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Food intake in patients on hemodialysis[1]

Ingestão alimentar de pacientes em hemodiálise

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ABSTRACT

Objective

To evaluate the intake of energy and nutrients by individuals on hemodialysis, following especific recommendations for this population and according to Food Guide for the Brazilian Population.

Methods

A cross-sectional study, 118 adult patients, considered stable from, ten dialysis centers in *Goiânia, Goiás*. Dietary intake was estimated by six 24-hour recalls, and classified as adequate or inadequate, according to specific recommendations for individuals undergoing dialysis and that recommended for a healthy diet. A descriptive analysis was performed.

Results

Average dietary intake of 2022.40 ± 283.70 kcal/day; 31.18 kcal/kg/day; 55.03 ± 4.20% carbohydrate; 30.23 ± 3.71% lipid, 1.18 ± 0.23 g protein/kg/day. Important prevalences of inadequacy were observed for the intake of calories (39.0%), protein (39.0%) and other nutrients such as retinol (94.9%), saturated fat (87.3%), cholesterol (61,9%), iron (61.0%), potassium (60.2%) and zinc (45.0%). Patients had a low intake of fruit food group (1.22 ± 0.89 servings) and vegetables (1.76 ± 1.01 servings), dairy products (0.57 ± 0.43 servings) and high intake of food group of oils and fats (3.45 ± 0.95 servings), sugars and sweets (1.55 ± 0.77 servings).

Conclusion

Observed food consumption imbalance, characterized by excess of oils and fats, especially saturated oils and cholesterol, sugars and sweets, parallel to low intake of fruits and vegetables and dairy products. A considerable percentage of patients did not intake the minimum recommended of calories, protein, retinol, iron, zinc and potassium.

Indexing terms: Eating. Nutrients. Renal dialysis.

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RESUMO

Objetivo

Avaliar o consumo de energia e nutrientes de indivíduos em hemodiálise, segundo recomendações específicas para essa população, e de acordo com o Guia Alimentar para a População Brasileira.

Métodos

Trata-se de estudo transversal, com 118 pacientes adultos considerados estáveis, tratados em 10 centros de diálise em Goiânia, Estado de Goiás. A ingestão alimentar foi estimada por meio de seis recordatórios de 24 horas, sendo classificada em adequada ou inadequada, conforme recomendações específicas para indivíduos em hemodiálise, é recomendado para uma alimentação saudável. Foi realizada análise descritiva dos dados.

Resultados

Observou-se ingestão alimentar média de 2022,40 ± 283,70 kcal/dia; 31,18 kcal/kg/dia; 55,03 ± 4,20% de carboidrato; 30,23 ± 3,71% de lipídeo; e 1,18 ± 0,23 g de proteína/kg/dia. Importantes prevalências de inadequação foram observadas para a ingestão de calorias (39,0%), proteínas (39,0%) e outros nutrientes, como retinol (94,9%), gordura saturada (87,3%), colesterol (61,9%), ferro (61,0%), potássio (60,2%) e zinco (45,0%). Os pacientes apresentaram baixa ingestão de alimentos do grupo das frutas (1,22 ± 0,89 porções), legumes e verduras (1,76 ± 1,01 porções), leite e derivados (0,57 ± 0,43 porções), bem como ingestão elevada de alimentos do grupo dos óleos e gorduras (3,45 ± 0,95 porções) e açúcares e doces (1,55 ± 0,77 porções).

Conclusão

Foi observado um consumo alimentar em desequilíbrio, caracterizado pelo excesso de óleos e gorduras, sobretudo gordura saturada e colesterol, açúcares e doces, paralelamente à baixa ingestão de frutas, legumes e verduras, leite e derivados. Um percentual considerável de pacientes deixou de ingerir a recomendação mínima de calorias, proteína, retinol, ferro, zinco e potássio.

Temos de indexação: *Ingestão de alimentos. Nutrientes. Diálise renal.*

INTRODUCTION

Alterations in nutritional status, such as protein-energy malnutrition and obesity, are conditions that are often found in patients with Chronic Kidney Disease (CKD), resulting in problems related to quality of life and increased morbidity and mortality[1,2].

Regular monitoring of individual hemodialysis patients' food consumption makes it possible to understand dietary habits and to define appropriate prescriptive measures for improved diet, something that is important in the prevention, treatment and monitoring of poor nutrition, be it a lack or an excess[2]. Thus an understanding of food intake of these individuals, taking into account energy and nutrient consumption and dietary habits, is essential to ensure dietary guidance that is adapted to dialysis and involves the limitation of some elements along with an increased consumption of others[1,3,4].

