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Original

Nutritional status influences generic and disease-specific quality of life measures in haemodialysis patients

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Abstract

Background: **Poor nutritional status and worse health-related quality of life (QoL) have been reported in haemodialysis (HD) patients. The utilization of generic and disease specific QoL questionnaires in the same population may provide a better understanding of the significance of nutrition in QoL dimensions.**

Objective: **To assess nutritional status by easy to use parameters and to evaluate the potential relationship with QoL measured by generic and disease specific questionnaires.**

Methods: **Nutritional status was assessed by subjective global assessment adapted to renal patients (SGA), body mass index (BMI), nutritional intake and appetite. QoL was assessed by the generic EuroQoL and disease specific Kidney Disease Quality of Life-Short Form (KDQoL-SF) questionnaires.**

Results: **The study comprised 130 patients of both genders, mean age 62.7 ± 14.7 years. The prevalence of undernutrition ranged from 3.1% by BMI ≤ 18.5 kg/m² to 75.4% for patients below energy and protein intake recommendations. With the exception of BMI classification, undernourished patients had worse scores in nearly all QoL dimensions (EuroQoL and KDQoL-SF), a pattern which was dominantly maintained when adjusted for demographics and disease-related variables. Overweight/obese patients (BMI ≥ 25) also had worse scores in some QoL dimensions, but after adjustment the pattern was maintained only in the symptoms and problems dimension of KDQoL-SF (p = 0.011).**

Conclusion: **Our study reveals that even in mildly undernourished HD patients, nutritional status has a significant impact in several QoL dimensions. The questionnaires used provided different, almost complementary perspectives, yet for daily practice EuroQoL is simpler. Assuring a good nutritional status, may positively influence QoL.**

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Key words: *Nutrition; Quality of Life. Generic and specific quality of life questionnaires. Chronic haemodialysis.*

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ESTADO NUTRICIONAL INFLUYE EN LA CALIDAD DE VIDA EN PACIENTES EN HEMODIÁLISIS APLICANDO CUESTIONARIOS GENÉRICOS Y ESPECÍFICOS DE LA ENFERMEDAD

Resumen

Antecedentes: **En pacientes en hemodiálisis (HD) se han comunicado un estado nutricional deficiente y una peor calidad de vida (CdV) relacionada con la salud. El uso de cuestionarios de CdV genéricos y específicos de la enfermedad en la misma población puede proporcionar un mejor conocimiento del significado de la nutrición en las dimensiones de CdV.**

Objetivo: **Evaluar el estado nutricional mediante parámetros fáciles de usar y evaluar la relación potencial con la CdV medida mediante cuestionarios genéricos y específicos de la enfermedad.**

Métodos: **Se evaluó el estado nutricional mediante evaluación global subjetiva (EGS) adaptada a pacientes renales, índice de masa corporal (IMC), la ingesta nutricional y el apetito. La CdV se evaluó mediante el cuestionario genérico EuroQoL y el específico de la enfermedad Kidney Disease Quality of Life-Short Form (KDQoL-SF).**

Resultados: **El estudio comprendía 130 pacientes de ambos sexos, edad media 62,7 ± 14,7 años. La prevalencia de la malnutrición varió desde 3,1% por un IMC ≤ 18,5 kg/m² hasta el 75,4% de los pacientes por debajo de las recomendaciones de ingesta de energía y proteínas. Con la excepción de la clasificación por el IMC, los pacientes malnutridos tenían peores puntuaciones en casi todos los dominios de la CdV (EuroQoL y KDQoL-SF), un patrón que se mantenía de forma dominante cuando se ajustaba para las variables demográficas y relacionadas con la enfermedad. Los pacientes con sobrepeso/obesidad (IMC ≥ 25) también mostraron peores puntuaciones en algunas dimensiones de la CdV, pero tras el ajuste el patrón sólo se mantenía en el dominio de síntomas y problemas de KDQoL-SF (p = 0,011).**

