

Original

Does nutrition play a role in the quality of life of patients under chronic haemodialysis?

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Abstract

Background: In patients with chronic renal failure under haemodialysis, we investigated the inter-relationships and relative contributions of disease, haemodialysis and of nutrition related factors on the patients' Quality of Life. **Methods:** Collected data in 60 adult patients comprised: co-morbidities (multiple medicines, other chronic diseases), duration of renal failure and of haemodialysis (in months), % weight loss since haemodialysis, nutrient intake derived from diet history analysis (DIETPLAN5 2003, UK). The EuroQoL instrument that includes 5 dimensions, mobility, self-care, activities, pain/discomfort, anxiety/depression, and an overall health visual analogue scale evaluated QoL. **Results:** Estimates of effect size attributed to each variable included in the general linear model revealed that 47% of patients' mobility/self-care scores were worsened by deficient protein/energy intake and 30% by weight loss =10%. Poor performance of usual activities was attributed in 45% to duration of haemodialysis and of disease, 70% to protein/energy/vitamin B₁₂/zinc/iron deficits, and 20% to weight loss =10%. Pain/discomfort were worsened in 45% by the duration of haemodialysis and of disease, and in 15% by co-morbidities. Higher anxiety/depression were related in 43% to protein/energy/selenium & vitamin C deficits, in 40% to the duration of haemodialysis and of disease, in 10% to weight loss =10%, and in 3% to co-morbidities. Likewise, 47% of poor overall health was determined by protein/energy/vitamin B₁₂/zinc/selenium & vitamin C deficits, 25% by weight loss =10%, 10% by disease duration, and 7% by co-morbidities. **Conclusion:** Protein, antioxidants and key micronutrients involved in protein metabolism, did exert a major effect on patients' Quality of Life. Given the prevalence

¿DESEMPEÑA LA NUTRICIÓN UN PAPEL EN LA CALIDAD DE VIDA DE LOS PACIENTES CON HEMODIÁLISIS CRÓNICA?

Resumen

Antecedentes: en pacientes con insuficiencia renal crónica y en hemodiálisis, investigamos las relaciones y contribuciones relativas de la enfermedad, hemodiálisis y factores nutricionales del paciente sobre la calidad de vida (QOL). **Métodos:** los datos recogidos de 60 pacientes adultos incluían: comorbilidades (múltiples fármacos, otras enfermedades crónicas), duración de la insuficiencia renal y hemodiálisis (en meses), % pérdida de peso desde la hemodiálisis, ingestión de nutrientes derivada del análisis de la historia dietética (DIETPLAN5, 2003, RU). La escala EuroQOL que incluye 5 dimensiones de movilidad, autocuidado, actividades, dolor / malestar, ansiedad/depresión, y una escala analógica visual sobre salud global, evaluó la QOL. **Resultados:** las estimaciones del efecto del tamaño atribuido a cada variable incluida en el modelo lineal general mostraron que el 47% de las puntuaciones de los pacientes sobre movilidad/pérdida de peso empeoraban con una ingestión de deficiente de proteínas / energía y el 30% por una pérdida de peso $\geq 10\%$. El bajo rendimiento en las actividades habituales se atribuyó en un 45% a la duración de la hemodiálisis y de la enfermedad, el 70% a deficiencias de proteínas/energía/vitamina B12/cinc/hierro, y el 20% a una pérdida de peso $\geq 10\%$. El dolor/ansiedad empeoraban en un 45% por la duración de la hemodialysis y de la enfermedad, y en un 15% por comorbilidades. La mayor ansiedad/depresión se relacionó en un 43% con deficiencias de proteínas / energía/selenio y vitamina C, en un 40% por la duración de la hemodiálisis y la enfermedad, en un 10% por una pérdida de peso $\geq 10\%$, y en un 3% a las comorbilidades. Asimismo, el 47% de la salud global mala vino determinado por deficiencias de proteína/energía/vitamina B12/cinc/selenio y vitamina C, 25% por pérdida de peso $\geq 10\%$, el 10% por la duración de la enfermedad, y el 7% por las comorbilidades. **Conclusiones:** las proteínas, los antioxidantes y los micronutrientes clave implicados en el metabolismo pro-

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of nutrient deficits, the ensuing impaired functional capacity is likely to compromise QoL, timely nutrition is thus warranted.

