Is energy intake underreported in hemodialysis patients?

Authors
Inaiana Marques Filizola Vaz [1]
Ana Tereza Vaz de Souza Freitas [1]
Maria do Rosário Gondim Peixoto [1]
Sanzia Francisca Ferraz [1]
Marta Izabel Valente Augusto Morais Campos [2]

[1] Universidade Federal de Goiás.
[2] Hospital de Doenças Tropicais Dr. Anuar Auad.

Submitted on: 02/02/2015.
Approved on: 03/13/2015.

Correspondence to:
Inaiana Marques Filizola Vaz.
Hospital das Clinicas da Universidade Federal de Goiás.
1ª avenida, s/nº, St Leste Universitário, Goiânia,GO, Brasil.
CEP: 74605-08.
E-mail: inaianaufg@gmail.com

DOI: 10.5935/0101-2800.20150056

ABSTRACT

Introduction: Underreporting of energy intake is not much studied in hemodialysis population. **Objective:** To evaluate the underreporting of energy intake and associated factors in hemodialysis patients. **Methods:** A cross-sectional study, with 344 patients stable adults, of ten hemodialysis centers in Goiânia-GO. Energy intake was assessed by six 24-hour dietary recalls and basal metabolic rate (BMR) was estimated using the Harris Benedict equation. It was considered as underreporting when the ratio between the average energy intake and basal metabolic rate was lower than1.27. For analysis of factors associated with underreporting, the Poisson regression with robust variance estimation was applied. **Results:** The prevalence of underreporting was 65.7%, being more significant in individuals who are overweight and in the non dialysis days. The result of the multivariate analysis identified four factors independently associated with the underreporting: being a female (PR = 1.27, CI = 1.10 to 1.46), body mass index ≥ 25 kg/m^2 (PR = 1.29, CI = 1.12 to 1.48), three meals or lower/day (PR = 1.31, CI = 1.14 to 1.51) and hemodialysis length lower than 5 years (PR = 1.19CI = 1.01 to 1.40). **Conclusion:** The population showed a high prevalence of underreporting of energy intake. Being a female, presenting overweight, lower number of meals/day and lower length time on hemodialysis were factors associated with underreporting.

Keywords: energy intake; kidney failure, chronic; renal dialysis; self report.

INTRODUCTION

Estimating energy intake is not an easy task in any population. Food intake assessment is usually based on individual self-report and epidemiological studies, a process that can be distorted and result in under- or over-reporting intake.[1-2] When not identified, underreporting produces measurement biases and inconsistent results, leading to a misinterpretation of energy and nutrient intake,[3] which can hamper nutritional diagnosis and generate inadequate dietary interventions.

Despite studies showing an energy intake below recommendations for hemodialysis patients, a significant prevalence of excess weight and body fat,[4-7] or maintenance of anthropometric parameters over time[8] have been found in this population. This paradox may be related to food intake underreporting.

Underreporting is a distortion of self-reported food intake[1]. Overall, it results from the individual's failure to recall all consumed food or the underestimation of the quantities ingested. We also understand it as a gap between said measured energy intake and energy expenditure measured without weight change or weight maintenance over a period of follow up.[9]

Although it is well referenced in the literature for healthy individuals, underreporting is still not well studied in chronic kidney disease,[3-5,8] especially in the hemodialysis population. Kloppenburg *et al.*[8] evaluated the under-reporting from hemodialysis individuals, identifying a prevalence higher than 60%. In Brazil, few studies have investigated underreporting among chronic kidney patients[4-5] and only one evaluated the population under hemodialysis, finding a prevalence of 65%.[7] Thus, the lack of national data regarding underreporting of food intake among patients with chronic kidney disease fostered this study, aimed at establishing the prevalence of energy intake underreporting and associated factors in hemodialysis patients.

Methods

This is a cross-sectional study carried out involving ten hemodialysis centers in Goiânia-GO, between May 2009 and March 2010. The study was approved by the Ethics in Research Committee of the University Hospital - Federal University of Goiás (HC/UFG, Protocol No. 011/2009) and the Santa Casa de Misericórdia de Goiania (Protocol 046/2009), and each participant signed an informed consent.