Conclusión: **Nuestro estudio reveló que incluso en pacientes en HD malnutridos, el estado nutricional tienen un impacto significativo en diversos dominios de la CdV. Los cuestionarios empleados proporcionaron perspectivas distintas, casi complementarias, si bien para la práctica diaria el EuroQoL es más sencillo. El asegurar un buen estado nutricional podría influir positivamente en la CdV.**

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Palabras clave: *Nutrición. Calidad de vida. Cuestionarios de calidad de vida genéricos y específicos. Hemodiálisis crónica.*

Abbreviation

BMI: Body Mass Index.
Kt/V: Dialysis adequacy based on urea kinetic modeling.
HD: Haemodialysis.
QoL: Health-related Quality of Life.
KDQoL-SF: Kidney Disease Quality of Life-Short Form.
SGA: Subjective Global Assessment.
UK-TTO: United Kingdom time trade-off index.
VAS: Visual Analogue Scale.

Introduction

Protein energy malnutrition and muscle wasting are observed in several patients undergoing haemodialysis (HD), in whom reduced food intake, poor nutritional status,[1] and worse QoL[2] are frequent. To assess nutritional status, international guidelines[3,4] recommend using several parameters, since in daily clinical practice no single indicator provides an accurate classification. Guidelines for HD patients recommend that nutritional status should be assessed by simple parameters such as Subjective Global Assessment (SGA),[3,4] Body Mass Index (BMI)[3], nutritional intake[4] and appetite.[5]

Quality of life always becomes more important in the absence of health restitution. In end-stage renal disease, replacement therapy such as HD has a major impact on patients' Health-related Quality of Life (QoL).[6,7] QoL is a global perception and includes physical, mental, and social domains affected by health or illness, in practice evaluated by a total score for each dimension assessed. Generic questionnaires permit research and knowledge about health status and comparison of the obtained data with those from the general population, whereas disease specific questionnaires are useful to determine the effects of a certain disease on patient's life.[6,7]

This study was designed to find out whether in patients undergoing HD, easy to use recommended parameters of nutritional status were associated with QoL, measured by generic and disease specific questionnaires.

Patients and methods

This prospective observational study was conducted Between December 2007 and July 2008; all adult patients undergoing maintenance HD in two dialysis clinics from Nephrocare were considered eligible. Inclusion criterion: being on maintenance HD for more than 6 months. Exclusion criteria: diagnosis of active cancer, active systemic infection, limb amputation or inability to understand the ethical issues. The study was approved by Nephrocare ethics committee and participants' enrolment required their written informed consent. All study methods were assessed by the same investigator (ACM).

Nutritional Assessment. Nutritional status evaluation included: SGA, BMI, nutrition intake and appetite. SGA is a subjective tool based on medical history of weight changes, appetite and gastrointestinal symptoms, in addition to physical examination of subcutaneous fat and muscles. A SGA version[8] adapted to renal patients was used, with a quantitative scoring system of 7 components: each component was rated from 1 to 5 with a possible total score ranging from 7 (well nourished) to 35 (severely undernourished). Based on SGA total scores, patients were subdivided into four groups: well nourished, mildly undernourished, moderate undernourished and severely undernourished.[8] To calculate BMI (kg/m^2 body weight divided by squared height) patients' dry weight was obtained from medical records and stature was measured by stadiometer.

To calculate current energy and protein intake, patients completed a 3 day food record[9] comprising a recording period from sunday to tuesday. Patients were instructed to provide specifications regarding the method of preparation, cooking and standard household measurements.[10] In order to calculate nutrient intake, food records were analyzed using the Food Processor 5.9, ESHA (ESHA, Salem, EUA). Energy and protein intake were calculated by kg of body weight and compared with recommendations.[3,4] In obese patients, weight was adjusted[11], i.e. such adjustment estimates that 25% of actual weight on top of ideal body weight is likely to be metabolically active tissue.

