Association between the level of quality of life and nutritional status in patients undergoing chronic renal hemodialysis

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Abstract

Introduction: The chronic kidney disease and undergoing hemodialysis (HD) cause limitation in patients' life interfering in their life's quality and the nutritional care is fundamental to the disease treatment. **Objective:** The objective is the goal is to analyze the association between quality of life through the instrument (SF-36) with dietary intake, nutritional status in patients with chronic kidney disease in HD through quantitative research and transversal. **Methods:** Realized valuation anthropometric, collection of the results of biochemical tests, application of the questionnaire SF-36 and dietary anamnesis (food recall of 24h). **Results**: The sample consisted of thirty adult patients with age between 28 to 76 years. The disease related with chronic kidney disease was found more hypertension systemic arterial (53.3%) The average body mass index was 25.04 ± 4.50 kg/m². By fold cutaneous arm, 73.3% were in malnutrition. The end nutritional diagnosis of malnutrition was 80% among the patients studied. The time of diagnosis of renal disease had a mean of 4.84 ± 3.51 years. By the middle of biochemical tests only phosphorus creatinine were adequate. In the mean the scores of SF-36 the lowest value found was limited to physical aspects (16.67 ± 29.60) and the largest for the social aspect (68.17 ± 33.67). **Conclusion:** The average energy consumption and protein was below the recommended. Got positive correlation of calories, protein, fiber, calcium and carbohydrate, with quality of life. It was concluded that feeding is associated with quality of life of renal patients undergoing hemodialysis.

Keywords: chronic, kidney failure, nutritional status, quality of life.

Introduction

Chronic Kidney Disease (CKD) is characterized by the slow progressive irreversible loss of exocrine (filtration, reabsorption, and secretion of substances through the urine) and endocrine function (decreased production of erythropoietin and 1.25-dihydroxycholecalciferol).[1]

It has been defined as a complex syndrome due to complications ensuing from the loss of renal function, such as anorexia, uremia, loss of the senses of smell and taste (which explains the high prevalence of malnutrition in subjects with CKD); hypertension, hypertriglyceridemia, and hyperglycemia (factors related to cardiovascular disease); increased incidence of bleeding episodes resulting from renal failure; oliguria; edema; mental confusion; adnamia; asterixis; obnubilation and coma.[2]

The 2011 Dialysis Census revealed that 91,314 people were undergoing dialysis in Brazil, and that 84.9% of the patients were covered by the Brazilian public health care system (SUS). The Census also found that the most common etiologies of CKD are systemic hypertension (SH) and diabetes mellitus (DM). Therefore, CKD needs to be considered as a public health issue.[3]

Nutrition in kidney care starts with prevention. The body mass index (BMI) is a strong indicator for CKD that can be modified with diet. Once renal disease sets in, nutrition also plays a central role in the assessment and treatment of the condition. CKD, whether in pre-dialysis or dialysis, imposes clinical challenges directly linked to the patient's nutritional status.[4]

Malnutrition is caused by uremia, which by its turn occurs consequently to the loss of exocrine function, causing a constant inflammatory state that predisposes patients to this condition. Additionally, dietary restrictions, loss of amino acids during dialysis, anorexia, infection, gastrointestinal disorders, and the administration of certain drugs favor the onset of nutritional anomalies.[5,6]

Signs of malnutrition are present in 10% to 70% of the patients on hemodialysis (HD) and in 18% to 56% of the individuals on continuous ambulatory peritoneal dialysis (CAPD). Malnutrition is a major factor in the morbidity and mortality of patients on HD.[7]

Although the many technological and therapeutic advances in the area of dialysis have helped increase the survival of individuals with CKD, they were not enough to allow patients to return to the lives they lived before the disease.[6]

Patients with CKD experience dramatic changes in their lives. Many are the limitations they face, in addition to painful hemodialysis sessions, strict diets, changes in their personal, professional, and social lives. Thoughts about death become more frequent, along with negative perceptions over health care and the hope that a kidney transplant will help improve their lives.[7]

This study aims to correlate quality of life with food intake and nutritional status in a population of patients with chronic kidney disease on hemodialysis.