The restrictions imposed on the patient by the need to control interdialytic weight gain and serum levels of phosphorus and potassium can often give rise to significant difficulties when it comes to following dietary recommendations and a balanced diet[4]. Shortcomings in intake of calories and proteins represent the food problems that are most commonly found in hemodialysis patients[4-7].

However in addition to the consumption of calories and proteins, the intake of other nutrients such as carbohydrates, lipids, vitamins and minerals and the types of minerals consumed must also be evaluated, with a view to promoting adequate diets among these individuals. The objective of this study is therefore to evaluate the consumption of energy, nutrients and fiber among individuals on hemodialysis, in accordance with specific recommendations for this population and intake by food group outlined in the Food Guide for the Brazilian Population.

METHODS

This was a cross-sectional study in ten hemodialysis centers in the city of *Goiânia* in *Goiás* State, between May 2009 and March 2010. The study was approvated by the Research Ethics Committees at the *Hospital das Clínicas* at the *Universidade Federal de Goiás* (HC/UFG) and at the *Santa Casa de Misericórdia de Goiânia* (Protocols CEP/HC/UFG nº 011/2009 and CEP/SCMG nº 046/2009). Terms of Informed Consent were obtained from all participants.

Criteria for inclusion in the study were: patients over the age of 18 that were clinically stable, of both sexes, undertaking hemodialysis for more than three months, non-institutionalized, with stable weights and without clinical evidence of inflammation and/or infections during the previous three months. Criteria for exclusion included patients with cancer, tuberculosis, acquired immunodeficiency syndrome, chronic obstructive pulmonary disease, uncontrolled diabetes mellitus, currently pregnant, undergoing venous catheter dialysis, those in situations that make it impossible to carry out an anthropometric evaluation or an investigation of food intake (advanced bone diseases, complications from cerebral vascular accidents, physical deficiencies or amputations). These criteria led to an initial sample involving 344 individuals. Among these a further 226 were excluded as they were classified as underreporting on energy intake, resulting in a final sample of 118 individuals. The individuals that were excluded because they underreported differed from the selected sample only in terms of sex and Body Mass Index (BMI), since the excluded group were predominantly of the female gender (p=0,002) and with a higher average BMI (p<0,001).

Underreporting was defined as having a ratio of average energy intake to Basal Metabolic Rate (BMR) of less than 1.27[8-10]. The BMR was calculated using Harris Benedict's equation, which provides an acceptable predictor of basal metabolism among chronic kidney patients[11]. It is estimated that for sedentary individuals, the minimum among of energy necessary for maintaining body weight is 1.27 times the BMR, a value below which it would be biologically and statistically improbable to maintain weight[8,9]. A daily energy intake below this limit in patients with stable weight is a strong indicator of underreporting[12,13]. This explains the choice of the cutoff point of 1.27, which is widely used in other studies[13-15] that evaluate underreporting in chronic kidney patients, and which was applied with the aim of excluding genuine underreporters and therefore ensuring the gathering of more precise data about food intake among the patients studied.

Food intake was evaluated using six 24-hour recalls, distributed across three days on which dialysis occurred and three days on which it did not. The foods reported were registered using household measures that were subsequently transformed into grams or milliliters in order to calculate intake of energy, nutrients and fibers. This was carried out using software that was developed specifically for the study (www. dbcheckout.com.br/nutri), and which uses as its principal database the Brazilian Table of Food Composition[16].

Food intake was converted into portions from eight food groups (cereals, beans, meat and eggs, fruits, vegetables and greens, milk and derivatives, oils and fats, sugars and sweets). In order to obtain portions, the caloric value of each food item was divided by the average energetic value of each group as set out in the *Guia Alimentar para a População Brasileira* (Food Guide for the Brazilian Population)[17]. Preparations that were consumed by the patients and that did not appear in this guide were divided up according to the different ingredients and then converted into the food groups.

The intake of energy and nutrients was compared to the specific recommendations for the population in hemodialysis[1,3,18] and the consumption in portions of the food groups as considered necessary for a health diet[17]. Based on these recommendations, the intake of energy,

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nutrients, fiber and of the food groups was classified as adequate or inadequate. When consumption values that did not match with the recommendations, intake was classified as inadequate. For calories per kilogram, proteins per kilogram, iron, selenium, cereals, beans, meat and eggs, fruits, vegetables and greens, milk and derivatives, intake below the recommended amount was considered to be inadequate[1,3,17]. For cholesterol, saturated fats, calcium, oils and fats, sugars and sweets, intake above the recommended amount was considered inadequate[1,3,17,18]. For carbohydrates, lipids, fibers, sodium, potassium, phosphorus, zinc, retinol and Vitamin C, intake outside the recommended range, be it below the lowest level or above the highest, was considered inadequate[1,3].

