U.PORTO

FACULDADE DE CIÊNCIAS DA NUTRIÇÃO E ALIMENTAÇÃO
UNIVERSIDADE DO PORTO

Comparação das estimativas da ingestão nutricional obtidas de um inquérito às 24 horas anteriores e de dois inquéritos às 24 horas anteriores em dias não consecutivos, em idosos

Comparison of the nutritional estimates from one 24-hour recall and two non consecutive 24-hour recalls in elderly

Ana Raquel Oliveira Esteves

Orientada por: Professor Doutor Pedro Moreira

Trabalho de Investigação

1.º Ciclo em Ciências da Nutrição

Faculdade de Ciências da Nutrição e Alimentação da Universidade do Porto

Porto, 2012

Resumo

A Autoridade Europeia para a Segurança Alimentar recomenda o uso de pelo menos dois inquéritos em dias independentes para determinar a exposição crónica.

O objetivo deste estudo foi comparar 53 constituintes alimentares, analisados pelo Food Processor SQL®, obtidos de um inquérito às 24 horas anteriores e de dois inquéritos às 24 horas anteriores não consecutivos, em idosos.

Participaram no estudo 127 idosos (92 mulheres), de idade entre 56 e 85 anos.

Foram aplicados os seguintes testes estatísticos: coeficiente de correlação intraclasse que variou de 0,407 para sódio a 0,691 para zinco, depois de ajustados para a energia; teste T de student para amostras emparelhadas ou teste de Wilcoxon; estatística *kappa*, na qual a maioria das variáveis teve concordância moderada, excetuando a energia proveniente da gordura, gordura total, pré-vitamina A, sódio e colina; percentagem de classificação correta, cujo valor mais baixo foi 52.8%, para gordura total; percentagem de indivíduos mal classificados, cujo valor mais alto foi 5.5% para a proteína; coeficientes de correlação, nos quais todas as variáveis obtiveram bons resultados; gráfico de Bland e Altman para a energia. Todos os testes foram aplicados antes e depois do ajuste para a energia.

Após ajuste para a energia, comparando os resultados de um inquérito com a média dos dois, a concordância e os coeficientes de correlação variaram de moderados a bons para a maioria das variáveis. Além disso, não foram encontradas diferenças estatisticamente significativas entre as médias de ingestão obtidas pelos dois métodos.

Abstract

The European Food Safety Authority recommends the recall of at least two independent days to determine chronic exposure.

The objective of this study was to compare 53 food constituents, analyzed by the Food Processor SQL®, obtained from one 24hDR and two non consecutive 24hDR conducted under the same conditions, in elderly.

Participants were 127 older adults (92 women) aged 56 to 85 years.

The following statistical tests were applied: intraclass correlation coefficients which ranged from 0,407 for sodium and 0,691 for zinc, after energy adjustment; student T test for paired samples or Wilcoxon's test; kappa statistics, in which the majority of variables had a moderate agreement, except for energy from fat, total fat, pre-vitamin A, sodium and choline; percentage of correct classification, being 52,8% the lowest value, found for total fat; percentage of gross misclassification, which higher value was 5,5% for protein; correlation coefficients, showing good results for all variables; Bland and Altman plot for energy. All tests were used both before and after adjustment for total energy intake.

After adjusting for total energy intake, comparing the results of a single 24hDR and the mean of two non-consecutive 24hDR, there was a moderate to good agreement and correlation coefficients of almost all variables studied. Furthermore, no significant statistical differences were found when comparing mean intake between the two methods.

Palavras-Chave

Inquérito às 24 horas anteriores; avaliação nutricional; idosos

Keywords

24 h diet recall; nutritional assessment; elderly

Summary

Abbreviations

24hDR – Twenty-four hour dietary recall

CIAFEL – Centro de Investigação da Actividade Física, Saúde e Lazer

EFSA – European Food Safety Authority

ICC – Intraclass Correlation Coefficient

NE – Niacin equivalents

RE – Retinol equivalents

TEI – Total Energy Intake

Introduction

The evaluation of nutritional intake in elderly is quite controversial and the question of which is the best method to use is the first to be asked when we address to study this population.

The European Food Safety Authority (EFSA)[(1)] and Biró *et al*[(2)] defend that the 24hDR may be used in healthy and well-functioning older adults, although Staveren *et al*[(3)] concluded that this method was unreliable to be applied in this population.

The 24hDR is a retrospective method used to assess food and beverages intake. In this questionnaire, "respondents are asked to remember and report all the foods and beverages consumed in the preceding 24 hours or in the preceding day".[(4)] The 24hDR is the most recall method used to assess food intake.[(1)] This method presents important advantages. It does not require literacy of the respondents as it is administered and recorded by a trained interviewer, there is relatively little burden from the respondents, so they will be more willing to participate, the time between the food intake and the record (approximately 24 hours) is little so memory is little affected, also because the recall occurs after the food intake the dietary behaviour is less affected by the assessment method.[4]

To determine acute exposure, EFSA defends that one day 24hDR is sufficient, however, to the estimation of chronic exposure it is recommended the recall of at least two independent days.[1] The application of a 24-hour recall in non-consecutive days is more expensive than the application in consecutive days[1]. Studies should address the differences in estimating dietary intake with one 24hDR versus two non-consecutive 24hDR.