Methods

This cross-sectional quantitative study was carried out at the Nephrology Care Center of the Vila Velha Evangelical Hospital (HEVV), in the State of Espírito Santo, Brazil. The clinic has been accredited by the SUS and currently takes care of 126 patients on HD per month.

Forty-two of the 126 patients were seen in the night shift, which prevented their inclusion in the study. Therefore, a total of 84 patients treated in the morning and afternoon shifts were invited to join the study. The sample was established based on convenience, and not on a probabilistic approach. All patients with CKD on HD seen at our center offered to join the study and were asked to sign an informed consent term, in accordance with Resolution 196/96 from the National Health Council.[8] Patients under the age of 18 years at the time of the study were excluded. The study was approved by the Research Ethics Committee of the Espírito Santo Catholic Salesian College and by the HEVV board.

The population was characterized based on the data collected from medical charts, namely: patient age, time on hemodialysis, time since diagnosis of kidney disease, conditions associated with kidney disease.

Patient socioeconomic status was assessed according to the Brazilian Economics Classification Criteria - CCEB (2008) issued by the Brazilian Association of Research Companies (ABEP).[9]

Quality of life (QoL) assessment

The validated Brazilian Portuguese version of the Medical Outcomes Study Short Form 36 (SF-36) survey was used to assess the health related quality of life (HRQOL) of the subjects enrolled in the study.[10]

The survey consists of 36 items divided into eight scales, namely: physical functioning (PF), role-physical (RP), bodily pain (BP) general health (GH), vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH). Subjects are given scores from 0 to 100 in each scale, where zero represents the worst and 100 the best health status.[11] The survey was applied by one of the authors while the subjects were on hemodialysis.

Food intake

Patients were asked to fill 24-hour dietary recall forms (R24h)[12] for three alternate days. One of the forms was filled on a day in which the patient had undergone HD and the other two in days without HD - one being a weekend day (WE) and the other a weekday (WD). Subsequently, the data were analyzed on software DietWin Personal (2012). Intake levels of calories (kcal/kg of body weight/day), carbohydrates (CHO), protein (PTN/kg of body weight/day), lipids, total cholesterol, fiber, calcium (Ca), phosphorus (P), potassium (K), and sodium (Na) were assessed in the study.

The reference values for the analysis of intake of macronutrients and micronutrients were the daily nutritional recommendations for individuals on hemodialysis.[13]

It is worth noting that by the time of the study the patients were not receiving any type of nutritional care or guidance.

Anthropometric assessment

Patient body weight, height, mid-upper arm circumference (MUAC), and tricipital skinfold thickness (TST) were measured. Measurements were made after HD session by a trained member of the study's staff.

Patients were weighed with shoes off, wearing light clothing, on an electronic digital MEA 08140 Plena® scale with increments of 100 g and a total capacity of 150 kg. The subject's dry weight was considered, i.e., the weight after the end of an HD session.

Subject height was measured using a two-meter vertical tape stadiometer, precise to the nearest 0.1 cm, attached to a wall. Arm circumference was measured with a non-extending measuring tape placed at the midpoint between the acromion and olecranon of the arm without the arteriovenous fistula, with subjects extending their arms along their bodies. Measurements were made in centimeters. Arm circumference measurements were used to estimate the mid-upper arm muscle circumference (MUAMC) using the formula developed by Blackburn & Thornton:[13] MUAMC (cm) = MUAC (cm) - ϖ x [TST (mm) ÷ 10]. Percent MUAC was calculated with the following formula: %MUAC = MUAC/MUAC 50 x 100.[13] The reference value was obtained from the 50th percentile, as defined for the general population according to Frisancho.[14]

Patients were categorized by percent MUAC as follows: severely malnourished for values under 70%; moderately malnourished for values ranging between 70% and 80%; mildly malnourished for values in the 80%-90% range; properly nourished for values in the 90%-110% range; and overweight for values greater than 110%.[13]

A Cescorf® caliper placed on the same spot used to measure MUAC, on the posterior part of the arm where the skinfold separated discretely from muscle tissue, was used to measure TST. Three consecutive measurements were performed and the mean value in millimeters was considered as the final result. Relative percent TST was calculated with formula %TST = TST/TST 50 x 100 using the reference value obtained from the 50th percentile for the normal population[14]. Patients were then categorized as severely malnourished when values were under 70%; moderately malnourished for values ranging between 70% and 80 %; mildly malnourished for values in the 80%-90% range; properly nourished for values in the 90%-110% range; overweight for values in the 110%-120% range; and obese for values greater than 120%.[15]

