an inferior quality in the dietary intake in relation to food such as fruit, greens and vegetables. Also, in this direction, insufficiency in the consumption of nutrients can aggravate obesity and further reflect in greater probabilities of other metabolic disorders.[3,29,30]

The high prevalence of inadequate consumption presented by the groups demonstrates a trend in the insufficient consumption of food considered as nutritive such as fruit, greens and vegetables, as well as other food rich in nutrients. Calcium was the mineral with higher prevalence of inadequacy in both groups (100%), but there was also a high deficiency in the consumption of vitamin D. Some studies suggest that the ingestion of calcium seems to exercise a control over weight through different mechanisms, and demonstrate that insufficient consumption can promote the deposit of fatty acids in the adipocytes, favoring lipogenesis and a decrease in the release of insulin contributing towards the state of obesity and consequently the increased risk of other cardiovascular disorders.[3,12,31] Further, calcium participates in important metabolic functions such as regulating body temperature and thermogenesis, which factors have been associated with anti-obesity effects, once the intake of calcium can explain a variation of up to 10% in the weight of an adult.[12] High prevalence of inadequacy of vitamin D, in turn, exercises an important role in the deposit of fat in the abdominal region, once vitamin D seems to be connected to the adipocytes, decreasing its availability and in a cascade process decreasing energy expenditure.[3,29,32] It should be observed that there are evidences in epidemiological studies and clinical trials that demonstrate that inadequate intake of calcium and vitamin D are risk factors for the development of inflammatory, autoimmune, infectious and metabolic diseases such as obesity and hypertension.[33] In this scenario, it is believed that the insufficient consumption of nutrients, as well as the decreased absorption, seem to be involved in weight increase and or increase in the inflammatory process of overweight patients.[3] Accordingly investigations of this scenario are very important, such as the prevalence of inadequacy observed for vitamin A, which in this study demonstrated greater evidence in the socioeconomic group class C/D/E, when compared to class A/B. In a study performed at the Ambulatório de Saúde da Mulher (Women's Health Outpatient Clinic) in São Paulo, it was observed that out of the women assisted, 82.8% presented insufficient intake of this vitamin. Although in the mentioned study there is no inference to socioeconomic class, there is a similarity in relation to income once these are women treated in a SUS clinic. In parallel, in a cross-sectional study performed in Mexico, obese women presented a higher prevalence of inadequate intake of e vitamin A, when compared to non-obese women[34] Therefore it is possible to infer that obese women present in their diets insufficient quantities of nutrients, within this context women from low socioeconomic classes demonstrate high prevalence of inadequacy of nutrients and thus lower quality of food intake when compared to high income obese women. Deficiency in vitamin A has been related to central obesity,[3] once it plays an extremely important role in the metabolism of adipocytes inhibiting adipogenesis, increasing the risk of hypertension, dyslipidemia and the severity of central obesity, increasing the risk of death.[35,36]

It is common knowledge that a high consumption of sodium is related to an increase in the risk of developing hypertension. In this study, the high consumption of sodium observed in class C/D/E may be related to a greater ingestion of industrialized food and ready-made seasoning, accessible to the least privileged socioeconomic classes.[37] Such habits can aggravate further the state of obesity and also increase the risk of secondary diseases.

As limitation to this study, we highlight the use of 24h recalls for obtaining dietary intake, once it depends on the memory of the interviewer. To minimize risks of bias, all of the interviews were performed by trained interviewers who followed the Multiple Pass Method.[12] Another limitation of the study refers to the use of the Nutrition Data System for Research (NDSR),[38] once this software presents as its main data base a U.S. table and not a Brazilian one, nevertheless all of the food was inserted in accordance with the TACO Table.[39] In order to respond to this limitation, various methodological procedures were adopted, as described in the section of methods. Additionally, it should be noted that despite this study having made an analysis on the inadequacy of vitamin D in the perspective of food consumption, the main source of this vitamin is not dietary, but from exposure to the sun, independently of dietary intake.

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Conclusion

In conclusion, the results of this research clearly demonstrate the high prevalence of the inadequacy of nutrients in both groups, nevertheless, a higher prevalence in class C/D/E emphasizing the distinction of the dietary pattern between the groups. This is very unsettling, inasmuch as the obese women of class C/D/E presented herein are accompanied by a multidisciplinary team in an Outpatient Teaching Clinic associated to the SUS. Thus, these results may contribute towards strengthening actions develop to promote health habits, mainly in this population, in order to decrease deficiencies in the intake of micronutrients and reduce associated health issues.

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Conflicts of interest

The author declares there are no conflicts of interest.

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