Objective

The objective of this study was to compare the nutritional intake from one 24-hour recall (day 1) and two non-consecutive 24-hour recalls (day 1 plus an extra 24-hour recall – day 2) conducted under the same conditions, in elderly.

Population and methods

Population: Socio-demographics and anthropometry

Subjects were recruited from participants in the project "Espinho em forma" (a university-based study that promotes leisure physical activity in elderly) that were also participating in a study coordinated by the Centro de Investigação da Actividade Física, Saúde e Lazer (CIAFEL) from Faculdade de Desporto da Universidade do Porto (FADEUP).

There were interviewed a total of 152 subjects but only 127 (92 women) responded to both the 24hDR applied, so these were the ones used in this study.

Data on socio-demographic characteristics was collected in the first interview. Population's age ranged from 56 to 85, being the mean equal to 69.02 (±6.633) years. In what concerns to professional activity, 80.4% of the individuals are retired and 49.3% have the 4th grade for education. The individual monthly income ranges from 63€ to 3000€, being the mean equal to 572€.

Body weight and height were assessed according to international standards and Body Mass Index (BMI) was evaluated(5). BMI ranged from 17.10 kg/m^2 to 40.11 kg/m^2, being the mean equal to 29.28 (±4.130) kg/m^2; approximately half of the individuals (48%) have a BMI higher than 29 kg/m^2, which is considered the cut-off point for overweight by Hajjar *at al*.(6)

Dietary Intake: The 24-h recall

Food intake was evaluated by 2 non-consecutive, in person, 24-hour recalls. Participants were asked to remember everything they have drunk or eaten as from when they got up one day until they got up the next day.

The first interview was made during the last two weeks of October 2011 and the second one between the last of November 2011 and the first two weeks of January 2012. A statement of consent was signed by each participant along with the first interview.

To determine food portion sizes there were used household measures, parts or multiples of foods that come in natural units and a photo album with 110 coloured photos of raw and cooked foods representing 3 different portion sizes for each food.(7)

The questionnaires were applied by specially trained interviewers to perform this method of assessment.

The conversion of food intake into nutrients [energy (kcal), energy from fat (kcal), energy from saturated fat (kcal), protein(g), carbohydrates (g), fibre (g), soluble fibre (g), monosaccharides (g), disaccharides (g), oligosaccharides (g), total fat (g), saturated fat (g), monounsaturated fat (g), polyunsaturated fat (g), n3 fatty acids (g), n6 fatty acids (g), trans fatty acids (g), cholesterol (mg), water (g), vitamin A (μg of retinol equivalents (RE)), pre vitamin A (μg), vitamin B1, vitamin B2, vitamin B3 (mg of niacin equivalents (NE)), vitamin B6 (mg), vitamin B12 (μg), biotin (μg), vitamin C (mg), vitamin D (μg), vitamin E (mg), folate (μg), vitamin K (μg), pantothenic acid (mg), calcium (mg), chrome (mg), copper (mg), fluorine (mg), iodine (μg), iron (mg), magnesium (mg), manganese (mg), molybdenum (μg), phosphorus (mg), potassium (mg), selenium (μg), sodium (mg), zinc (mg) and choline (mg)] , ethanol (g), caffeine (g) and total food weight (g) was done using the software Food Processor SQL®.[8]

Statistical analysis

Data analysis was performed with the SPSS 19.0. The normality of the distribution of data for nutrient intake was assessed using the Kolmogorov-Smirnov test. Since some distributions were not normal, nutrient values were log-transformed before analysis. For those parameters with a value of zero there was added 0.0001 units to the values originally found, so that logarithmic transformation could be applied. Even after this transformation, some variables kept an abnormal distribution at least in one of the methods (27 out of the 53 studied), so for these we used the original variables and not the transformed ones. All variables were adjusted for total energy intake by applying a linear regression and the residuals method developed by Willet.[9]

Five different approaches for statistical analysis were used, all of them applied both before and after adjustment for total energy intake (TEI): (1) To compare intakes obtained with one or two 24hDR we used the paired samples Student T test (for normal distributions) and the Wilcoxon test (for non-normal distributions); (2) We studied the intraclass correlation coefficients (ICC) between the two questionnaires applied; (3) We categorized individuals in tertiles of intake in each method (one 24hDR and two non-consecutive 24hDR) and we evaluated, with contingency tables, the percentage of correct classification of intake into one tertile, the percentage of gross misclassification (percentage of individuals classified in opposite tertiles by the two methods) and absolute agreement (applying the kappa statistics); (4) We evaluated the correlation coefficients between one 24hDR and two non-consecutive 24hDR, using Pearson's coefficient for normal distributions and Spearman's coefficient for non-normal ones; (5) We used the method developed by Bland and Altman[(10)] to evaluate agreement for energy intake.