The cutoff points used for the BMI, calculated as the ratio between the subject's weight and height to the square, were the ones described by Riella & Martins[15] for the population with kidney disease, which were then compared to the cutoff points proposed by World Health Organization (WHO) for the general population.[16]

The following indicators were measured to verify the presence of malnutrition: %MUAC, %TST, and BMI.

The MUAC looks into muscle reserves without a correction for bone tissue; TST is used to assess subcutaneous fat; and the BMI to evaluate total body mass.[17] As each parameter assesses different bodily compartments, the same patient can present three different diagnoses. Therefore, patients diagnosed as having a degree of malnutrition in at least one of the parameters were considered to be malnourished.

Biochemical parameters

The levels of the following biochemical indicators were collected: phosphorus, total calcium, creatinine, parathyroid hormone (PTH), and potassium. Only the tests cited above were mentioned in the patients' charts. Data from other tests were stored in the clinic's information system, to which we did not have access. The reference values used in this study were the ones reported by Martins & Riella[15], in which the levels seen in patients with chronic kidney disease were different from those of the general population, as specified: phosphorus: 4.5-6.0 mg/dl; total calcium: 9.0-11 mg/dl; creatinine: 7-12 mg/dl; PTH: 100-300 mg/dl; potassium: 3.5-5.5 mg/dl.

Important biomarkers such as complete blood count, urea, and albumin were not considered, as these test results were not released by the clinic for this study.

Statistical analysis

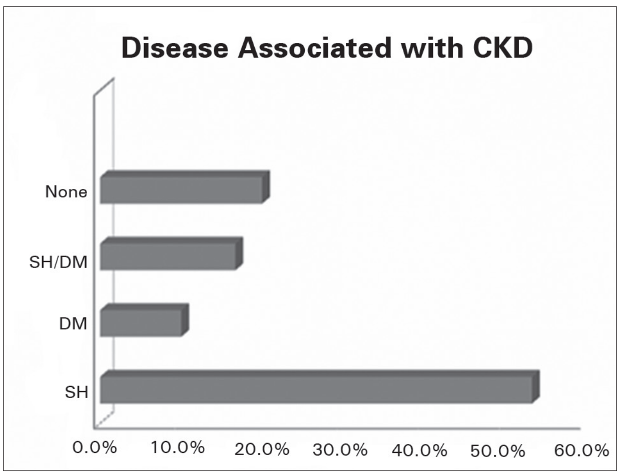
Software program Bioestat 5.0 was used in statistical analysis. A five-percent significance level was defined. The correlation coefficient was used to measure the degree of correlation between two metric variables. Spearman's rank correlation coefficient was used for variables not following a normal distribution.

Results

The sample consisted of 30 individuals, 23 adults and seven elderly subjects, aged 28-76 years, with a mean age of 51.90 ± 14.19 years. The time since the diagnosis of kidney disease ranged from one month to 17 years (mean of 5.31 ± 4.02). The population was homogeneous with respect to gender, as 15 females and 15 males were enrolled in the study. Patients had been on dialysis for 1-197 months, and a mean of 43.37 ± 47.38 months.

When level of income was considered, 26 (76.6%) patients were on class C. Data on diseases associated with CKD are presented in Graph 1.

Graph 1. Results on diseases associated with chronic kidney disease. SH: Systemic hypertension; DM: Diabetes Mellitus.



In the analysis of anthropometric variables, the categorization of patients according to the BMI classification proposed by Riella & Martins[15] revealed that 50% (n = 15) of the subjects had malnutrition, 36.7% (n = 11) were normally nourished, and 13.3% (n = 4) were overweight. According to the classification proposed by the WHO,[16] none of the patients was malnourished, 56.7% (n = 17) were eutrophic, and 43.3% (13) were overweight.