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Key words: *Chronic haemodialysis. Nutrition. Morbidity. Quality of life.*

Introducción

In renal failure under chronic haemodialysis, similarly to other disease states, nutrition is likely to influence patients' recovery, morbidity, mortality as well as their Quality of Life (QoL)¹. It is widely known that an adequate diet *per se* may delay the need for haemodialysis^{2,3}, hence dietary management is, since the early 1960's, mandatory in chronic renal failure patients⁴. Indeed, virtually every study in such patients has reported some degree of malnutrition, with a mean prevalence around 40%, ranging from 20% to 80%⁵. There have been reports on increased morbidity and mortality in patients with renal failure that suffer from malnutrition. Nonetheless, in haemodialysis patients it is frequent to see both deficient nutritional intake, determined by inappropriately restricted diets and/or anorexia or dysgeusia⁶, as well as by increased nutrient losses, due to metabolic alterations, inadequate haemodialysis dose and/or inadequate membrane biocompatibility^{7,8}. Thus, nutrition care and tight monitoring, eventually using dietary supplements of trace elements and electrolytes, is required for an adequate nutritional intake in patients under haemodialysis^{9,10}.

Within this framework, this cross-sectional study, conducted in patients submitted to chronic haemodialysis, was designed to explore the potential interaction(s) between various disease-related and diet-related factors likely to be implicated in such patients' Quality of Life. Our specific aims were: 1) to evaluate patients' weight changes, nutritional intake and QoL; 2) to investigate potential inter-variable associations and 3) to quantify the relative impact of disease and/or nutrition-related factors on patients' QoL.

Patients and methods

Patients

This cross-sectional study was approved by the University Ethics Committee and was conducted in accordance with the Helsinki Declaration of 1975 as revised in 1983. Patients' interviews were conducted approximately 30 minutes before or after the haemodialysis session (according to the Center's organizational convenience). Every patient was informed of the nature, purpose and procedures involved in the study, before obtaining his/her informed consent. Data

teico ejercieron un efecto principal sobre la calidad de vida de los pacientes. Dada la prevalencia de las deficiencias nutricionales, la alteración resultante de la capacidad funcional probablemente comprometa la calidad de vida, por lo que se debe garantizar una nutrición adecuada.

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Palabras clave: *Hemodiálisis crónica. Nutrición. Morbilidad. Calidad de vida.*

were recorded on individual forms pre-constructed for statistical analysis. Between January and June 2001 in a Center of Haemodialysis treatment, all consecutive ambulatory patients with renal failure undergoing chronic haemodialysis were considered eligible, and were randomly selected with no exclusion criteria. This study included 60 adult patients (36M: 24F), with a mean age of 57.0 ± 18.2 (21-89) years, all receiving routine dietary counselling.

The investigators had access to the patients' baseline data registered by the medical staff, namely the duration and severity/stage of kidney failure¹¹. For this study, besides demographics, the following data were collected for every patient: renal failure aetiology, date of diagnosis, length of the haemodialysis treatment, type of haemodialysis regimen, recent and/or chronic medications including micronutrient supplementation, and co-morbidities (high blood pressure, diabetes, chronic cardiac disease, and chronic hepatic disease).

Nutritional Parameters

Weight was always obtained after a session; patients' weight changes were valued by calculating the percentage of weight loss, by comparison with the patient's usual weight, and classified as severe if $\geq 10\%$.

Nutritional Requirements and Dietary Assessment. Since basal energy requirements are similar between patients under haemodialysis and healthy individuals⁶, requirements were estimated using the World Health Organization formulae for patients aged = 60 yrs¹² or by the Owen et al formulae for patients aged > 60 yrs^{13,14}, given their better performance in predicting resting metabolic rate¹⁵. To estimate patients' daily energy requirements, basal requirements were multiplied by a 1.5 activity factor^{6,16}; daily protein requirements were estimated by comparison with the standardized recommended intake for haemodialysis patients, which ranges from 0.8 to 1.2 g/kg per day². Micronutrient intake was compared with the recommendations for patients under haemodialysis⁶. Total nutrient intake was derived from a diet history, which consists of a questionnaire relative to the usual food and beverage intake^{17,18}. In detail, the primary source of the dietary data was Burke's diet history, which was further complemented by the evaluation of the diet intake regarding 2 week-days and 1 weekend day. The software DIETPLAN version 5 for Windows (Forestfield software Ltd 2003, Horsham, UK) was used to analyze

and detail nutrient contents of regular foods (raw and cooked), beverages and meals (raw and cooked). In this study, only the relevant nutrients for haemodialysis and peritoneal dialysis patients were analyzed⁵.