The sample was estimated at 302 individuals, considering the total number of patients on hemodialysis in the municipality (n = 1400), margin of error and significance level at 5%, test power of 80% and prevalence of 50% underreporting for this population. We added 20% more individuals to the sample, because we forecasting losses and refusals, totaling 362 individuals. Of this total, 344 patients completed the study. For sample selection purpose, we used a simple random draw, proportional to the total number of patients in a hemodialysis center.

We included non-institutionalized clinically stable patients older than 18 years, of both genders, with stable weight and no clinical evidence of inflammation and/or infection, in the last three months and in hemodialysis for more than three months. The exclusion criteria were: cancer, tuberculosis, acquired immunodeficiency syndrome, chronic obstructive pulmonary disease and severe cardiovascular disease, uncontrolled severe *diabetes mellitus*, current pregnancy, dialysis through a venous catheter, situations that prevented the anthropometric evaluation or the investigation of food intake (advanced bone disease, stroke sequelae, disability or amputations).

Clinical (disease etiology, comorbidities, and duration of hemodialysis), demographic (gender and age), socioeconomic (education, occupation, marital status, income), anthropometric (weight, height), food intake and physical inactivity data was obtained from medical records. The patient was interviewed through nutritional assessment by four nutritionists, using standardized forms tested in a pilot study. Physical inactivity was defined according to criteria from the Pan American Health Organization.[10]

According to Lohman *et al.*,[11] weight and height were measured after the intermediate dialysis session of the week. We obtained the body mass index (BMI) from the dry weight/square of height ratio, considering the World Health Organization classification.[12] The ideal weight was obtained from the BMI 23 (kg/m^2).[13] To calculate energy intake per kilogram we used the ideal weight. When their weight adequacy was less than 95% or greater than 115%, we used the adjusted weight, calculated as recommended by the NKF/KDOQI (2000).[14]

Food intake was evaluated using six 24-hour recalls, over three days in and three days out of dialysis, obtained in a three-week period. Of the six recalls, one was obtained on a Saturday. The food quantities reported by patients were recorded in household measures, with the aid of utensils such as glasses, cups and spoons and then converted into grams or milliliters. Energy intake was calculated by a software designed for the study (www.dbcheckout.com.br/nutri), which is mainly based on data from the Brazilian Table of Food Composition.[15]

We considered it to be underreporting when the ratio between the average energy intake and basal metabolic rate (EI/BMR) was less than 1.27. For sedentary individuals, it is estimated that the minimum daily energy needed to maintain body weight is 1.27 times the BMR,[12,16] below which weight maintenance is biologically and statistically unlikely.[1,12] A value higher than 2.39 was considered to characterize the overreporting energy intake.[17] BMR was calculated by the Harris Benedict equation, a method that provides an acceptable prediction of basal metabolism for chronic renal patients.[18]

The data was entered in duplicate using regularity check by the Epi-Info 6.0 software (Centers for Disease Control and Prevention, Atlanta). Analyses were performed in the STATA/SE 12.0 statistical software (Stata Corporation, Texas). Categorical variables were expressed as frequencies and percentages and compared by the Descartes Rule of Signs. Continuous variables had their normality checked by the Kolmogorov-Smirnov test ($p \geq 0.05$) and expressed as mean or median and standard deviation and compared by the *t*-test ($p < 0.05$) or the Wilcoxon test. In the bivariate analysis among socioeconomic, demographic, clinical and anthropometric data and underreporting, we used the Pearson's chi-square test. To analyze the factors associated with underreporting, we initially used a simple Poisson regression. The variables with $p \leq 0.20$ were tested in the multivariate analysis using Poisson regression with robust variance estimation. The ones with a $p < 0.05$ remained in the model.

Results

Table 1 depicts the patients' characteristics. Table 2 shows a high prevalence of underreporting in the study sample (65.7%), being significantly higher for individuals with BMI ≥ 25 kg/m² (78.4%). None of the patients showed overreporting of energy intake. Energy intake per kilogram of body weight and the EI/BMR ratio were significantly lower in the group with BMI ≥ 25 kg/m².