Information about age, gender, etiology, comorbidities and time on hemodialysis were obtained from either the hospital records, by means of an interview with the patient or from the doctor responsible. Weight and height were obtained after a session of intermediary dialysis and used to calculate the body mass index, with a classification value of 23 kg/m^2, which is associated with the lowest morbidity/mortality in hemodialysis patients[3]. For the energy intake per kilogram calculation, ideal weight was used, based on BMI 23 (height^2 x 23). When the adaptation of the weight was below 95% or above 115%, adjusted weight was used [(actual weight - ideal weight) x 0.25 + ideal weight], as recommended by the National Kidney Foundation[1]. Blood samples were collected and analyzed at the laboratory of the HC/UFG, in order to determine the serum levels of albumin, phosphorus and potassium.

The data were double entered and checked for consistency using the Epi-info program version 6.0 (Centers for Disease Control and Prevention, Atlanta) and analyzed using version 13.0 of Statistical Package for the Social Sciences (SPSS). A descriptive analysis was carried out in which the categorical variables were expressed as frequencies and percentages and the continuous variables as averages and standard deviation or median and interquartile interval (25-75 percentile), with a confidence interval of 95%, after normality tests using *Kolmogorov-Smirnov* ($p \geq 0.05$). The calorie variables per kilogram, fiber, iron, retinol and the number of portions of cereals did not have a normal distribution.

RESULTS

The population that was studied was made up of 118 individuals, the majority of whom were male. Hypertensive nephrosclerosis was the main cause of chronic kidney disease and the predominant comorbidity was arterial hypertension. The median for albumin and averages for phosphorus and potassium serum were within normal standards. The average BMI was below the recommended 23 kg/m^2 that is recommended for individuals undergoing hemodialysis (Table 1).

Table 1. Characteristics of hemodialysis patients. *Goiânia* (GO), 2012.

Characteristics (n=118)	n (%)
Gender	
Masculine	83 (70.30)
Feminine	35 (29.70)
CKD etiology	
Hypertensive nephrosclerosis	41 (34.70)
Diabetic nephropathy	29 (24.60)
Glomerulonephritis	12 (10.20)
Indeterminate	7 (05.90)
Other	29 (24.60)
Comorbidities	
Arterial Hypertension	83 (70.30)
Diabetes	14 (11.90)
Non-existent	18 (15.20)
Other	3 (02.60)
Age (years)	47.36 ± 14.68[1]
Time of hemodialysis (months)	48.00 (24.00 - 98.00)[2]
BMI (kg/m^2)	22.61 ± 3.83[1]
Serum albumin (g/dL)	4.15 (4.00 - 4.3)[2]
Serum phosphorus (mg/dL)	5.30 ± 1.68[1]
Serum potassium (mg/dL)	5.20 ± 0.97[1]

Note: [1]Average ± standard deviation; [2]Median (percentile 25-75).
CKD: Chronic Kidney Disease; BMI: Body Mass Index.

Table 2 shows data on energy intake, macronutrients and fibers among the patients evaluated. Average energy intake was 2,022.40±283.70 kcal/day, which represented a median of 31.2 kcal per kilogram of adjusted weight, distributed in 55.03±4.20% of carbohydrates, 30.23±3.71% of lipids and 1.18±0.23 grams of proteins per kilogram of adjusted weight. For saturated fat and cholesterol a high average level of intake was found, and for fiber the median intake was close to the minimum recommended level. Analyzing intake with relation to specific recommendations for patients on hemodialysis, the items that were most commonly ranked as inadequate were saturated fats, cholesterol, protein and calories per kilogram.

Table 3 presents information on the intake of minerals and vitamins. For sodium, iron and retinol, average or median intake was below the recommended levels. For calcium, average intake was well below the recommended levels, while results for phosphorus, zinc and selenium were appropriate. Although average intake of potassium was reasonable, a significant share of patients (60.2%) had inadequate intake levels, with 54.2% of this group having an intake below the recommended level (data not shown). The intake of iron was inadequate for the majority of patients evaluated. The proportion of patients showing inadequate levels of retinol intake was also high (94.9%), with 81.4% of this total consuming less than the minimum recommended levels (data not shown).