According to the MUAMC, 6.7% (n = 2) of the subjects had severe malnutrition, 3.3% (n = 1) had moderate malnutrition, and 20% (n = 6), had mild malnutrition, i.e., 30% (9) had some degree of malnutrition.

According to the TST, 73.3% (n = 22) of the individuals were malnourished; of these, 63.3% (n = 19) had severe malnutrition, 6.7% (n = 2) had moderate malnutrition, and 3.3% (n = 1) had mild malnutrition.

The final nutritional diagnosis established based on anthropometric data indicated that 80% (n = 24) of the included subjects were malnourished. This diagnosis was not reflected on all anthropometric variables, since each variable may yield different diagnoses for the same patient. The results of patient nutritional assessments are shown in Table 1.

Table 1 Nutritional status according to BMI, MUAC, and TST

Variables	n	%
BMI (Riela)		
Malnutrition	15	50.0
Adequate	11	36.7
Overweight	4	13.3
BMI (WHO)		
Malnutrition	0	0.0
Adequate	17	56.7
Overweight	13	43.3
Categorization according to MUAC		
Severe malnutrition	2	6.7
Moderate malnutrition	1	3.3
Mild malnutrition	6	20.0
Adequate/eutrophic	16	53.3
Overweight	5	16.7
Categorization according to TST		
Severe malnutrition	19	63.3
Moderate malnutrition	2	6.7
Mild malnutrition	1	3.3
Eutrophic	4	13.3
Overweight	1	3.3
Obesity	3	10.0
Nutritional diagnosis		
Malnutrition	24	80.0
Eutrophic	4	13.3
Obesity	2	6.7
Total	30	100.0

Biochemical parameters[15] revealed that only 3.3% (n = 1) of the patients had adequate calcium serum levels and that 96.7% (n = 29) had calcium levels below recommended values. When phosphorus serum levels were considered, 36.7% of the patients had adequate levels, 30% had hyperphosphatemia, and 33.3% hypophosphatemia. Creatinine levels in 53.3% (n = 16) of the population was found to be adequate, but 30% (n = 9) had levels above recommended values. Conversely, PTH levels were elevated in 53.3% (n = 16) of the subjects, adequate in 30% (n = 9), and low in 16.7% (n = 5) of the individuals. For potassium levels, 96.7% (n = 29) of the patients were hyperkalemic.

The lowest mean score observed among the SF-36 scales was in the role-physical (RP) scale (16.67 ± 29.60) and the highest in social functioning (SF) (68.17 ± 33.67), as shown in Table 2.

The mean values found in the analysis of the 24-hour dietary recall forms presented in Table 3 show that the subjects' mean calorie intake (kcal/kg of body weight/day) was below the recommended levels for patients on hemodialysis. As 80% of the patients had some degree of malnutrition, adequate intake should be of at least 32 kcal/kg of body weight/day. Protein intake was also lower than recommended. The mean intake of carbohydrates and lipids was adequate.

The mean intake of total cholesterol was adequate, but the standard deviation revealed that intake values were significantly scattered, thus showing that many patients were having much less or much more cholesterol than recommended.

The lower values found for fiber intake in some patients speak of how little attention this nutrient has been given. The mean intake of calcium was far below adequate levels (410.81 ± 265.60 mg). The mean intakes of phosphorus (821.93 ± 357.19 mg), potassium (1770.18 ± 609.53 mg), and sodium (2470.90 ± 975.06 mg) were within recommended levels.

Table 4 shows a statistically significant correlation between HRQOL (physical functioning, bodily pain, vitality, and role-emotional scales) and variable values for Kcal/kg of bodyweight/day (mean 3-day value). All correlation coefficients were positive, i.e., as the value of variable Kcal/kg/day increases, so do the scores of quality of life. The highest correlation coefficient was found between Kcal/kg/day and the physical functional scale, showing that higher Kcal/kg/day intake led to better physical functional capacity. There was no significant correlation between time on hemodialysis and QoL.

No statistically significant correlations were found between HRQOL and variables TST, MUAC, and BMI.

Table 5 shows the correlations between HRQOL and Kcal, PTN/kg of body weight/day, and CHO. Statistically significant (positive) correlations were seen between quality of life and the following: KCAL and physical functioning and bodily pain scales, the strongest of which with physical functioning; CHO and physical functioning and bodily pain scales, the strongest of which with bodily pain; PTN/kg of bodyweight/day and physical functioning, role-physical, bodily pain, vitality, role-emotional, and mental health scales, the strongest of which with physical functioning.