Table 3 depicts the intake of energy and macronutrients in dialysis days, days off dialysis, under-reporters and valid reporters. We found that underreporting was significantly higher (74.4%) on the dialysis-off day, and under-reporters had higher protein intake.

The prevalence of underreporting was significantly higher among females (75%), in individuals with up to eight years of education (70.18%), with up to five years on hemodialysis (69.91%), with BMI ≥ 25 kg/m² (78.38%) and those who had up to three daily meals (76.56%), as shown on Table 4.

Table 1 Characteristics of patients on hemodialysis. Goiânia-GO, 2012

Characteristics (n = 344)	n (%) or mean ± SD
Age (years)	49.33 ± 13.76*
Gender	
Male	204 (59.30)
Sedentary lifestyle	274 (79.65)
CKD etiology **	
Hypertensive nephrosclerosis	130 (37.70)
Glomerulonephritis	67 (19.50)
Diabetic nephropathy	54 (15.70)
Undetermined	26 (7.60)
Others	67 (19.50)
Comorbidities	
Arterial hypertension	228 (66.28)
Diabetes	12 (3.49)
Arterial hypertension + Diabetes	40 (11.63)
Non-existent	51 (14.83)
Others	13 (3.77)
Time on hemodialysis	
< 5 years	216 (62.79)
≥ 5 years	128 (37.21)
Body Mass Index	
< 18.5 kg/m²	30 (8.72)
18.5 - 24.99 kg/m²	203 (59.01)
≥ 25 kg/m²	111 (32.27)
Daily intake	
Energy (kcal)	1490.3 (1269.5-1840.1)***
Energy/kg of ideal weight or adjusted (kcal)	25.4 ± 7.4
Carbohydrate (%)	54.52 ± 4.66
Protein (%)	15.47 ± 2.27
Protein/kg ideal or adjusted weight (g)	0.97 ± 0.27
Lipids (%)	30.00 ± 3.60
Basal Metabolism Rate	1368.0 (1242.7-1534.1)***
EI/BMR#	1.13 ± 0.27

* Mean ± standard deviation; ** Chronic kidney disease; *** Median (percentile 25-75), # Ratio between energy intake and basal metabolism rate.

Being female, having a BMI ≥ 25 kg/m², having up to three daily meals, being on hemodialysis for five years were factors associated with underreporting in this population (Table 5). Other variables were tested (age, body fat percentage, education, family income, socioeconomic status,

Table 2 Energy intake, estimated basal metabolism rate and underreporting of patients in hemodialysis, according to the body mass index. Goiânia-GO, 2012

Variable	BMI < 25kg/m² (n = 233) Mean ± SD* or n (%)	BMI ≥ 25kg/m² (n = 111) Mean ± SD* or n (%)	*p***
Underreporting	139 (59.7)	87 (78.4)	0.001
EI***	1577.4 ± 420.4	1616.4 ± 549.7	0.468
EI/kg#	27.4 ± 7.0	21.2 ± 6.6	< 0.001
BMR¶	1338.6 ± 174.1	1531.6 ± 234.5	< 0.001
EI/BMR§	1.17 ± 0.26	1.05 ± 0.28	< 0.001

* Standard deviation; ** Independent *t*-test or Person's chi-square test; *** EI: Energy Intake in kcal/day; # EI/kg: energy intake by kilogram of ideal or adjusted weight; ¶ BMR: Basal Metabolic Rate in kcal/day; § EI/BMR: energy intake and basal metabolic rate ratio.