For the interpretation of the ICC, we considered that results presented a good consistency when measures were 0.8 or higher[(11)], however we needed to classify lower values so we considered the following cut-off points: 0-0.2 indicates poor agreement; 0.3-0.4 indicates fair agreement; 0.5-0.6 indicates moderate agreement; 0.7-0.8 indicates strong agreement; and >0.8 indicates almost perfect agreement.[(12)] The kappa statistics was interpreted according to Landis and Koch, who considered an excellent agreement for kappa values of 0.75 or higher, intermediate to good agreement for values ranging from 0.40 to 0.75 and poor agreement for values lower than 0,4.[(13)] As for the correlation coefficients, they were considered stronger, the closer they were to 1, which represented perfect correlation.[14]

Results Tables below present the results obtained in the various tests applied. Table 1 shows the comparison of means of one 24hDR and the mean of two non-consecutive 24hDR. Before adjustment for TEI, there are 21 variables with p value over 0.05, showing no statistically significant differences between methods. The higher p value found was 0.798 for water and the lower was <0.001 for 26 variables. After energy adjustment, p values ranged from 0.448 for zinc to 0.974 for folate, showing no statistically significant differences between the two methods.

The ICC before adjustment for TEI (Table 2) comparing average measures ranged from -0.031 for trans fatty acids and n3 fatty acids to 0.670 for total food weight, showing fair to good agreement in 17 of all variables studied. After adjustment for total energy intake (Table 3) the ICC for average measures had a lower value of -0.025 for choline and a higher value of 0.691 for n3 fatty acids. This shows a fair to good agreement between methods for all variables, except for choline, which showed poor agreement.

Table 4 shows the kappa statistics, the percentage of correct classification and the percentage of gross misclassification both before and after adjustment for TEI. Before adjustment for TEI, kappa value ranged from 0.351 for vitamin K to 0.679 for ethanol; the percentage of correct classification ranged from 56.8% for vitamin K to 78.7% for ethanol; the percentage of gross misclassification ranged from 0.0% for chrome to 7.9% for polyunsaturated fat. When energy-adjustment was considered, kappa value ranged from 0.291 for energy from fat and total fat to 0.587 for vitamin K, zinc and ethanol; percentage of correct classification ranged from 52.8% for total fat to 72.5% for sugar, vitamin K, zinc and ethanol; percentage of gross misclassification ranged from 0.0% for potassium to 5.5% for protein.

Table 1- Comparison of mean intake between one 24hDR and two non-consecutive 24hDR

	Mean intakes			
Nutrient	**One 24hDR**	**Two 24hDR**	**p**	**p*[1]**
Energy (kcal)	1931.6086	1898.5751	0.080	
Energy from Fat (kcal)	453.7453	458.1083	<0.001	0.493
Energy from Saturated Fat (kcal)	113.4661	113.2182	<0.001	0.524
Protein (g)	84.5768	83.1344	<0.001	0.785
Carbohydrates (g)	256.1134	248.4847	0.015	0.864
Fibre (g)	22.0554	21.1142	<0.001	0.741
Soluble Fibre (g)	3.8948	3.8767	0.253	0.788
Sugar (g)	88.1474	81.9198	<0.001	0.858
Monosaccharide's (g)	29.0953	26.5479	0.024	0.561
Disaccharide's (g)	6.0543	6.9374	0.021	0.594
Oligosaccharide's (g)	82.2130	79.6162	<0.001	0.527
Total Fat (g)	50.4610	50.9452	<0.001	0.492
Saturated Fat (g)	12.6072	12.5796	<0.001	0.524
Monounsaturated fat (g)	19.0051	18.9089	<0.001	0.453
Polyunsaturated fat (g)	7.5653	7.6430	0.114	0.686
N3 fatty acids (g)	.6663	.6999	<0.001	0.655
N6 fatty acids (g)	5.3177	5.4502	<0.001	0.653
Trans fat (g)	.1714	.2302	0.103	0.528
Cholesterol (mg)	209.1805	208.3107	<0.001	0.777
Ethanol (g)	9.7983	9.2074	0.103	0.720
Caffeine (mg)	294.2960	233.3434	<0.001	0.663
Water (g)	1838.5691	1823.4031	0.798	0.485
Vit A (µg RE)	307.5941	327.1283	<0.001	0.669
Pre Vit A (µg)	253.8691	249.5792	<0.001	0.705
Vit B1(mg)	.9410	.8904	0.102	0.774
Vit B2 (mg)	1.1072	1.0380	0.003	0.779
Vit B3 (mg NE)	28.9724	27.6414	0.046	0.677
Vit B6 (mg)	1.3420	1.2731	<0.001	0.568
Vit B12 (µg)	7.2910	6.9627	<0.001	0.602
Biotin (µg)	17.8005	16.8261	0.142	0.569
Vit C (mg)	95.1443	103.4462	<0.001	0.774
Vit D (mg)	2.5049	2.5059	0.714	0.605
Vit E (mg)	3.8986	3.3526	<0.001	0.505
Folate (µg)	305.8019	284.3313	0.152	0.974
VitK (µg)	128.0398	169.7522	0.321	0.626
Pantothenic Acid (mg)	2.7977	2.5574	0.144	0.477
Calcium (mg)	890.7297	882.3202	0.066	0.963
Chrome (mg)	3.9089	3.6980	0.402	0.717
Copper (mg)	.9727	.9150	0.654	0.804
Fluorine (mg)	382.2522	371.6808	<0.001	0.568
Iodine(µg)	96.8489	97.0428	0.491	0.630
Iron (mg)	12.5364	11.6474	0.530	0.828
Magnesium (mg)	346.6776	330.2098	<0.001	0.795
Manganese (mg)	2.2719	1.9469	<0.001	0.595
Molybdenum (µg)	25.2551	22.3825	<0.001	0.721
Phosphorus (mg)	1276.2432	1252.0756	0.038	0.782
Potassium (mg)	3406.1872	3323.4817	0.028	0.814
Selenium (µg)	86.5553	81.0205	<0.001	0.720
Sodium (mg)	2044.8927	1990.8461	<0.001	0.817
Zinc (mg)	6.7565	6.2846	0.067	0.448
Total Food Weight (g)	2250.1111	2221.3057	0.309	0.529
Choline (mg)	63.1043	59.3646	<0.001	0.702