Quality of Life assessment. QoL was assessed using the multidimensional EuroQoL Instrument¹⁹, which evaluates five QoL dimensions and the overall health. The QoL dimensions include mobility, self-care, activities, pain/discomfort and anxiety/depression, each consisting of 3 items, the first corresponding to the best status and the third to the worst; in order for these scores to be included in the ANOVA analysis, original scores were linearly transformed to obtain quantified scores within the range of 0 to 100¹⁹. To assess overall health a visual analogue scale was used. Patients were asked to quantify their health from 0 to 100, with higher scores indicating a higher level of functioning and well being.

Statistical analysis

Statistical analysis was performed using SPSS 11.5 (SPSS Inc, Chicago, USA) and EPI-Info 2000 (CDC, Atlanta, USA). Age was expressed as the mean \pm standard deviation (range); macro and micronutrient intakes as well as the patients' QoL scores were expressed as the median values. Continuous variables were analyzed using one-way analysis of variance (ANO-

VA) or Wilcoxon rank sum tests as appropriate; categorical variables and incidence, prevalence or frequency were evaluated by the Chi-square test. Univariate or multiple correlations were assessed by two-tailed non parametric Spearman tests. A multivariate general linear model was used to identify variables that were significantly related with the patients' QoL. For all statistics, significance was accepted at the 5% probability level.

Results

Patients. Table I shows chronic renal failure aetiology for the patient sample¹¹; hypertensive nephrosclerosis was the main cause (32%). The average

Table I
Aetiology of renal failure

| Major causes | Men (n) | Women (n) |
|------------------------------|---------|-----------|
| Glomerulopathies | 7 | 11 |
| Tubulointerstitial nephritis | 2 | 2 |
| Hereditary diseases | 0 | 3 |
| Obstructive nephropathies | 2 | 0 |
| Vascular diseases | 16 | 3 |
| Others | 9 | 5 |

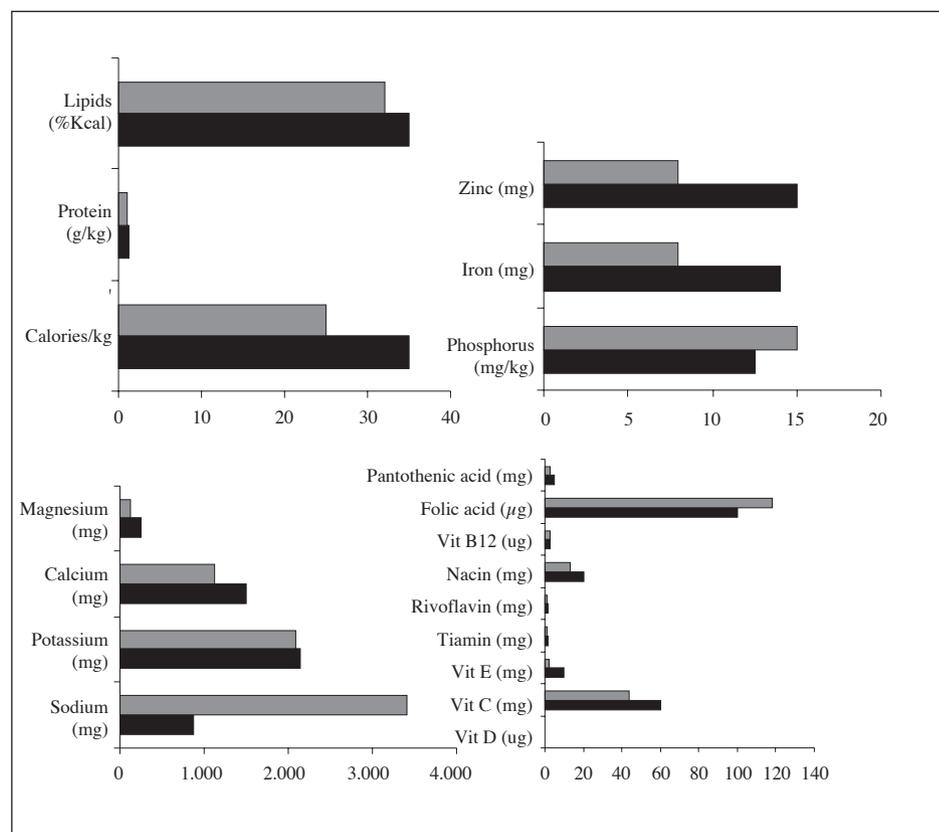


Fig. 1. Patients' median current nutritional intake □ and median nutritional requirements ■. Vitamin D is not shown because of minute amounts.

durations of the disease and of haemodialysis treatment were 121±110 and 63.6±66.9 months, respectively.