Table 3 Energy intake and macronutrients on days with dialysis, without dialysis, under-reporters and valid reporters. Goiânia-GO, 2012

Variables (n = 344)	Days on dialysis	Days off dialysis	*p**
Underreporting ** (n,%)	211 (61.3)	256 (74.4)	< 0.001
Kcal/day	1576.5(1309.2-1893.8)***	1439.3(1185.4-17.89.1)***	< 0.001
Carbohydrate (%)	54.8 ± 5.4	54.2 ± 5.7	0.067
Protein (%)	15.42 ± 2.3	15.4 ± 2.6	0.082
Lipids (%)	29.7 ± 4.1	30.2 ± 4.7	0.490
	Under-reporters (n = 226)	Valid reporters (n = 118)	*p*#
Kcal/day	1364.3 ± 283.7	2022.4 ± 283.7	< 0.001
Carbohydrate (%)	54.3 ± 4.9	55.0 ± 4.2	0.139
Protein (%)	15.9 ± 2.4	14.7 ± 1.8	< 0.001
Lipids (%)	29.9 ± 3.5	30.2 ± 3.7	0.403

* Paired *t*-Test, Wilcoxon or Descartes rule of signs; ** EI/BMR < 1.27; *** median; # Independent *t*-test.

general health, comorbidities, etiology, marital status, smoking, alcohol consumption, albumin, pre and post-dialysis urea), however, these were not associated with underreporting among the patients studied.

Discussion

When analyzing the energy intake report of the patients evaluated in this study, we noticed a considerable percentage of underreporting, while there was no overreporting. Other studies with CRF patients did not assess the occurrence of overreporting.[3-5,8] In different populations, overreporting seems to be far less common[1] than underreporting, with prevalence rates between 1 and 39%,[2,19,20] and it is usually found among females,[2,9] eutrophic and young patients.[2]

Some studies have identified high levels of underreporting in patients with chronic kidney disease not on dialysis and on peritoneal dialysis, with prevalence rates between 52.2 and 72.5%.[3-5] Although well explored in healthy subjects, with prevalence ratios between 2 and 85%,[3] in hemodialysis patients, underreporting is not much studied. There is only one Dutch[8] and one Brazilian[7] studies which investigated underreporting in this population, finding prevalence rates of 61% and 65%, respectively, similar to this study (65.7%). This data indicates that the prevalence of underreporting in hemodialysis individuals is high, similar to that found in other populations.

Another interesting data found in this study was the higher prevalence of underreporting in the dialysis-off day and the increased protein intake by under-reporters compared to valid reporters. The difference in underreporting on days with and without dialysis,[3-5,7,8] was not addressed by other authors. As for macronutrient intake between valid reporters and under-reporters, findings are not uniform in the literature. While some studies

Table 4 PREVALENCE AND GROSS PREVALENCE RATIO OF ENERGY INTAKE UNDERREPORTING IN HEMODIALYSIS PATIENTS, ACCORDING TO DEMOGRAPHIC, SOCIOECONOMIC, CLINICAL AND NUTRITIONAL CHARACTERISTICS. GOIÂNIA-GO, 2012

	Prevalence (n/%)	Gross PR* (IC**95%)	*p*#
Gender			
Male	121 (59.31)	1	
Female	105 (75.00)	1.26 (1.08-1.46)	0.002
Age			
< 60 years	164 (63.57)	1	
≥ 60 years	62 (72.09)	1.13 (0.96-1.33)	0.125
Education			
≤ 8 years	160 (70.18)	1.23 (1.03-1.47)	0.022
> 8 years	66 (56.90)	1	
Family income			
≤ 2 minimum wages	110 (67.90)	1.06 (0.91-1.24)	
> 2 minimum wages	116 (63.74)	1	0.416
Occupation			
Working	45 (56.25)	1	
Not working	181 (68.56)	1.21 (0.98-1.50)	0.065
Marital status			
With a spouse	136 (67.00)	1.04 (0.89-1.22)	0.547
Without a spouse	90 (63.83)	1	
Diabetes			
No	187 (64.26)	1	
Yes	39 (73.58)	0.87 (0.72-1.04)	0.147
Time in hemodialysis			
≤ 5 years	151 (69.91)	1.19 (1.01-1.41)	0.042
> 5 years	75 (58.59)	1	
BMI***			
< 25 kg/m²	139 (59.66)	1	
≥ 25 kg/m²	87 (78.38)	1.31 (1.13-1.51)	0.000
Meals/day			
≤ 3	98 (76.56)	1.29 (1.11-1.49)	0.001
> 3	128 (59.26)	1	

* Prevalence ratios; ** Confidence interval; *** Body mass index; # Simple Poisson regression.

have identified a lower intake of carbohydrates[2,21] and/or lipids[2,21,22] between under-reporters, others found only higher protein intake[2,8,23] in the same group.