[1] Adjusted for energy intake

Table 2- Intraclass Correlation Coefficients between one 24hDR and two 24hDR, before adjustment for energy intake

Intraclass Correlation Coefficient (before adjustment for total energy intake)

Nutrient	Single measures[2]	Confidence interval	Agreement	Average measures[3]	Confidence interval	Agreement
Energy	0.471	0.324;0.596	fair to good	0.640	0.489;0.747	fair to good
Energy from Fat	0.001	-0.173;0.175	poor	0.002	-0.417;0.297	poor
Energy from Saturated Fat	0.006	-0.167;0.18	poor	0.013	-0.402;0.305	poor
Protein	0.007	-0.167;0.18	poor	0.013	-0.402;0.305	poor
Carbohydrates	0.466	0.318;0.592	fair to good	0.636	0.482;0.744	fair to good
Fibre	0.050	-0.125;0.221	poor	0.095	-0.286;0.363	poor
Soluble Fibre	0.365	0.204;0.506	poor	0.535	0.339;0.672	fair to good
Sugar	0.283	0.115;0.435	poor	0.441	0.206;0.606	fair to good
Monosaccharide's	0.201	0.028;0.362	poor	0.334	0.055;0.531	poor
Disaccharide's	0.012	-0.162;0.185	poor	0.023	-0.388;0.312	poor
Oligosaccharide's	0.010	-0.164;0.183	poor	0.019	-0.393;0.309	poor
Total Fat	0.010	-0.164;0.183	poor	0.020	-0.392;0.310	poor
Saturated Fat	0.057	-0.118;0.228	poor	0.107	-0.268;0.371	poor
Monounsaturated fat	0.028	-0.146;0.201	poor	0.054	-0.343;0.334	Poor
Polyunsaturated fat	0.171	-0.003;0.335	poor	0.292	-0.006;0.501	Poor
N3 fatty acids	-0.015	-0.189;0.159	poor	-0.031	-0.465;0.274	Poor
N6 fatty acids	0.072	-0.103;0.243	poor	0.134	-0.229;0.390	Poor
Trans fat	-0.015	-0.188;0.159	poor	-0.031	-0.464;0.274	Poor
Cholesterol	0.140	-0.034;0.306	poor	0.246	-0.071;0.469	Poor
Ethanol	0.378	0.219;0.518	poor	0.549	0.359;0.682	fair to good
Caffeine	0.175	0.002;0.339	poor	0.298	0.004;0.506	Poor
Water	0.490	0.346;0.612	fair to good	0.658	0.514;0.759	fair to good
Vit A	<0.001	-0.173;0.173	poor	<0.001	-0.419;0.295	Poor
Pre Vit A	0.185	0.012;0.347	poor	0.312	0.023;0.515	Poor
Vit B1	0.186	0.012;0.348	poor	0.313	0.025;0.516	Poor
Vit B2	0.223	0.051;0.382	poor	0.364	0.097;0.552	Poor
Vit B3	0.011	-0.163;0.184	poor	0.022	-0.389;0.311	Poor
Vit B6	0.210	0.038;0.370	poor	0.348	0.074;0.541	Poor
Vit B12	0.089	-0.086;0.258	poor	0.163	-0.189;0.411	Poor
Biotin	0.276	0.108;0.429	poor	0.433	0.195;0.601	fair to good
Vit C	0.008	-0.166;0.181	poor	0.015	-0.398;0.307	Poor
Vit D	0.200	0.027;0.361	poor	0.333	0.053;0.530	Poor
Vit E	0.433	0.280;0.564	fair to good	0.604	0.438;0.721	fair to good
Folate	0.002	-0.172;0.176	poor	0.004	-0.415;0.299	Poor
VitK	0.061	-0.114;0.232	poor	0.115	-0.257;0.377	Poor
Pantothenic Acid	0.354	0.192;0.497	poor	0.523	0.322;0.664	fair to good
Calcium	0.462	0.314;0.589	fair to good	0.632	0.478;0.741	fair to good
Chrome	0.197	0.024;0.358	poor	0.329	0.047;0.528	Poor
Copper	0.310	0.144;0.459	poor	0.474	0.252;0.629	fair to good
Fluorine	0.487	0.342;0.609	fair to good	0.655	0.510;0.757	fair to good
Iodine	0.502	0.360;0.622	fair to good	0.669	0.530;0.767	fair to good
Iron	0.226	0.054;0.384	poor	0.368	0.103;0.555	Poor
Magnesium	0.341	0.178;0.486	poor	0.508	0.302;0.654	fair to good
Manganese	0.396	0.239;0.533	poor	0.567	0.385;0.695	fair to good
Molybdenum	0.091	-0.084;0.261	poor	0.168	-0.182;0.414	Poor
Phosphorus	0.350	0.188;0.494	poor	0.519	0.317;0.661	fair to good
Potassium	0.238	0.067;0.395	poor	0.384	0.126;0.566	Poor
Selenium	0.013	-0.161;0.186	poor	0.026	-0.383;0.314	Poor
Sodium	<0.001	-0.173;0.174	poor	0.001	-0.419;0.296	Poor
Zinc	0.115	-0.60;0.283	poor	0.206	-0.128;0.441	Poor
Total Food Weight	0.503	0.361;0.623	fair to good	0.670	0.532;0.767	fair to good
Choline	0.158	-0.016;0.323	poor	0.273	-0.033;0.488	Poor