Correlations were found between HRQOL and fiber and calcium intake. Statistically significant correlations were seen between HRQOL and the following: fiber intake and physical functioning, bodily pain, and role-emotional scales, the strongest of which with bodily pain; calcium intake and the role-physical scale, phosphorus and physical functioning, bodily pain, and role-emotional scales, the strongest of which with bodily pain.

Quality of life and time for which the patient had been on dialysis were also tested, but no statistically significant correlation was found between these variables.

Discussion

Low socioeconomic status has been implicated as a risk factor for chronic disease.[18] In our study, 78.3% of the patients had low income levels (classes C and D). Zambonato *et al.*[19] found that 89.6% of CKD patients on dialysis were in classes C, D, and E. According to the authors, the association between low socioeconomic status and CKD can be attributed to factors such as difficulty having access to health care and inadequate management of hypertension and DM. Another factor that may bias the results of

Table 2 Overall quality of life

Variables	Minimum	Maximum	Median	Mean	Standard deviation
Physical functioning	0.00	100.00	55.00	52.83	35.32
Role-physical	0.00	100.00	0.00	16.67	29.60
Bodily pain	0.00	100.00	90.00	67.03	37.75
General health	5.00	94.00	46.00	43.60	23.42
Vitality	10.00	100.00	60.00	57.67	24.49
Social functioning	0.00	100.00	75.00	68.17	33.67
Role-emotional	0.00	100.00	0.00	22.21	36.44
Mental health	20.00	100.00	66.00	67.73	21.88

Table 3 24-hour dietary recall (three-day mean values)

Variable	Minimum	Maximum	Median	Mean	Standard deviation
Dry weight (kg)	46.40	110.20	64.50	66.26	12.55
KCAL	787.97	2972.38	1399.20	1445.70	466.21
Kcal/Kg of bodyweight/day	10.59	44.63	22.47	22.70	8.53
CHO (g)	100.58	445.77	197.45	206.36	74.87
PTN/Kg of bodyweight/day	0.30	1.92	0.92	1.02	0.41
PTN (g)	33.11	126.10	62.73	64.38	22.34
LIP (g)	23.22	84.98	40.90	40.61	14.14
Cholesterol (mg)	58.13	673.51	139.90	162.37	112.73
Fiber (g)	8.05	39.09	16.52	18.62	7.22
Ca (mg)	63.91	1258.81	349.80	410.81	265.60
P (mg)	340.89	1769.64	810.39	821.93	357.19
K (mg)	791.10	3447.44	1708.31	1770.18	609.53
Na (mg)	881.48	5721.95	2350.94	2470.90	975.06

Table 4 Correlations between quality of life, KCAL/KG of bodyweight/day and time on dialysis

Quality of life	Kcal/kg of bodyweight/day (3-day mean values)		Time on hemodialysis	
	Correlation coefficient	*p*-value	Correlation coefficient	*p*-value
Physical functioning	0.669*	0.000	-0.283	0.130
Role-physical	0.342	0.064	-0.155	0.415
Bodily pain	0.604*	0.000	-0.103	0.587
General health	0.158	0.404	0.201	0.287
Vitality	0.419*	0.021	-0.180	0.342
Social functioning	0.180	0.340	0.210	0.266
Role-emotional	0.376*	0.040	-0.121	0.524
Mental health	0.288	0.123	-0.072	0.706

* Statistically significant correlation coefficients.