Appetite was assessed using the first question of the Haemodialysis Study Appetite questionnaire: the multiple-choice answers for the first question "During the past week, how would you rate your appetite?"'[12] and a 100 mm vertical visual analogue scale (VAS) appetite instrument.[13]

Quality of Life Questionnaires. To assess QoL, two questionnaires were applied, one generic and another disease specific. The generic questionnaire, devised by the international EuroQol group, is a standardized generic measure for general health status' description[14]; comprises 5 dimensions which reflect the evaluation of one's own overall health. The 5 dimensions are mobility, self-care, usual activities, pain/discomfort and anxiety/depression, each dimension is divided into 3 levels: no problem, same problems or extreme problems. These health states are software converted into a single index using a valuation technique that estimate models were patients can choose to give up some life years to live for a shorter period in full health (time trade-off) that allow to calculate values for all states of health[15]. In the absence of these models for the Portuguese population, we used the United Kingdom model (UK-TTO). In addition, for the general health evaluation, each patient had to indicate his personal perception in a visual analogue scale ranging from 0 (worst imaginable state) to 100 (best imaginable state).

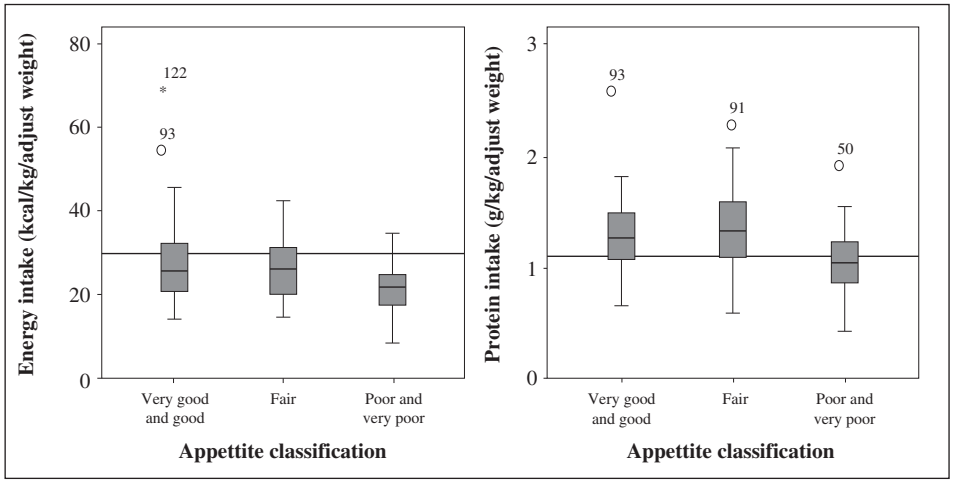

Fig. 1.—Energy and protein intake by appettite classification.

These two (UK-TTO and general health) provided a QoL global evaluation.

QoL was also assessed by a disease specific questionnaire, the validated Kidney Disease Quality of Life-Short Form (KDQoL-SF)[16]. The elements selected for the KDQoL-SF have been shown to demonstrate good reliability and validity in quantifying quality of life among HD patients[16]. Responses to the items of this questionnaire are classified in 3 disease specific dimensions: burden of kidney disease, symptoms and problems of kidney disease, and effects of kidney disease on daily life, plus 2 global dimensions: physical health and mental health, amounting to a total of 5 domains. The scores on the KDQoL-SF may range from 0 to 100; higher scores represent higher quality of life[16].

Demographic and disease-related characteristics. Data included age, gender; comorbidities, where each medical condition is assigned a score of 1, 2 or 3, depending on the risk of dying associated with each; another point is added for each decade above 40 years, thus achieving a total score, the Charlson index;[17] HD time in years and HD adequacy assessed by the Kt/V^3 formula.

Data analysis

Categorical variables are presented as median and proportions and continuous variables are presented as mean values and standard deviations. The Kolmogorov-Smirnov test was used to assess the normality of distribution; Student's T-tests or Mann-Whitney U test were used for comparisons between groups, as appropriate. Correlations were evaluated by Pearson or Spearman tests as appropriate. According to VAS (appetite classification), patients were divided into tertiles to examine the potential influence in QoL. A multivariate linear regression analysis was performed in order to analyze how nutritional status affects QoL, adjusted for demographics and disease-related variables (age, time on HD in years, comorbidity index and dialysis efficacy). For all statistics, significance was accepted at the 5% probability level.