Nutritional intake. Figure 1 shows the comparison between current nutrient intake and the recommended values (2, 6, 12-14). On average, macronutrient intake was lower than recommended requirements, which reached significance for protein intake (lower than recommended in 58% of patients, $p=0.01$). Lower than recommended requirements was registered for 2 or more micronutrients in 92% of patients ($p<0.01$).

Quality of Life. The median QoL dimensions' scores are summarized in table II. ANOVA analysis including nutrition related factors (independent variables) and their relationships with QoL (dependent variable), showed that worse overall QoL dimension scores were associated with deficient protein/energy intakes ($p<0.0001$); an energy deficit was significantly associated with poorer performance of usual activities ($p=0.02$), but did not reach significance with overall health, $p=0.07$. Worse anxiety/depression were associated with selenium ($p=0.001$) and vitamin C deficits ($p=0.05$); poorer performance of usual activities was significantly associated with zinc and vitamin B₁₂ deficits ($p=0.05$), not reaching significance with reduced iron intake ($p=0.07$). Worse overall health

was associated with deficient intake of zinc ($p=0.04$), selenium ($p=0.05$), vitamin C ($p=0.03$) and vitamin B₁₂ ($p=0.03$), not significant for iron intake, $p=0.06$.

Table III shows the results of a general linear model that included linearly transformed QoL scores (dependent variables), nutritional parameters and disease/haemodialysis-related variables (independent) in order to calculate the estimates of effect size and the respective statistics. Estimates of effect size attributed to each variable included in the general linear model (sum of percentages may not equal 100% due to corrected error size) revealed that 47% of patients' mobility/self-care scores were negatively associated with deficient protein/energy intake and 30% by weight loss $\geq 10\%$. Poor performance of usual activities was attributed in 45% to the duration of haemodialysis and of renal failure, 35% to protein/energy deficits 35% to vitamin B₁₂, zinc and iron deficits, and 20% to weight loss $\geq 10\%$. Pain/discomfort was worsened in 45% by the duration of haemodialysis and of renal failure, and in 15% by co-morbidities. Higher anxiety/depression were related in 43% to protein/energy, selenium and vitamin C deficits, in 40% to the duration of haemodialysis and of the disease, in 10% to weight loss $\geq 10\%$, and in 3% to co-morbidities. Likewise, 47% of poor overall health was determined by protein, energy, vitamin B₁₂, zinc, iron, selenium and vitamin C deficits, 25% by weight loss $\geq 10\%$, 10% by the duration of the disease, and 7% by co-morbidities.

Table II

Patients reporting problems in each EuroQoL dimension

| EuroQoL dimension | Problem | | |
|--------------------|---------|----------|---------|
| | Mild | Moderate | Extreme |
| Mobility | 2 (3) | 24 (40) | 34 (57) |
| Self care | 3 (5) | 9 (15) | 48 (80) |
| Usual activities | 29 (48) | 18 (30) | 48 (80) |
| Pain/discomfort | 7 (12) | 29 (48) | 24 (40) |
| Anxiety/depression | 18 (30) | 19 (32) | 23 (38) |
| Overall health | 12 (20) | 20 (33) | 28 (47) |

Data expressed as number (percentage) of patients.

Discussion

To be meaningful, QoL assessment must include the patients' perception of their overall health, together with expectations, personal satisfactions and physical/psychological impairments; hence the EuroQoL instrument was chosen as an effective tool¹⁹. The present study clearly shows that haemodialysis patients' QoL is multifactorial and that it is distinctively influenced by the disease, co-morbidities and nutritional parameters.

Table III

Inter-relationships and estimates of effect size (relative weights) of nutritional parameters and disease/haemodialysis related variables on QoL: results from general linear model analysis

| Variable | Mobility/self care | | Usual activities | | Pain/ discomfort | | Anxiety/depression | | Overall health | |
|-------------------------------------|---------------------------|--------|---------------------------|--------|---------------------------|--------|---------------------------|--------|---------------------------|-------|
| | Estimates of effect size* | p | Estimates of effect size* | p |
| Duration of haemodialysis + disease | 2% | 0,52 | 30% | 0,0001 | 45% | 0,0001 | 40% | 0,0001 | 10% | 0,04 |
| Co-morbidities | 2% | 0,61 | 2% | 0,45 | 15% | 0,02 | 3% | 0,55 | 7% | 0,05 |
| Weight loss >10% | 30% | 0,001 | 20% | 0,01 | 4% | 0,42 | 10% | 0,01 | 25% | 0,003 |
| Protein/energy | 47% | 0,0001 | 22% | 0,005 | 2% | 0,45 | 23% | 0,003 | 15% | 0,009 |
| Vitamin B ₁₂ /Zinc/Iron | 1% | 0,54 | 21% | 0,006 | 1% | 0,56 | 4% | 0,23 | 15% | 0,008 |
| Selenium/Vitamin C | 1% | 0,66 | 4% | 0,32 | 1% | 0,71 | 20% | 0,004 | 17% | 0,006 |

Columns denote dependent variables, and rows independent variables; *the sum of percentages may not equal 100% due to the corrected error size.