Table 5 Correlations between quality of life and intake of KCAL, CHO, and PTN/KG of bodyweight/day

Quality of life	KCAL		Carbohydrates		PTN/Kg of bodyweight/day	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Physical functioning	0.568*	0.001	0.444*	0.010	0.610*	0.000
Role-physical	0.279	0.135	0.273	0.144	0.470*	0.009
Bodily pain	0.529*	0.003	0.461*	0.010	0.603*	0.000
General health	-0.026	0.890	-0.048	0.802	0.076	0.691
Vitality	0.097	0.012	0.201	0.287	0.492*	0.006
Social functioning	0.949	0.325	-0.162	0.392	0.222	0.239
Role-emotional	0.325	0.080	0.253	0.178	0.439*	0.015
Mental health	0.254	0.176	0.215	0.254	0.419*	0.021

* Statistically significant correlation coefficients.

the study is that the clinic where the study was carried out saw patients from the Brazilian public health care system (SUS) only. According to the 2011 Dialysis Census, 84.9% of the HD centers provided their services to SUS patients.[3]

Systemic hypertension and diabetes mellitus are significant risk factors for the development of CKD.[20] In our study, systemic hypertension and diabetes mellitus were the conditions most frequently associated with CKD. Similar findings were described in a study done in 2005, in which 42.4% of the subjects were hypertensive, 12.9% had diabetes, and 19.8% had both hypertension and diabetes.[21]

According to Batista *et al.*,[22] successful clinical management of CKD must include the following items: rigorous management of hypertension; glucose control in diabetic patients; correction of proteinuria; management of anemia; management of calcium and phosphorus levels; management of metabolic acidosis; and prevention of malnutrition.

The analysis of anthropometric data revealed significant discrepancies between the BMI classifications proposed by Riella & Martins[15] and the WHO.[16] However, anthropometric measurements have been found to be highly reproducible and 90% sensitive.[13] Bioelectrical impedance tests were used in overweight and obese dialysis patients to find reductions in body cell mass and phase angle, which suggested that even when BMI values were above normal patients could be at risk for malnutrition.[23] The reported prevalence of malnutrition ranged from 6.7% to 73.3% in the different anthropometric methods used. A study with 58 dialysis patients from northeastern Brazil found, through anthropometric assessment, that 12.1% of the patients were malnourished according to the BMI, 84.5% according to TST, and 43% according to the MUAC.[24] A study conducted in 20 dialysis centers with 574 patients looked into BMI, arm circumference, TST, and MUAC and noted moderate/severe malnutrition in 51.6% of the male and 46.3% of the female patients.[25]

The mean age of the patients in our study was similar to that of Cabral *et al.*[26] The 47 patients seen at the Nephrology Service of the University Hospital of Pernambuco enrolled by the authors had a mean age of 50.4 years. To the authors, this sample comprised a relatively young group when compared to cohorts of European patients, whose reported mean age ranged between 58 and 62 years.

Oliveira *et al.*[24] reported their patients had been on dialysis for a mean of 4.27 years, whereas the individuals in our study had been on dialysis for a mean of 3.61 years. In the United States the risk of death is estimated to increased by 6% for each additional year in dialysis after adjustments for several covariates. However, it is not clear whether the correlation between time on dialysis and risk of death is linear.[27]

In terms of HRQOL, although no statistically significant differences were found in the areas of quality of life and gender, with the exception of the bodily pain domain, male patients had higher scores in all scales. A multicenter prospective study carried out in Canada enrolled 9,423 individuals and found that males had substantially higher scores than females in all scales and components of the SF-36; according to the authors, their scores were also higher than their American counterparts in all SF-36 scales.[28]

Biochemical tests usually draw attention to alterations patients are possibly experiencing. PTH values indicate the presence of secondary hyperparathyroidism in this population. This is a common complication among patients with chronic renal disease induced by hypocalcemia, hyperphosphatemia, calcitriol deficiency [1.25(OH)2D3] and skeletal resistance to PTH.[29]

Riella & Martins[15] explained that PTH is released in increased amounts in response to hypocalcemia to correct the reduction in calcium serum levels, once PTH acts on bone, which leads to release of calcium and phosphate.

Biochemical tests also indicate the presence of hyperkalemia, which, in severe cases, may trigger fatal arrhythmias. The dietary intake of this mineral should be controlled by managing potassium levels in the dialysate and educating patients on which foods they should cut down and on the proper preparation of foods to reduce the intake of potassium.[15]

The SF-36 elicited the areas in which patients had impaired performance. The scale with the most significant level of involvement was physical functioning, followed by role-emotional, and general health, which had mean scores below 50.