Results

From the 186 patients who met the inclusion criteria, only 130 (69.9%) accepted to participate and completed all study requirements. Their mean age was 62.7 ± 14.7 years and 83 (63.8%) were men. Time on HD was 4.5 ± 5.0 years, mean Kt/V^3 was 1.4 ± 0.2 and the comorbidity index[17] ranged between 2 and 10 with a median of 5.

According to the SGA score,[8] 8 (6.2%) patients were well nourished, 106 (81.5%) mildly undernourished and 16 (12.3%) moderately undernourished; none of the patients were severely undernourished. Mean BMI was 24.8 ± 3.8 kg/m^2, 4 patients (3.1%) were undernourished (BMI < 18.5) and 62 (47.7%) were overweight/obese (BMI ≥ 25 kg/m^2); 9 (6.9%) were indeed obese (BMI ≥ 30).[18] Mean dietary energy and protein intake per kg of body weight were 25.8 ± 8.6 kcal and 1.27 ± 0.36 g of protein, respectively. Energy intake was below recommendations in 97 patients (74.6%), protein intake was below recommendations in 42 (32.3%); among the latter, 41 also had low energy intake.

Appetite was reported to be very good/good in 60 (46.2%) patients, fair in 47 (36.2%), and poor/very poor in 23 (17.7%). Mean appetite assessed by VAS was 64.5 ± 25.6. The mean energy and protein intake according to appetite classification is presented in figure 1.

Quality of Life results, EuroQoL and KDQoL-SF, are shown in table I.

Undernourished patients, classified by most of nutritional parameters analyzed, had lower scores in QoL dimensions and this difference was maintained when adjusted for age, time on HD in years, comorbidity index and dialysis efficacy as evaluated by general linear model. This trend had one exception when QoL was analyzed according to BMI; overweight patients

Tabla I
EuroQoL, and KDQoL-SF dimensions

Dimension	*EuroQoL*		
	No problem	*Moderate problems*	*Extreme problems*
Mobility [frequency (%)]	62 (47.7)	66 (50.8)	2 (1.5)
Self-care (frequency (%)]	112 (86.2)	12 (9.2)	6 (4.6)
Usual activities [frequency (%)]	69 (53.1)	55 (42.3)	6 (4.6)
Pain discomfort [frequency (%)]	55 (42.3)	64 (49.2)	11 (8.5)
Anxiety/depression [frequency (%)]	51 (39.2)	69 (53.1)	10 (7.7)
General health (mean ± sd)	57.7 ± 19.7		
UK-TTO (mean ± sd)	0.652 ± 0.297		
Dimension	*KDQoL-SF*		
Symptom and problems (mean ± sd)	76.2 ± 15.4		
Effects of kidney disease on daily life (mean ± sd)	63.2 ± 19.0		
Burden of kidney disease (mean ± sd)	43.0 ± 28.1		
Physical health (mean ± sd)	39.4 ± 9.6		
Mental health (mean ± sd)	46.1 ± 10.9		

(BMI ≥ 25 kg/m^2) had worse scores in KDQoL-SF and EuroQoL, although when adjusted to demographics and disease-related variables the difference was only maintained in the dimension symptoms and problems of KDQoL-SF, score 71.5 ± 15.0 *vs* 80.4 ± 15.0, p = 0.011. Results of QoL by SGA classification are shown in table II, even moderately undernourished patients showed lower (worse) QoL scores. When nutritional intake was analyzed by adequate/inferior to recommendations, patients who met energy recommendations presented higher scores in EuroQoL general health, 63.7 ± 15.5 *vs* 55.6 ± 20.6, p = 0.027; whereas those with adequate protein intake presented higher scores in KDQoL-SF mental health, 43.1 ± 10.6 *vs* 47.5 ± 10.8, p = 0.020. However both differences disappeared when adjusted for demographics and disease-related variables.