Table 4 presents information on food intake by food group. The population under study had low levels of fruit intake (1.22±0.89 portions),

Table 2. Intake of energy, macronutrients and fiber among hemodialysis patients. *Goiânia* (GO), 2012.

Variables	n (%)	Average ± SD	Recommendation[3]
Kcal/day	-	2022.40 ± 283.70	-
Kcal/kg[1]		31.20 (28.90 - 34.00)[2]	30 kcal ≥60 years
Adequate	72 (61.00)		35 kcal <60 years
Inadequate	46 (39.00)		
Proteins (g/kg[1])		1.18 ± 0.23	≥1.1
Adequate	72 (61.00)		
Inadequate	46 (39.00)		
Carbohydrates (%)		55.03 ± 4.20	50 - 60
Adequate	90 (76.30)		
Inadequate	28 (23.70)		
Lipids (%)		30.23 ± 3.71	25 - 35
Adequate	99 (83.90)		
Inadequate	19 (16.10)		
Saturated fats (%)		8.66 ± 1.62	<7
Adequate	15 (12.70)		
Inadequate	103 (87.30)		
Cholesterol (mg)		229.99 ± 81.67	<200
Adequate	45 (38.10)		
Inadequate	73 (61.90)		
Fibre (g)		21.53 (17.69 - 30.31)[2]	20 - 30
Adequate	74 (62.70)		
Inadequate	44 (37.30)		

Note: [1]Ajusted or ideal kilogram of weight; [2]Median (percentile 25-75); [3]National Kidney Foundation Kidney Disease Outcomes Quality[1]; National Kidney Foundation Kidney Disease Outcomes Quality[18]; Fouque *et al*.[3].
SD: Standard Deviation.

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Table 3. Intake of minerals and vitamins in hemodialysis patients. *Goiânia* (GO), 2012.

Variables (n=118)	n (%)	Average ± SD	Recommendation[2]
Sodium (mg)		1406.99 ± 519.94	2000 - 2300
Adequate	111 (94.10)		
Inadequate	7 (5.90)		
Phosphorus (mg)		862.17 ± 215.29	800 - 1000
Adequate	86 (72.89)		
Inadequate	32 (27.11)		
Potassium (mg)		1980.12 ± 527.68	1950 - 2730
Adequate	47 (39.80)		
Inadequate	71 (60.20)		
Calcium (mg)		355.31 ± 132.95	≤2000
Adequate	118 (100.00)		
Inadequate	-		
Ferro (mg)		7.79 (6.24-9.24)[1]	8 p/ ♂ e 15 p/ ♀
Adequate	46 (39.00)		
Inadequate	72 (61.00)		
Zinc (mg)		10.47 ± 3.17	10-15 p/ ♂ e 8-12 p/ ♀
Adequate	65 (55.00)		
Inadequate	53 (45.00)		
Selenium (mcg)		67.63 ± 20.08	≥55
Adequate	84 (71.20)		
Inadequate	34 (28.80)		
Retinol (mcg)		373.98 (257.57 - 649.50)[1]	700 - 900
Adequate	6 (5.10)		
Inadequate	112 (94.90)		
Vitamin C (mg)		104.47 ± 71.74	75 - 90
Adequate	71 (60.20)		
Inadequate	47 (39.80)		

Note: [1]Median (percentile 25-75); ♂ masculine; ♀ feminine; [2]Fouque *et al.*[3]; SD: Standard Deviation.

fruit and greens (1.76±1.01 portions) and milk and derivatives (0.57±0.43 portions) and a high level of intake of oils and fats (3.45±0.95 portions) and sugars and sweets (1.55±0.77 portions). For the groups cereal, beans and meat and eggs, intake was consistent with a healthy diet.

DISCUSSION

Hemodialysis patients commonly have poor dietary habits, particularly with regard to the intake of foods with high concentrations of sugar and fats, and low levels of consumption of cereals, fruits and vegetables[2,4], an observation that is consistent with the findings of this study. Shortcomings in the intake of calories, proteins, saturated fats, cholesterol, vitamins and minerals, among other food components, are also found by other researchers[4-7,19], as was the case with our results.

A number of studies point to a lack of intake of energy[4-7,19] and proteins[5-7,19] in hemodialysis patients. Among the individuals evaluated in this study, average intake of calories and proteins was higher than that found by other researchers[4,5,7,19,20], which was probably a result of the exclusion of underreporters. In spite of this, a significant proportion of patients were found

Table 4. Food intake by food group in hemodialysis patients. *Goiânia* (GO), 2012.