Haemodialysis-related nutritional deterioration has been traditionally attributed to symptoms, metabolic derangements and increased nutrient losses⁶⁻⁸. Despite the fact that nutritional deterioration is associated with functional impairment²⁰, the interaction between nutrition and QoL is as yet barely unexplored²¹. Patients' nutritional status at initiation of haemodialysis is a strong predictor of their short term, as well as their long term outcome^{22,23}; notwithstanding, the prevalence of malnutrition ranges from 20% to 80% and to date, only one study has suggested a relationship between nutritional status and QoL in chronic haemodialysis patients⁵. Indeed, in our study, 63% of the patients showed a significant weight loss, which was associated with worse mobility, higher anxiety/depression, impaired usual activities and worse overall health.

In chronic haemodialysis, longstanding nutritional intake deficits were not previously investigated. Nevertheless, protein, antioxidants and some vitamins are key nutrients in various metabolic pathways^{3,8,24}. Abnormalities in micronutrient concentrations are the primary result of uraemia and/or of the dialysis procedure²⁴⁻²⁶, both mechanisms may justify the supplementation with micronutrients of the patients' diet. In fact, when micronutrients concentrations were corrected, an improvement in QoL perception has been registered^{25,27,28}. In our study, despite the fact that all patients were receiving micronutrient supplements, there were important dietary deficits in the majority of the patients, in whom current intake was markedly lower than the reference values, suggesting a longstanding severe depletion in energy, protein and micronutrients. Specifically, protein intake was on average lower than recommended in 58% of the patients, as well as for two or more micronutrients in 92% of the patients; these findings may ensue from poor patients' compliance or inadequate prescription in addition to the poor dietary intake. Such results are of the utmost importance if we acknowledge that fatigue, symptoms and emotional stress, common in haemodialysis patients, may further aggravate, but also be worsened by, poor nutritional intake and QoL^{26,29}. Indeed, a deficient intake of protein, energy, antioxidants and key micronutrients involved in protein metabolism, did exert a major negative effect on patients' QoL, namely on overall health, performance of usual activities, anxiety/depression and mobility/self-care.

Focusing on a thorough analysis of potential factors influencing haemodialysis patients' QoL, we further determined the relative weights of disease and nutrition-related parameters, which corroborated and stressed the key role exerted by nutrition on QoL. Estimates of effect size attributed to each variable revealed that 47% of patients' mobility/self-care scores were worsened by deficient protein/energy intake and 30% by weight loss $\geq 10\%$. Poor performance of usual activities was attributed in 45% to the duration of haemodialysis and of renal failure, 35% to protein/energy, 35% to vi-

tamin B₁₂, zinc and iron deficits, and 20% to weight loss $\geq 10\%$. Pain/discomfort were worsened in 45% by the duration of haemodialysis and of renal failure, and in 15% by co-morbidities. Higher anxiety/depression were related in 43% to protein/energy, selenium and vitamin C deficits, in 40% to the duration of haemodialysis and of the disease, in 10% to weight loss $\geq 10\%$, and in 3% to co-morbidities. Likewise, 47% of poor overall health was determined by protein, energy, vitamin B₁₂, zinc, iron, selenium and vitamin C deficits, 25% by weight loss $\geq 10\%$, 10% by the duration of the disease, and 7% by co-morbidities.

This study of 60 patients with renal failure under chronic haemodialysis, provides objective evidence that the disease, co-morbidities, nutritional deterioration and dietary deficits are key factors influencing the patients' QoL, but with distinct relative weights. Given the prevalence of dietary deficits and deterioration of nutritional status, with a negative impact on the patients' QoL, timely nutrition intervention with diets adapted to the haemodialysis dose is warranted; these patients certainly require a professional individualized dietary counselling. A multidisciplinary management integrating health professionals with nutrition expertise allows a proper assessment of nutritional status and requirements, early nutritional counselling and monitoring of diet compliance, enabling timely adjustments. Our results concur with *Keys et al* landmark study, which showed semi-starvation to impair functional and psychological abilities³⁰. Early intervention and sensible partnership with patients are the keys to success.

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