[2] Single measures: comparison of the first 24hDR with the second 24hDR
[3] Average measures: comparison of each 24hDR with the mean of two 24hDR

Table 3- Intraclass Correlation Coefficients between one 24hDR and two 24hDR, after adjustment for energy intake

Intraclass Correlation Coefficient (after adjustment for total energy intake)

Nutrient	Single measures[4]	Confidence interval	Agreement	Average measures[5]	Confidence interval	Agreement
Energy						
Energy from Fat	0.352	0.190;0.495	poor	0.521	0.319;0.662	fair to good
Energy from Saturated Fat	0.439	0.288;0.570	fair to good	0.611	0.447;0.726	fair to good
Protein	0.280	0.112;0.433	poor	0.437	0.201;0.604	fair to good
Carbohydrates	0.310	0.144;0.460	poor	0.473	0.251;0.630	fair to good
Fibre	0.443	0.292;0.573	fair to good	0.614	0.452;0.728	fair to good
Soluble Fibre	0.448	0.297;0.577	fair to good	0.619	0.458;0.731	fair to good
Sugar	0.465	0.317;0.591	fair to good	0.635	0.482;0.743	fair to good
Monosaccharide's	0.483	0.338;0.606	fair to good	0.652	0.505;0.755	fair to good
Disaccharide's	0.467	0.320;0.593	fair to good	0.637	0.485;0.744	fair to good
Oligosaccharide's	0.370	0.210;0.511	poor	0.541	0.347;0.676	fair to good
Total Fat	0.352	0.190;0.496	poor	0.521	0.320;0.663	fair to good
Saturated Fat	0.439	0.288;0.570	fair to good	0.611	0.447;0.726	fair to good
Monounsaturated fat	0.414	0.259;0.548	fair to good	0.586	0.412;0.708	fair to good
Polyunsaturated fat	0.412	0.257;0.546	fair to good	0.583	0.408;0.707	fair to good
N3 fatty acids	0.456	0.307;0.584	fair to good	0.626	0.470;0.737	fair to good
N6 fatty acids	0.424	0.271;0.557	fair to good	0.596	0.426;0.715	fair to good
Trans fat	0.464	0.316;0.590	fair to good	0.634	0.480;0.742	fair to good
Cholesterol	0.446	0.296;0.575	fair to good	0.617	0.456;0.730	fair to good
Ethanol	0.450	0.300;0.579	fair to good	0.621	0.462;0.733	fair to good
Caffeine	0.473	0.327;0.598	fair to good	0.643	0.492;0.748	fair to good
Water	0.431	0.279;0.563	fair to good	0.603	0.436;0.720	fair to good
Vit A	0.422	0.268;0.555	fair to good	0.593	0.423;0.714	fair to good
Pre Vit A	0.401	0.244;0.537	fair to good	0.572	0.393;0.699	fair to good
Vit B1	0.437	0.286;0.568	fair to good	0.609	0.444;0.724	fair to good
Vit B2	0.486	0.341;0.608	fair to good	0.654	0.509;0.757	fair to good
Vit B3	0.460	0.311;0.586	fair to good	0.630	0.474;0.739	fair to good
Vit B6	0.479	0.333;0.603	fair to good	0.648	0.500;0.752	fair to good
Vit B12	0.479	0.333;0.603	fair to good	0.648	0.500;0.752	fair to good
Biotin	0.431	0.278;0.562	fair to good	0.602	0.435;0.720	fair to good
Vit C	0.487	0.342;0.609	fair to good	0.655	0.510;0.757	fair to good
Vit D	0.461	0.313;0.588	fair to good	0.631	0.476;0.740	fair to good
Vit E	0.446	0.296;0.575	fair to good	0.617	0.456;0.731	fair to good
Folate	0.358	0.196;0.500	poor	0.527	0.328;0.667	fair to good
VitK	0.466	0.318;0.592	fair to good	0.636	0.482;0.743	fair to good
Pantothenic Acid	0.461	0.313;0.588	fair to good	0.631	0.476;0.740	fair to good
Calcium	0.441	0.290;0.571	fair to good	0.612	0.449;0.727	fair to good
Chrome	0.454	0.304;0.582	fair to good	0.624	0.467;0.736	fair to good
Copper	0.467	0.319;0.593	fair to good	0.637	0.484;0.744	fair to good
Fluorine	0.466	0.319;0.592	fair to good	0.636	0.483;0.744	fair to good
Iodine	0.467	0.319;0.593	fair to good	0.637	0.484;0.744	fair to good
Iron	0.503	0.361;0.622	fair to good	0.669	0.530;0.767	fair to good
Magnesium	0.410	0.254;0.545	fair to good	0.581	0.405;0.705	fair to good
Manganese	0.472	0.325;0.597	fair to good	0.641	0.491;0.748	fair to good
Molybdenum	0.449	0.299;0.578	fair to good	0.620	0.460;0.732	fair to good
Phosphorus	0.398	0.242;0.535	poor	0.570	0.389;0.697	fair to good
Potassium	0.394	0.236;0.531	poor	0.565	0.382;0.694	fair to good
Selenium	0.444	0.293;0.573	fair to good	0.615	0.453;0.729	fair to good
Sodium	0.256	0.086;0.411	poor	0.407	0.158;0.583	fair to good
Zinc	0.528	0.390;0.642	fair to good	0.691	0.561;0.782	fair to good
Total Food Weight	0.435	0.282;0.566	fair to good	0.606	0.440;0.722	fair to good
Choline	-0.012	-0.185;0.162	poor	-0.025	-0.025;0.278	poor