Food group (n=344)	n (%)	Average ± SD	Recommendation[2]
Cereals		6.03 (5.25 - 7.12)[1]	6 portions
Adequate	61 (51.70)		
Inadequate	57 (48.30)		
Beans		1.72 ± 1.12	1 portion
Adequate	83 (70.30)		
Inadequate	35 (29.70)		
Meat and eggs		1.79 ± 0.64	1 portion
Adequate	112 (94.90)		
Inadequate	6 (5.10)		
Fruit		1.22 ± 0.89	3 portions
Adequate	6 (5.10)		
Inadequate	112 (94.90)		
Vegetables and greens		1.76 ± 1.01	3 portions
Adequate	15 (12.70)		
Inadequate	103 (87.03)		
Milk and derivatives		0.57 ± 0.43	3 portions
Adequate	-		
Inadequate	118 (100.00)		
Oils and fats		3.45 ± 0.95	Up to 1 portion
Adequate	-		
Inadequate	118 (100.00)		
Sugars and sweets		1.55 ± 0.77	Up to 1 portion
Adequate	33 (28.00)		
Inadequate	85 (72.00)		

Note: [1]Median; [2]Food Guide for the Brazilian Population[17].
SD: Standard Deviation.

to have a caloric and protein intake below recommended levels (39% in both cases).

For adequate levels of protein intake and a positive or neutral nitrogen balance, around 1.2 to 1.4 grams of protein and 35 kcal per kg *per* day are necessary[1]. In order to improve the consumption of proteins and calories among the patients evaluated, an increase of these two components in the diet will therefore be recommended. To increase protein intake, the consumption of meat with a lower phosphorus/protein ratio and less fat can be recommended, since these foods provide proteins with high biological values and contribute to improved iron intake, something which was lacking in the patients in this and in other studies of hemodialysis patients[7,19]. This is why a daily portion of meat and eggs is recommended for a healthy diet but is usually insufficient for hemodialysis patients, who need higher levels of protein and at least 50% of protein with high biological levels[1].

A strategy to improve calorie intake for the individuals evaluated would be to increase the consumption of complex carbohydrate, with an emphasis on cereals and whole foods and a reduction in simple carbohydrates, since nearly half of patients consumed less than the six daily portions of cereals recommended[17], and had excessive levels of consumption of sugar and sweets. This measure should also be useful to improve the intake of fibers, that was close to the minimum recommended levels and would

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increase consumption of proteins and zinc, since whole foods such as oats, bread, rice and others, have reasonable levels of these three elements[16].

Although the average intake of lipids among patients in this study was consistent with levels recommended for hemodialysis patients[18], qualitative shortcomings were observed, on account of the increased consumption of saturated fats and cholesterol and an excess of oils and fats. Chronic kidney disease sufferers often have dyslipidemia and although food intake is not a cause of this disorder[21], inadequate consumption of lipids can aggravate the condition.

Since the average level of lipid consumption was appropriate, instead of promoting a reduction in intake of this macronutrient, which would result in a lower calorie intake, there would be a greater impact if the quality of fat consumed by the patients under evaluation was changed. Lou *et al*.[4] reported that measures such as moderating red and processed meat consumption and prioritizing lean meats along with poultry and fish, are relevant strategies for reducing saturated fat and cholesterol intake, while the daily consumption of olive oil contributes to a better balance between polyunsaturated fatty acids and monounsaturated fats.

Given the need to control the intake of potassium, many hemodialysis patients end up reducing their consumption of fruits, vegetables and greens[2,4], a fact that was also observed in this study. However, although these foods are a significant source of potassium, their consumption should be encouraged in order to ensure a balance between fibers, vitamins and minerals. The choice of fruit, vegetables and greens with lower levels of this mineral, controlling portion sizes and the frequency of consumption of potassium rich foods and the avoidance of boiling certain vegetables[22], will ensure an intake in compliance with the recommended amounts[3] without comprising the offer of other nutrients that are important for a healthy diet. For the individuals evaluated, increased consumption of fruit, vegetables and greens will improve the intake of fibers, retinol and Vitamin C as well as the significant number of patients with levels of potassium consumption above the recommended levels (54.2%).