According to appetite classification: very good/good, fair, and poor/very poor, even after adjustment for demographics and disease-related variables, differences were found in general health score 61.5 ± 19.7 *vs* 57.9 ± 16.2 *vs* 47.3 ± 23.2, p = 0.011 and UK-TTO score 0.696 ± 0.260 *vs* 0.677 ± 0.255 *vs* 0.489 ± 0.407, p = 0.013 from EuroQoL. Similar results were found when appetite was accessed by VAS: with worse QoL for patients in lower VAS tertiles (48.1 ± 17.8 *vs* 58.1 ± 13.6 *vs* 67.8 ± 20.4, p = 0.000 in general health and 0.540 ± 0.341 *vs* 0.743 ± 0.224 *vs* 0.712 ± 0.252, p = 0.004 in UK-TTO). In the disease specific questionnaire KDQoL-SF, and for every level of appetite classification, a better appetite scored higher in physical health, mental health, and symptoms and problems; however, after adjustment the difference was only maintained for symptoms and problems, whilst

Table II
EuroQoL, and KDQoL-SF dimensions by SGA

EuroQoL	*SGA classification*			*p*	*p adjust*
	well nourish (n = 8)	*middle unnourished (n = 106)*	*moderate unnourished (n = 16)*		
General health	66.8 ± 19.4	58.7 ± 18.7	46.5 ± 23.0	0.054	0.047*
UK-TTO	0.710 ± 0.238	0.681 ± 0.274	0.434 ± 0.384	0.027*	0.007*
KDQoL-SF					
Symptoms and problems	81.7 ± 12.0	77.6 ± 14.3	63.2 ± 18.6	0.006*	0.001*
Effects of kidney disease on daily life	61.3 ± 24.3	64.0 ± 18.8	58.9 ± 18.3	0.735	0.525
Burden of kidney disease	46.0 ± 10.1	42.9 ± 27.8	42.5 ± 31.8	0.948	0.779
Physical health	40.9 ± 29.1	40.4 ± 9.1	32.2 ± 10.1	0.003*	0.019*
Mental health	49.6 ± 10.0	46.9 ± 11.1	38.8 ± 7.0	0.007*	0.008*

*Correlation at 0.05 level.

Table III
Regression multivariate model of the general QoL dimensions by nutritional parameters

	EuroQoL				*KDQoL-SF*			
	General health		*UK-TTO*		*Physical health*		*Mental health*	
Nutritional parameter	*B*	*95% CI*	*B*	*95% CI*	*B*	*95% CI*	*B*	*95% CI*
BMI	-0.347*	-1.320 to 0.625	-0.011	-0.025 to 0.004	-0.042	-0.511 to 0.427	-0.033	-0.582 to 0.516
SGA	-1.764*	-3.041 to -0.488	-0.041*	-0.059 to -0.022	-1.056*	-1.660 to -0.452	-1.406*	-2.104 to -0.709
Appetite classification	-4.607*	-7.669 to -1.546	-0.057*	-0.104 to -0.010	-1.937*	-3.422 to -0.452	-1.854*	-3.609 to -0.098
Appetite VAS	0.305*	0.131 to 0.430	0.003*	0.001 to 0.005	0.085*	0.022 to 0.149	0.067	-0.009 to 0.143
Energy intake (kcal/kg/day)	0.564*	0.174 to -0.954	0.005	-0.001 to 0.011	0.120	-0.073 to 0.312	0.160	-0.065 to 0.385
Protein intake (g/KG/DAY)	9.059	-0.334 to 18.452	0.160*	0.018 to 0.302	5.147*	0.654 to 9.641	7.734*	2.540 to 12.927

"B" ins the unstandardized regression coefficient that reflects the change in the HRQOL score related with one unit increase of the nutritional parameter adjusted for age, time on HD in years, comorbidity index and dialysis efficacy.
*Correlation at 0.05 level, 2-tailed comparison.