For the patients evaluated in this study, the factors associated with underreporting were BMI starting at 25 kg/m², female gender, having up to three meals a day and being in hemodialysis for up to five years. There are a number of associated factors or predictors of underreporting when healthy individuals are concerned. The most frequently cited are females,[19,20,24] age, lower educational level[2] and income,[9] overweight (by IMC)[3-5,20,23,24] and high body fat.[7,19,20] In the study by Bazanelli *et al.*,[4] BMI was the only determinant of underreporting in patients undergoing peritoneal dialysis. Other studies carried out with patients with chronic kidney disease did not evaluate predictors of underreporting.[3,5,8] Mafra *et al.*[7] did not investigate determinants of underreporting; however, they found a negative correlation between the Goldberg index and BMI, and between the reported energy intake and BMI for hemodialysis patients.

Excess weight has been pointed out as an important factor associated with underreporting.[9,20,22,25,26] Evidence shows that

Table 5 Factors associated with energy intake underreporting from patients in hemodialysis. Goiânia-GO, 2012

Variables (n = 344)	RP* (IC**95%)	p***
Gender		
Males	1	
Females	1.27 (1.10-1.46)	0.001
Body Mass Index		
< 25 kg/m²	1	
≥ 25 kg/m²	1.29 (1.12-1.48)	0.000
Meals/day		
≤ 3	1.31 (1.14-1.51)	0.000
> 3	1	
Time in hemodialysis		
≤ 5 years	1.19 (1.01-1.40)	0.030
> 5 years	1	

* Prevalence ratio; ** Confidence interval; *** Poisson regression with a robust variance estimate.

a considerable percentage of individuals who underreport have high BMI.[3-5,7-9,21,24] In general, there is a mismatch between the energy intake reported by those who are overweight, especially the obese,[9,21] and the energy expenditure assessed by the double marked water method.[27]

The low energy intake found in patients with chronic kidney disease is usually not associated with long-term weight loss, indicating that these individuals consume more energy than reported.[3-5,8] Monitoring studies of stable patients on hemodialysis have shown that for part of them, BMI and weight are maintained or increased with time, despite an energy intake reported to be lower than the recommended 30 to 35 kcal/kg/day.[8,28,29]

In this study, we found a higher prevalence of underreporting in the overweight group, with BMI starting at 25 kg/m² a factor associated with underreporting for the individuals evaluated. Although we did not follow the patients evaluated in order to monitor anthropometric parameters, we found that the high prevalence of underreporting is not consistent with the mean EI/BMR ratio, nor with the high percentage of overweight patients according to BMI. These results are in agreement with those from Avesani *et al.*[5] and Bazanelli *et al.*,[4] who observed greater underreporting, with prevalence rates of 80 and 83.3%, respectively, in chronic renal failure patients with a BMI ≥ 25 kg/m².

Interestingly, in general, overweight individuals undergo frequent dietary restrictions in order to reduce weight.[9] Thus, they become proficient connoisseurs of food with higher energy content[30] and develop a selective underreporting for food rich in carbohydrates and lipids,[2] which may arise from greater access to information on healthy eating, whether due to health policies or clarifications published by means of comunication.[2]

Being female is another factor commonly associated with underreporting.[3,7,9,22,25,26,28] Novotny *et al.*[19] found a prevalence of underreporting of 61% *versus* 85% for men and women, while Gomes & Leão[2] reported 61% *versus* 79.5%, respectively. Among some female characteristics that may explain the greater underreporting in women, we list dissatisfaction with weight and body image (leading to repeated dietary restrictions), guilt[19], fear of a negative evaluation[9] and desire for social approval. Dissatisfaction with weight, body image, guilt[18], fear of a negative evaluation[9] and repeated dietary restrictions in an attempt to lose weight,[23] are female characteristics identified as causes of underreporting among women. Another explanation is the desire to adjust or a lust for social approval, defined as the tendency to answer what is socially accepted.[20] Thus, at the time of answering the dietary diary,[3] women tend to report a consumption considered appropriate rather than declaring their actual intake.