Although the average consumption of milk and derivatives was found to be lower than the levels recommended for a healthy diet[17], increased ingestion of these foods to the recommended three daily portions would not be advised, since it would imply an increased supply of phosphorus in the diet. The consumption of phosphorus was consistent with recommended levels[3], and can contribute towards increases in the serum levels of this mineral, which were also found to be appropriate. Furthermore, the majority of foods in this group have a relationship between phosphorus and protein that is higher[23]. For these reasons, it is rare for individuals undergoing hemodialysis to comply with this recommendation, which would require adjustments that take into account the particularities of this population. The low levels of consumption of these foods might have contributed towards the increased prevalence of inadequate levels of retinol and may explain the reduced average intake of calcium that was found, something which should not give rise to concern, since part of the calcium that comes from some of the chelations of phosphorus is absorbed and should be considered as a non-dietary source of this mineral[3,23].

With regard to dietary sodium, the average intake below the minimum recommended level may be explained by the fact that in the calculation for dietary composition, the separate addition of salt was not considered. Estimating salt intake is a complex task, since daily consumption varies considerably and there are differences between people in terms of how much salt they choose to add to their diets. In addition, the amount of salt in foods can vary depending on the soil in which the food was produced, and the tables for the chemical composition of foods do not always take into account the regional preparation of dishes and the range of industrialized products[24]. Based on the average intake of sodium among patients

of this study (1,406.99 mg), the quantity of salt added to food that would be permissible to avoid going beyond the maximum recommended level of salt consumption[3], would be 2.2 g *per* day, which is the approximate equivalent of a level teaspoon.

It is complicated to balance restrictions on some nutrients on the one hand with the need to increase others in the foods consumed by patients on hemodialysis[1,3,4], which may result in inadequate intake, particularly of vitamins and minerals. There are therefore specific recommendations for supplementing water soluble vitamins, iron, selenium and zinc[7], since the recommended levels of consumption cannot always be obtained through dietary means.

In summary, the analysis of dietary patterns among the patients in this study showed the need for a number of changes including greater intake of fruits, vegetables and greens, whole-grain cereals, greater sources of protein that provide protein that has a high biological value and iron, along with a reduction in consumption of foods rich in saturated fats and cholesterol, and that would reflect consumption that more closely follows specific recommendations and a more health standard of eating. Nonetheless, Nerbass & Cuppari[25] advise that significant and sudden changes in eating habits are not well tolerated and can result in reduced adherence to the recommendations.

Given the specific nutritional recommendations for individuals on hemodialysis[1,3,18], the guidelines drawn up in the *Guia Alimentar para a População Brasileira*[17] can be used provided that certain adjustments are made to adapt to the particular needs of these patients. An increase in the portions of cereals (with an emphasis on complex carbohydrates), meat, oils and fats with better lipid profiles, a reduction in portions of milk and derivatives, and improved intake of fruits, vegetables and greens in order to control the supply of potassium would result in food consumption that is more in line with the recommendations for the population on hemodialysis.

While the exclusion of individuals who underreported may have led to a reduced sample size for this study, this measure, which is not generally taken in the majority of studies that estimate food intake among patients with chronic kidney disease, led to the acquisition of more accurate data for the study. The interpretation of data about food intake without excluding people who underreport could lead to inconsistent results[26], to the wrong interpretation of data on energy and nutrient intake[15] among the individuals evaluated and result in inadequate dietary measures. It is also worth considering that when the underreporters are excluded, the results about food intake obtained in this study may not reflect the general population of patients on hemodialysis, but rather just a group that is mainly made up of men with lower BMI rates.

CONCLUSION

The patients evaluated in this study showed significant shortcoming in terms of quantitative and qualitative measure of food intake, when compared with specific recommendations for individuals in hemodialysis and guidelines for a healthy diet. The patients were found to have an imbalanced diet, characterized by an excess of consumption of oils and fats, particularly saturated fats and cholesterol, sugars and sweets, along with a low level of consumption of iron, retinol, fruits, vegetables and greens, milk and derivatives and a considerable proportion of patients who did not attain the minimum recommended amounts of intake for calories, protein, retinol, iron, zinc and potassium.

CONTRIBUTORS

IMF Vaz: conceived and designed the study; analyzed and interpreted the data; and wrote and reviewed the manuscript. ATVS FREITAS: conceived and

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designed the study; analyzed and interpreted the data; and reviewed the manuscript. MRG PEIXOTO: supervised the statistical analysis and reviewed the manuscript. SF FERRAZ: interpreted the data and reviewed the manuscript. MIVAM CAMPOS: interpreted the data and reviewed the manuscript.

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