[4] Single measures: comparison of the first 24hDR with the second 24hDR
[5] Average measures: comparison of each 24hDR with the mean of two 24hDR

Table 4- Kappa Statistics, misclassification and absolute agreement between one 24hDR and two non-consecutive 24hDR

Kappa Statistics

Nutrient	Not energy-adjusted				Energy-adjusted			
	Kappa value	Agreement	% correct classification[6]	% gross misclassification[7]	Kappa value	Agreement	% correct classification	% gross misclassification
Energy	0.587	Moderate	72.5%	1.6%				
Energy from Fat	0.433	Moderate	62.1%	3.1%	0.291	Fair	52.8%	4.7%
Energy from Saturated Fat	0.421	Moderate	61.3%	4.7%	0.551	Moderate	70.0%	3.2%
Protein	0.516	Moderate	67.7%	1.6%	0.504	Moderate	66.9%	**5.5%**
Carbohydrates	0.622	Substantial	74.8%	0.8%	0.421	Moderate	61.4%	0.8%
Fibre	0.575	Moderate	71.7%	0.8%	0.445	Moderate	63.0%	3.2%
Soluble Fibre	0.445	Moderate	62.9%	1.6%	0.492	Moderate	66.1%	2.4%
Sugar	0.516	Moderate	67.7%	1.6%	0.587	Moderate	72.5%	0.8%
Monosaccharide's	0.469	Moderate	64.5%	2.4%	0.551	Moderate	70.1%	0.8%
Disaccharide's	0.398	Fair	59.8%	6.3%	0.539	Moderate	69.3%	1.6%
Oligosaccharide's	0.504	Moderate	66.9%	2.4%	0.492	Moderate	66.1%	3.2%
Total Fat	0.433	Moderate	62.1%	3.1%	**0.291**	Fair	52.8%	4.7%
Saturated Fat	0.421	Moderate	61.3%	4.7%	0.563	Moderate	70.8%	3.2%
Monounsaturated fat	0.433	Moderate	62.1%	2.4%	0.445	Moderate	63.0%	0.8%
Polyunsaturated fat	0.386	Fair	59.0%	7.9%	0.539	Moderate	69.3%	1.6%
N3 fatty acids	0.397	Fair	59.9%	5.5%	0.516	Moderate	67.7%	1.6%
N6 fatty acids	0.445	Moderate	63.0%	6.3%	0.551	Moderate	70.1%	3.2%
Cholesterol	0.433	Moderate	62.2%	1.6%	0.445	Moderate	63.0%	1.6%
Ethanol	0.679	Substantial	78.7%	3.1%	0.587	Moderate	72.5%	2.4%
Caffeine	0.622	Substantial	74.8%	1.6%	0.551	Moderate	70.1%	0.8%
Water	0.563	Moderate	70.9%	0.8%	0.516	Moderate	67.7%	1.6%
Vit A	0.421	Moderate	61.3%	4.7%	0.516	Moderate	67.7%	1.6%
Pre Vit A	0.504	Moderate	66.9%	2.4%	0.409	Fair	60.6%	2.4%
Vit B1	0.492	Moderate	66.1%	0.8%	0.480	Moderate	65.3%	2.4%
Vit B2	0.504	Moderate	66.9%	2.4%	0.563	Moderate	70.9%	1.6%
Vit B3	0.398	Fair	59.8%	3.2%	0.504	Moderate	66.9%	0.8%
Vit B6	0.492	Moderate	66.2%	3.9%	0.445	Moderate	63.0%	1.6%
Vit B12	0.515	Moderate	67.7%	1.6%	0.575	Moderate	71.7%	1.6%
Biotin	0.468	Moderate	64.5%	1.6%	0.480	Moderate	65.4%	0.8%
Vit C	0.445	Moderate	63.0%	1.6%	0.539	Moderate	69.3%	1.6%
Vit D	0.457	Moderate	63.7%	2.4%	0.516	Moderate	67.7%	0.8%
Vit E	0.528	Moderate	68.5%	0.8%	0.528	Moderate	68.5%	1.6%
Folate	0.563	Moderate	70.9%	3.9%	0.551	Moderate	70.1%	2.4%
VitK	0.351	Fair	56.8%	7.1%	0.587	Moderate	72.5%	1.6%
Pantothenic Acid	0.496	Moderate	66.5%	0.8%	0.587	Moderate	72.4%	0.8%
Calcium	0.481	Moderate	65.3%	0.8%	0.492	Moderate	66.2%	0.8%
Chrome	0.539	Moderate	69.3%	**0.0%**	0.516	Moderate	67.7%	1.6%
Copper	0.445	Moderate	63.0%	1.6%	0.504	Moderate	66.9%	4.0%
Fluorine	0.563	Moderate	70.8%	0.8%	0.563	Moderate	70.9%	1.6%
Iodine	0.528	Moderate	68.5%	1.6%	0.480	Moderate	65.4%	0.8%
Iron	0.540	Moderate	69.3%	1.6%	0.504	Moderate	66.9%	1.6%
Magnesium	0.587	Moderate	72.5%	0.8%	0.563	Moderate	70.9%	0.8%
Manganese	0.610	Substantial	74.0%	0.8%	0.539	Moderate	69.3%	2.4%
Molybdenum	0.551	Moderate	70.1%	2.4%	0.445	Moderate	63.0%	2.4%
Phosphorus	0.445	Moderate	62.9%	0.8%	0.421	Moderate	61.5%	**0.0%**
Potassium	0.551	Moderate	70.1%	2.4%	0.409	Moderate	60.7%	3.2%
Selenium	0.433	Moderate	62.2%	3.9%	0.516	Moderate	67.7%	1.6%
Sodium	0.492	Moderate	66.1%	1.6%	0.374	Fair	58.3%	4.7%
Zinc	0.468	Moderate	64.5%	3.1%	0.587	Moderate	72.5%	0.8%
Total Food Weight	0.575	Moderate	71.7%	0.8%	0.516	Moderate	67.7%	0.8%
Choline	0.457	Moderate	63.8%	3.9%	0.398	Fair	59.8%	2.4%