Table IV
Correlation between nutrition paramters and QoL scores

	EuroQoL		*KDQoL-SF*				
Nutritional parameter	*General health*	*UK-TTO*	*Symptoms and problems*	*Effects of kidney disease on daily life*	*Burden of kidney disease*	*Physical health*	*Mental health*
BMI	-0.120 p = 0.173	-0.125 p = 0.156	-0.201 p = 0.022*	-0.198 p = 0.024*	-0.229 p = 0.009*	-0.045 p = 0.611	0.114 p = 0.196
SGA	-0.173 p = 0.049*	-0.331 p = 0.000*	-0.252 p = 0.004*	0.006 p = 0.948	-0.005 p = 0.955	-0.348 p = 0.000*	-0.282 p = 0.001*
Appetite classification	-0.250 p = 0.004*	-0.214 p = 0.014*	-0.113 p = 0.199	-0.030 p = 0.735	-0.038 p = 0.644	-0.235 p = 0.007*	-0.167 p = 0.057
Appetite VAS	0.415 p = 0.000*	0.264 p = 0.003*	0.159 p = 0.070	0.079 p = 0.375	0.075 p = 0.394	0.260 p = 0.003*	0.138 p = 0.118
Energy intake (kcal/kg/day)	0.258 p = 0.003*	0.166 p = 0.059	0.253 p = 0.004*	0.140 p = 0.112	0.076 p = 0.529	0.154 p = 0.080	0.163 p = 0.064
Protein intake (g/kg/day)	0.138 p = 0.117	0.205 p = 0.020*	0.277 p = 0.001*	0.191 p = 0.030*	0.074 p = 0.400	0.194 p = 0.027*	0.209 p = 0.017*

*Correlation at 0.05 level.

patients with very good/good appetite scored better QoL those with poor/very poor appetite, 77.1 ± 14.9 *vs* 79.2 ± 13.2 *vs* 67.5 ± 18.3, p = 0.005. There were differences in tertiles of appetite VAS, with better QoL in physical health, maintained after adjustment for demographics and disease-related variables, 41.9 ± 9.5 *vs* 41.6 ± 9.2 *vs* 35.7 ± 8.9, p = 0.010.

The EuroQoL general health, as well as the UK-TTO and the KDQoL-SF dimensions physical health and mental health were analyzed using multivariate linear regression analysis adjusted for age, time on HD in years, HD efficacy and comorbidity index. SGA and appetite classification were related to all analyzed dimensions whereas among the analyzed nutritional parameters, only BMI was not related with any of QoL dimensions (table III).

Table IV shows the correlation coefficients between the different nutritional parameters and QoL domains; for most parameters, patients with better nutritional status had higher (better) QoL scores. These correlations were positive for appetite VAS and nutritional intake, and negative for SGA and appetite classification, given that higher scores in the two latter variables corresponded to less well nourished patients. Regarding BMI, negative correlations were only found in disease specific dimensions of KDQoL-SF, symptoms and problems (r = -0.201, p = 0.022), effects of kidney disease on daily life (r = -0.229, p = 0.009) and burden of kidney disease (r = -

0.198, p = 0.024) revealing that patients with higher BMI had lower QoL.

Discussion

The potential association between nutritional status and QoL assessed by generic and disease specific questionnaires has so far been barely explored in HD patients.

EuroQoL is easy to use, has been translated and validated in many languages, its 5 questions and visual analogue scale (general health) are quickly applied (£5 min/patient in our experience); it also allows comparisons of QoL in HD patients with expected values from general population.[19] The KDQoL-SF is somewhat longer (10-20 min/patient) to complete but focus on dialysis' patients specific problems.[16] Notwithstanding, the application of both EuroQoL and KDQoL-SF provide a more in depth and comprehensive understanding of QoL.[7,20] Our results showed that all nutritional parameters were significantly associated with QoL, even after controlling for demographic and disease-related variables, by and large showing that patients with worse nutritional status reported worse QoL, when accessed by generic and disease specific QoL.