The act of eating less often is a feature of underreporters.[20] Among our sample population, the lowest number of daily meals was associated with underreporting. It is supposed that individuals who have fewer meals, consume a higher volume, which can hamper their memory about the quantities they actually ate[9] and cause underreporting, since the 24-hour recall depends on memory. Not reporting snacks[20] and drinks consumed between meals in the form of tweaks, which are not included in the calculation of daily energy consumption can also contribute to food intake underreporting.

The shorter time in hemodialysis proved to be a factor associated with underreporting among the evaluated individuals, which was not investigated in other studies with chronic kidney patients.[3-5,7,8] It is possible that having a nutritionist at each dialysis center, constantly monitoring and questioning patients about food intake may have conditioned those patients on longer time in dialysis to be more aware of their intake and this had not yet occurred in individuals under shorter treatment time, resulting in greater underreporting among the latter.

Underreporting is a major limitation of food consumption studies,[7,25] leading to inaccuracies in dietary intake monitoring. Among hemodialysis patients, an accurate assessment of energy consumption is crucial for assessing their clinical status, nutritional interventions and overall health outcomes.[7,21] When not detected, it can negatively interfere in the nutrition and monitoring of hemodialysis patients.

Thus, the nutritionist monitoring these patients must analyze critically[1] the intake data. This will be useful to prevent misconduct in a nutritional intervention plan,[21] as, for example, supplying more calories which, over time, may contribute to overweight or unnecessary body fat build up, or even encouraging the consumption of certain foods, to correct certain nutrient that "may be considered in deficit," which can cause imbalance of serum levels of phosphorus, potassium, glucose, and others. The EI/BMR ratio can be a useful, simple and feasible tool to detect underreporting in clinical practice, which would help the healthcare professional interpret food data in a safer and more rigorous way for hemodialysis patients, obtained by traditional methods of dietary assessment. Removal of underreported data enables a more accurate assessment of food intake[24] regarding the evaluated group and provides for safer advice regarding nutritional counseling.[7]

A limitation of this study is the fact that the patients' BMR was not measured, but rather estimated by a predictive equation of energy expenditure. Although it is more appropriate to calculate the BMR of individuals with chronic kidney disease, the Harris Benedict equation may overestimate this calculation by about 5.8%,[18] which would result in a higher prevalence of underreporting in this population. However, the underreporting prevalence we found was not different from that of other studies,[4,5] which used indirect calorimetry to find the energy expenditure and classify the self-reported energy levels of intake.

Another point to be considered is the use of 24-hour recalling to obtain dietary intake information. In general, more precise methods such as direct weighing are not feasible for studies with larger samples. Recalling is one method of choice because it is practical, easy to perform, inexpensive and can be applied in individuals with different levels of education.[21] Despite these advantages, this method has limitations, such as having to depend on memory recall, and its application in just one day may not represent normal intake.[21] In this study, we tried to compensate for these disadvantages using household measures to assist in a more adequate identifying of how much food was eaten.[9] In addition to all these steps, we employed six reminders, comprising the days on dialysis and the interdialytic period, making it more representative of the normal dietary intake for valid responders.

This study was different because we assessed the effects of various variables associated with underreporting in a representative sample of the population on hemodialysis, much higher compared to samples from other studies evaluating the underreporting among individuals with chronic renal disease.[3- 5,7,8] A multivariate analysis identified the variables that remained associated with underreporting, given the interdependence between the factors evaluated.

Conclusion

This population had a high prevalence of energy intake underreporting, especially among individuals who are overweight by BMI and on days without dialysis. The under-reporters had higher protein consumption than valid reporters and we did not detect the over-reporting of energy intake. Being female, overweight, having fewer meals and being in hemodialysis for a shorter time were factors associated with underreporting.

Our findings draw attention to the fact that the analysis of dietary data, regardless of underreporting, may result in a false interpretation of intake and even inadequacies in carrying out dietary treatment of the patients. Thus, it is suggested that food intake of female patients, those in overweight, with less daily meals and less time in hemodialysis be investigated more carefully and interpreted by the nutritionist of dialysis centers.