[6] % correct classification: percentage of individuals classified in the same tertile by the two methods

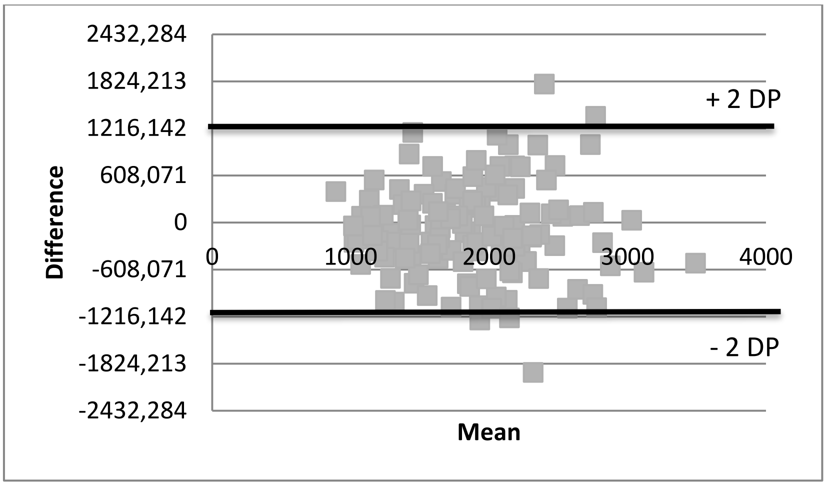
[7] % gross misclassification: percentage of individuals classified in opposite tertiles by the two methods

The correlation coefficients obtained are shown in Table 5 before and after energy adjustment. Before adjustment for TEI, coefficients varied between 0.600 for trans fatty acids to 0.889 for water; for energy adjusted variables, coefficients varied from 0.697 for sodium to 0.870 for niacin.

Table 5- Correlation Coefficients between one 24hDR and two non-consecutive 24hDR