Previous studies have shown that severely malnourished patients evaluated their QoL as being significantly worse than in those better nourished.[21,22] In our study, without patients classified as severely undernourished, those who had worse nutritional status by SGA showed significantly worse global dimensions general health and UK-TTO accessed by EuroQoL and disease specific dimension symptoms and problems, physical health and mental health, when accessed by KDQoL-SF; these results were unchanged after adjustment in for demographics and disease-related variables. There were weak but significant correlations between SGA and QoL dimensions in both general and diseases specific questionnaires. In a study from Kalantar-Zadet et al.[2] there were no correlations between SGA and physical health or mental health, whilst Laws et al.[22] only found association with the physical component of QoL before adjustments for variables such as age and comorbidities. Both studies concentrated on smaller samples whereas another study on a larger sample, obtained similar results to ours.[23] In our study, the only dimensions not affected by SGA classification were the KDQoL-SF dimensions effects of kidney disease on daily life and burden of kidney disease, which suggests that these disease specific dimensions seem not to be significantly affected by nutritional status. However SGA has limitations: in our study most patients had a similar SGA classification, 81.5% were mildly undernourished, this might have limited the power to detect further differences. Yet SGA is considered a reliable method for nutritional status assessment, even if according to published guidelines should not be used alone.[3,4] In this study, we did use other methods such as BMI and nutritional intake.[24]

In what concerns BMI, we found a significant negative correlation with the disease dimensions assessed by KDQoL-SF, which suggests that overweight HD patients perceive a worse QoL. This might seem conflicting to the implicit association between poor nutritional status and worse QoL, however overweight/obesity is not a good nutritional status; in fact negative associations have been described between fat percentage and QoL.[25] On the other hand, in the final multivariate model there were no significant interactions with BMI and physical or mental health components. This lack of association might be explained by the small number of obese patients (6.9%) in our sample; indeed Dwyer et al.[26] found lower physical health in higher BMI only in obese patients.

Dietary protein and energy intakes are often reduced in HD patients.[4,27] Our study confirmed that energy intake was below recommendations[3,4] in the majority of patients. Energy and protein intake was lower in patients with poor appetite and even in those with good/very good appetite some had energy intakes lower than recommended. However we admit natural limitations by the use of 3-day dietary record, despite being the recommended tool to assess nutritional intake among HD patients;[4] besides, a higher prevalence of lower intake reports in this population[28] is acknowledged. Nutritional intakes seem to have a high influence in QoL. When Raimundo et al.[27] estimated the effect size of nutritional variables in QoL, found that 15% of poor overall health was determined by protein and energy intake. In our study, we found a weak but significant positive association between energy or protein intake and QoL dimensions of general health, symptoms and problems and mental health. Similar findings have also been reported in other studies, e.g. the positive association of energy intake with better physical health found in the HEMO study,[26] as well as the association of protein intake with higher QoL.[2]

Appetite was correlated with the dimensions assessed by EuroQol, general health and UK-TTO; our findings concur with a prior study[5] also using a general questionnaire. Using KDQoL-SF, only physical health showed association with appetite; the lack of association with other dimensions may result from the application of a disease specific questionnaire or from the methodology used in our study to assess appetite. Using a general QoL and another complex 44 questions' questionnaire to evaluate appetite (Appetite and Diet Assessment Tool),[29] a previous study found a significant positive association between appetite and mental health.[26] Assessing appetite by a VAS scale and a simple question, as we did in our study, despite the advantage of being easy to apply some accuracy may be lost. This limitation was observed only with KDQoL-SF, since in EuroQoL dimensions, these associations were still significant even after adjustments.

There are limitations to our study, an observational study where no causal inference between nutritional status and QoL can be drawn. Even after adjustment for several demographic and disease-related variables there is a possibility of residual confounding due to other unknown or unmeasured factor(s).

In summary, even in a mildly undernourished cohort of HD patients, nutritional status seem to have an important impact on QoL, assessed by generic and disease specific questionnaires. The questionnaires used provided different, almost complementary perspectives, yet for daily practice EuroQoL is simpler. Our results call attention to the need to assure a good nutritional status since small differences in nutritional status classification were associated with a poorer QoL.

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