Comparing our results with those of other studies conducted in Brazil that used the SF-36 in HD patients, we observed that the role-physical scale also had the lowest scores.[30] The findings reported by Castro *et al.*[31] corroborate our results as the social functioning, bodily pain and mental health scales had the highest scores.

Cunha *et al.*[32] described higher scores than our study in social functioning. In contrast, the scale with the lowest score in the aforementioned study was bodily pain - curiously among the scales with the highest scores in our study.

Coelho *et al.*[33] concluded in their study that patients with CKD may show decreased functional performance and impairment in physical activities. However, several studies have shown that physical activity can raise the level of quality of life, especially when it comes to physical aspects and functional capacity.[34]

The analysis of patient 24-hour dietary recall forms revealed that the three-day mean calorie intake in Kcal/Kg/day was far below the ideal conditions for individuals as described in our sample. Most patients had calorie intake deficits in the range of at least 10 kcal/kg of body weight/day in relation to the minimum level required for weight repletion, while 80% of the patients had some degree of malnutrition.

Energy intake values close to our findings were reported by Martinez *et al.*[35] In contrast, Favalessa *et al.*[36] described considerably higher mean energy intake values that were closer or reached recommended levels.

Mean protein intake was below appropriate levels required for weight repletion. Favalessa *et al.*[36] and Batista *et al.*[22] reported mean protein intakes below recommended levels, as also seen in our study. Valenzuela *et al.*[5] found high mean protein intake levels, but 47% of their sample also had less protein than recommended. By their turn, Santos *et al.*[4] and Koehnlein *et al.*[37] described adequate mean protein intake levels.

Phosphorus and potassium intake levels were within normal range, as also reported by Valenzuela *et al.*,[5] Batista *et al.*[22], and Koehnlein *et al.*[37] Favalessa *et al.*[36] described mean phosphorus intake below the recommended levels, along with adequate levels of mean potassium intake.

Calcium intake was below recommended levels, which can be explained by the fact that calcium-rich foods are avoided because they are sources of phosphorus. A number of studies with patients on hemodialysis corroborate our findings.[26,29,35]

The mean sodium intake levels reported in our study are close to the recommended levels.[15] Batista *et al.*[22] reported a similar finding. Vaz[38] described lower sodium intake levels.

The method used to investigate calorie intake, the R24h, has the following strengths: it is affordable, easy and quick to apply to patients, and allows for quantitative and qualitative assessment of patients' diets. However, it also has limitations, such as relying on patients' memories and on estimated food portion sizes, which may underestimate or overestimate interviewee actual calorie intake levels.[39]

Cupisti *et al.*[40] carried out a study in Italy with CKD patients on HD and observed mean intakes of cholesterol within the recommended range, at levels close to those found in our study.

Calorie intake seems to directly impact QoL, according to the data found in this population. Calorie intake was correlated with the physical functioning, vitality, role-physical, and role-emotional scales. These scales refer to difficulties in physical capacities and limitations in the type and amount of activities of daily living performed, the level of energy and fatigue, and the psychological well-being of patients.

Protein intake was correlated with more scales of HRQOL. Protein intake in hemodialysis patients was found to directly interfere with the capacity patients have of performing daily living activities because of fatigue or pain.

Conclusion

Several inadequacies in food intake were found in this study, indicating that patients do not maintain adequate nutrition, as recommended for their underlying disease. The lack of nutritional counseling may have led to these inadequacies. Food intake was correlated with quality of life, as the individuals with better quality of life were those who had higher levels of calorie intake.

However, one should be cautious when using this data, because food quality is very important for these patients. And increasing calorie intake in a disorganized manner, without guidance or proper recommendation, may adversely affect the patients' general condition.

It is important to remember that this is a sample in which the majority of the patients was categorized as malnourished. However, at a global level this finding may not be consistent with every population and cannot, therefore, be extrapolated to any given set of subjects without prior study. Recent studies have shown that there are populations in which a significant portion of the sample is overweight. It is important to remember that obesity itself is a risk factor for CKD. Therefore, one must identify the limits of increasing or not the calorie intake levels of the target population.

The diet for CKD patients imposes several restrictions, but they can be managed. Therefore, nutritional counseling needs to be specific and tailored to patient needs so that they can improve their food intake levels and quality of life altogether.

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