References

1. Scagliusi FB, Lancha Júnior AH. Subnotificação da ingestão energética na avaliação do consumo alimentar. Rev Nutr 2003;16:471-81. DOI:http://dx.doi.org/10.1590/S1415-52732003000400010
2. Gomes AA, Leão LSCS. Prevalência de sub-relato e super-relato de ingestão energética em população ambulatorial do Rio de Janeiro, Brasil. Cad Saúde Colet 2011;19:197-202.
3. Fasset RG, Robertson IK, Geraghty DP, Ball MJ, Coombes JS. Dietary intake of patients with chronic kidney disease entering the lord trial: adjusting for underreporting. J Ren Nutr 2007;17:235-42. DOI: http://dx.doi.org/10.1053/j.jrn.2007.04.004
4. Bazanelli AP, Kamimura MA, Vasselai P, Draibe SA, Cuppari L. Underreporting of energy intake in peritoneal dialysis patients. J Ren Nutr 2010;20:263-9. DOI:http://dx.doi.org/10.1053/j.jrn.2009.08.009
5. Avesani CM, Kamimura MA, Draibe SA, Cuppari L. Is energy intake underestimated in nondialyzed chronic kidney disease patients? J Ren Nutr 2005;15:159-65.
6. Lorenzo V, Martin M, Rufino M, Sanchez E, Jimánez A, Hernández D, et al. High prevalence of overweight in a stable Spanish hemodialysis population: a cross sectional study. J Ren Nutr 2003;13:52-9. DOI: http://dx.doi.org/10.1053/jren.2003.50004
7. Mafra D, Moraes C, Leal VO, Farage NE, Stockler-Pinto MB, Fouque D. Underreporting of energy intake in maintenance hemodialysis patients: a cross-sectional study. J Ren Nutr 2012;22:578-83. DOI: http://dx.doi.org/10.1053/j.jrn.2011.10.037
8. Kloppenburg WD, de Jong PE, Huisman RM. The contradiction of stable body mass despite low reported dietary energy intake in chronic haemodialysis patients. Nephrol Dial Transplant 2002;17:1628-33. DOI: http://dx.doi.org/10.1093/ndt/17.9.1628
9. Poslusna K, Ruprich J, de Vries JH, Jakubikova M, van't Veer P. Misreporting of energy and micronutrient intake estimated by food records and 24 hour recalls, control and adjustment methods in practice. Br J Nutr 2009;101:S73-85. PMID: 19594967 DOI: http://dx.doi.org/10.1017/S0007114509990602
10. Organización Panamericana de la Salud. Protocolo y directrices: Conjunto de Ações para la Reducción Multifactorial de Enfermedades no Transmisibles (CARMEN/CINDI). OPAS; 1997.
11. Gordon CC, Chumlea WC, Roche AF. Stature, recumbent length, and weight. In: Lohman TG, Roche AF, Martorell R, eds. Anthropometric standardization reference manual. Champaign: Human Kinetics Books; 1988. p.3-8.
12. World Health Organization (WHO). Obesity. Preventing and managing the global epidemic. Report of a WHO consultation on obesity. Geneva: World Health Organization; 1997.
13. Fouque D, Vennegoor M, ter Wee P, Wanner C, Basci A, Canaud B, et al. EBPG Guideline on nutrition. Nephrol Dial Transplant 2007;22:ii45-87. DOI:http://dx.doi.org/10.1093/ndt/gfm020
14. Clinical practice guidelines for nutrition in chronic renal failure. K/DOQI, National Kidney Foundation. Am J Kidney Dis 2000;35:S1-140.
15. Tabela Brasileira de Composição de Alimentos. NEPA-UNICAMP. 4ª ed. Campinas: NEPA-UNICAMP; 2011. p.161 [Acesso 20 Jun. 2015]. Disponível em: http://www.unicamp.br/nepa/taco/tabela.php
16. Food and Agriculture Organization/World Health Organization/United Nations University. Energy and protein requirements. Report of a joint FAO/WHO/ONU meeting. Technical Report Series, nº 724. Geneva: World Health Organization; 1985.