Nutrient	Correlation Coefficients: Not energy-adjusted		Energy-adjusted	
	R	p	r	P
Energy	.860	<0.001		
Energy from Fat	.758	<0.001	.760	<0.001
Energy from Saturated Fat	.730	<0.001	.838	<0.001
Protein	.797	<0.001	.761	<0.001
Carbohydrates	.876	<0.001	.829	<0.001
Fibre	.818	<0.001	.840	<0.001
Soluble Fibre	.836	<0.001	.837	<0.001
Sugar	.859	<0.001	.850	<0.001
Monosaccharide's	.753	<0.001	.861	<0.001
Disaccharide's	.663	<0.001	.860	<0.001
Oligosaccharide's	.800	<0.001	.809	<0.001
Total Fat	.758	<0.001	.760	<0.001
Saturated Fat	.730	<0.001	.838	<0.001
Monounsaturated fat	.627	<0.001	.773	<0.001
Polyunsaturated fat	.730	<0.001	.833	<0.001
N3 fatty acids	.715	<0.001	.825	<0.001
N6 fatty acids	.684	<0.001	.828	<0.001
Trans fat	.600	<0.001	.858	<0.001
Cholesterol	.791	<0.001	.830	<0.001
Ethanol	.852	<0.001	.815	<0.001
Caffeine	.862	<0.001	.865	<0.001
Water	.889	<0.001	.851	<0.001
Vit A	.752	<0.001	.832	<0.001
Pre Vit A	.794	<0.001	.808	<0.001
Vit B1	.813	<0.001	.842	<0.001
Vit B2	.800	<0.001	.862	<0.001
Vit B3	.793	<0.001	.870	<0.001
Vit B6	.747	<0.001	.856	<0.001
Vit B12	.787	<0.001	.857	<0.001
Biotin	.822	<0.001	.834	<0.001
Vit C	.739	<0.001	.859	<0.001
Vit D	.810	<0.001	.845	<0.001
Vit E	.856	<0.001	.841	<0.001
Folate	.827	<0.001	.819	<0.001
VitK	.647	<0.001	.842	<0.001
Pantothenic Acid	.838	<0.001	.854	<0.001
Calcium	.851	<0.001	.838	<0.001
Chrome	.831	<0.001	.851	<0.001
Copper	.772	<0.001	.855	<0.001
Fluorine	.856	<0.001	.859	<0.001
Iodine	.862	<0.001	.856	<0.001
Iron	.833	<0.001	.868	<0.001
Magnesium	.881	<0.001	.853	<0.001
Manganese	.869	<0.001	.850	<0.001
Molybdenum	.857	<0.001	.842	<0.001
Phosphorus	.841	<0.001	.817	<0.001
Potassium	.813	<0.001	.838	<0.001
Selenium	.711	<0.001	.834	<0.001
Sodium	.808	<0.001	.697	<0.001
Zinc	.788	<0.001	.877	<0.001
Total Food Weight	.892	<0.001	.850	<0.001
Choline	.736	<0.001	.642	<0.001

The Bland and Altman plot for energy shows a moderate agreement between the two methods. In Graphic 1 we see that most of the individuals are placed between (-)2 standard deviations and (+)2 standard deviations from the mean.



Graphic 1 – Bland and Altman Plot for energy intake

Discussion and Conclusions

According to our best knowledge, this is the first study that addresses the comparison of nutritional intake obtained with one 24hDR and two non-consecutive 24hDR, in elderly.

The main finding from the present study is that when using one 24hDR or two 24hDR, results may differ particularly for energy from fat, total fat, pre vitamin A, sodium and choline.

Analyzing data from the tables above, we see that, when we compare means, all variables had high p values after adjusting for TEI, showing no differences between the two methods.

The ICC values obtained before adjustment for TEI show a relatively low degree of agreement between methods. However, after adjusting for this confounder, all of the variables show a fair to good agreement, except for choline.

As for the kappa statistics, percentage of correct classification and percentage of gross misclassification, the adjustment for total energy intake does not have the same effect in all variables studied. Some of the variables improve their degree of agreement while others get worse. The variables that present a decrease in the degree of agreement when energy-adjusted are energy from fat, carbohydrates, total fat, pre-vitamin A, manganese, sodium, ethanol, caffeine and choline. The ones that show an improvement in agreement with energy-adjustment are disaccharides, polyunsaturated fat, vitamin B3 (niacin equivalents), vitamin K and n3 fatty acids. The rest of the variables, even with alterations in the kappa values, kept in the same interval of classification. We eliminated trans fatty acids from this analysis, because the values of intake didn’t allow the division in tertiles. Kappa statistics shows a moderate agreement between the two methods, except for energy from fat, total fat, pre vitamin A, sodium and choline.

The correlation coefficients also had high values for all variables both before and after adjustment for total energy intake.

Studying all the tables obtained from the analysis, we see that the statistical tests applied present different results when evaluating the agreement of the two methods, even if, in general, they show a relatively moderate agreement.

The results of the present study suggest that there are not many differences between the application of one 24hDR and two non-consecutive 24hDR in elderly.

We may also conclude that energy has good results in all the tests, showing that one interview would probably be enough to quantify its intake in elderly. The same does not apply to the other nutrients because they showed many differences of results in all the tests applied.

The high level of agreement for some variables may have been influenced by the fact that the first day was included in the calculation of the mean of the two days, being used both as the first day of interview and as a contributor for the mean. To overcome this obstacle, we suggest the application of a third 24hDR that would be used to calculate the mean with the second interview. The first day would then be compared with this new variable.

The use of the 24hDR in older people presents some limitations that may have influenced the results of this study. The fact that this method requires the use of recent memory from the respondent may negatively influence energy intake and, consequently, nutrients intake also. A review from Poslusna *et al* found that respondent's memory lapses are related to energy misreporting both for under and over reporting.[15]

Furthermore, according to our sample characteristics, energy misreporting might have occurred due to higher number of women, increased age of subjects, low level of education and prevalence of high BMI [15, 16]

There isn't a gold standard method for evaluating nutritional intake in elderly, however the recommendation is to apply various 24hDR[1]. Future studies should assess the differences that may occur in the quality of results obtained with increasing number of 24hDR.

We found no studies that evaluated the differences between the application of one 24hDR and two non-consecutive 24hDR. Being so, we see this paper as a suggestion for further investigation, with a bigger sample size and with different age groups.

Acknowledgements

This study was carried out with the support of FADEUP. Also, we should acknowledge the importance of the participation of the students from FCNAUP and FADEUP that conducted the interviews.

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