17. Goldberg GR, Black AE, Jebb SA, Cole TJ, Murgatroyd PR, Coward WA, et al. Critical evaluation of energy intake data using fundamental principles of energy physiology: 1. Derivation of cut-off limits to identify under-recording. Eur J Clin Nutr 1991;45:569-81. PMID: 1810719
18. Kamimura MA, Avesani CM, Bazanelli AP, Baria F, Draibe AS, Cuppari L. Are prediction equations reliable for estimating resting energy expenditure in chronic kidney disease patients? Nephrol Dial Transplant 2010;26:544-50.
19. Novotny JA, Rumpler WV, Riddick H, Hebert JR, Rhodes D, Judd JT, et al. Personality characteristics as predictors of underreporting of energy intake on 24-hour dietary recall interviews. J Am Diet Assoc 2003;103:1146-51. PMID: 12963942 DOI: http://dx.doi.org/10.1016/S0002-8223(03)00975-1
20. Tooze JA, Subar AF, Thompson FE, Troiano R, Schatzkin A, Kipnis V. Psychosocial predictors of energy underreporting in a large doubly labeled water study. Am J Clin Nutr 2004;79:795-804.
21. Anjos LA, Souza DR, Rossato SL. Desafios na medição quantitativa da ingestão alimentar em estudos populacionais. Rev Nutr 2009;22:151-61. DOI:http://dx.doi.org/10.1590/S1415-52732009000100014
22. Mendez MA, Popkin BM, Buckland G, Schroder H, Amiano P, Barricarte A, et al. Alternative methods of accounting for underreporting and overreporting when measuring dietary intake--obesity relations. Am J Epidemiol 2011;173:448-58. PMID: 21242302 DOI: http://dx.doi.org/10.1093/aje/kwq380
23. Pomperleau J, Ostbye T, Bright-See E. Potential underreporting of energy intake in the Ontario Health Survey and its relationship with nutrient and food intakes. Eur J Epidemiol 1999;15:553-7. DOI: http://dx.doi.org/10.1023/A:1007512420937
24. McGowan CA, McAuliffe. Maternal nutrient intakes anda levels of energy underreporting during early pregnancy. Eur J Clin Nutr 2012;66:906-13. DOI:http://dx.doi.org/10.1038/ejcn.2012.15
25. Gemming L, Jiang Y, Swinburn B, Utter J, Mhurchu CN. Under-reporting remains a key limitation of self-reported dietary intake: an analysis of the 2008/09 New Zealand Adult Nutrition Survey. Eur J Clin Nutr 2014;68:259-64. PMID: 24300904 DOI: http://dx.doi.org/10.1038/ejcn.2013.242
26. Kye S, Kwon SO, Lee SY, Lee J, Kim BH, Suh HJ, et al. Under--reporting of Energy Intake from 24-hour Dietary Recalls in the Korean National Health and Nutrition Examination Survey. Osong Public Health Res Perspect 2014;5:85-91. DOI: http://dx.doi.org/10.1016/j.phrp.2014.02.002
27. Goris AH, Westerterp KR. Improved reporting of habitual food intake after confrontation with earlier results on food reporting. Br J Nutr 2000;83:363-9. PMID: 10858694
28. Schoenfeld PY, Henry RR, Laird NM, Roxe DM. Assesment of nutritional status of the National Cooperative Dialysis Study population. Kidney Int 1983;23:80-8.
29. Thunberg BJ, Swamy AP, Cestero RV. Cross-sectional and longitudinal nutritional measurements in maintence hemodialysis patients. Am J Clin Nutr 1981;34:2005-12.
30. Lafay L, Basdevant A, Charles MA, Vray M, Balkau B, Bory JM, et al. Determinants and nature of dietary underreporting in a free-living population: the Fleurbaix Laventie Ville Santé (FLVS) Study. Int J Obes Relat Metab Disord 1997;21:567-73. DOI: http://dx.doi.org/10.1038/sj.ijo.0800443