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NUTRITIONAL STATUS AS PREDICTOR OF QUALITY OF LIFE IN PATIENTS UNDERGOING HEMODIALYSIS

Estado nutricional como preditor de qualidade de vida em pacientes em hemodiálise

Estado nutricional como predictor de calidad de vida en pacientes en hemodiálisis

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ABSTRACT

Objective: to evaluate the association between quality of life and nutritional status of hemodialysis patients, according to anthropometric and biochemical measurements. **Methods:** cross-sectional study conducted with 1,024 patients from 11 hemodialysis centers in a metropolitan region of southeastern Brazil. **Results:** through multiple linear regression, the nutritional predictors of each domain of quality of life were identified. We highlight serum albumin, Body Mass Index (BMI) and waist circumference, among the measures associated with both physical and mental health in this population. **Conclusion:** inadequate nutritional status is associated with worse physical and mental quality of life in hemodialysis individuals. In addition to monitoring the nutritional status, nutritional assessment predicts quality of life and becomes a fundamental tool for a better health outcome, since low quality of life is one of the main problems in this population.

DESCRIPTORS: Quality of life related to health; Renal replacement therapy; Nutritional assessment.

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RESUMO

Objetivo: avaliar a associação entre qualidade de vida e estado nutricional de pacientes em hemodiálise, segundo medidas antropométricas e bioquímicas. **Métodos:** estudo transversal realizado com 1.024 pacientes de 11 centros de hemodiálise de uma região metropolitana da região sudeste do Brasil. **Resultados:** por meio da regressão linear múltipla, foram identificados os preditores nutricionais de cada domínio da qualidade de vida. Destacamos a albumina sérica, o Índice de Massa Corporal (IMC) e a circunferência da cintura, dentre as medidas associadas tanto a saúde física quanto a mental desta população. **Conclusão:** a inadequação do estado nutricional está associado a pior qualidade de vida física e mental de indivíduos em hemodiálise. Além do monitoramento do estado nutricional, a avaliação nutricional prediz a qualidade de vida e torna-se uma ferramenta fundamental para um melhor desfecho de saúde, uma vez que a baixa qualidade de vida é um dos principais problemas desta população.

DESCRITORES: Qualidade de vida relacionada à saúde; Terapia renal substitutiva; Avaliação nutricional.

RESUMEN

Objetivo: evaluar la asociación entre calidad de vida y estado nutricional de pacientes en hemodiálisis, según medidas antropométricas y bioquímicas. **Métodos:** estudio transversal realizado con 1.024 pacientes de 11 centros de hemodiálisis de una región metropolitana del sureste de Brasil. **Resultados:** mediante regresión lineal múltiple, se identificaron los predictores nutricionales de cada dominio de la calidad de vida. Destacamos la albúmina sérica, el índice de masa corporal (IMC) y la circunferencia de la cintura, entre las medidas asociadas a la salud tanto física como mental en esta población. **Conclusión:** el estado nutricional inadecuado se asocia con una peor calidad de vida física y mental en los individuos en hemodiálisis. Además de monitorear el estado nutricional, la evaluación nutricional predice la calidad de vida y se convierte en una herramienta fundamental para un mejor resultado de salud, ya que la baja calidad de vida es uno de los principales problemas en esta población.

DESCRIPTORES: Calidad de vida; Terapia de reemplazo renal; Evaluación nutricional.

INTRODUCTION

The advancement of chronic kidney disease (CKD) is an important public health problem. It is estimated that 9.1% of the world's population has CKD.[1] In the last 10 years, Brazil has registered an increase of 58% of individuals on dialysis,[2] in which hemodialysis (HD) is the predominant renal replacement therapy, chosen by 92% of individuals.[2]

Given the increasing prevalence of chronic diseases, quality of life (QOL) has gained a greater importance, becoming a health outcome measure[3]. In the health area, QOL is directed to the perception of physical, psychological, and social limitations influenced by the disease, treatment, and other problems, since the disease affects the condition of life.[4] Low QOL has been one of the main problems of individuals with CKD, and its occurrence can negatively affect the course of the disease,[3] in addition to representing a strong predictor of mortality.[5]

Individuals on HD are subject to several hemodynamic and metabolic changes, from disorders caused by the disease itself to side effects of treatment and medications and dietary restrictions that cause changes in the patient's nutritional status.[6] In this scenario, the impairment of nutritional status has a negative effect on individuals on HD, becoming an important predictor of survival in this population[7,8] and, therefore, its evaluation is configured as an important approach in clinical practice.[9]

Excess weight appears as a highly prevalent nutritional disorder in individuals with CKD,[10] whereas muscle mass markers indicate a high number of individuals with nutritional depletion.[10] Despite the high body mass index (BMI) being considered a protective factor in this population, the coexistence of muscle depletion and greater body fat has a negative effect on physical capacity, contributing to frailty.[11]

Given the importance of a complete nutritional assessment, in addition to anthropometric measurements, serum albumin is fundamental in HD patients and has been confirmed as a predictor of mortality, infection, and hospitalization[7,12] as well as a marker of nutritional depletion.[10] Therefore, monitoring the nutritional status of this population not only reduces complications but also improves the QOL.

Thus, the objective of this study is to assess the association between QOL and nutritional status of users of hemodialysis services.

METHODS

Study design

This cross-sectional, observational, and analytical study was carried out from February to September 2019. The study was conducted in all 11 hemodialysis centers in a metropolitan region of Southeastern Brazil. The study was approved by the Research Ethics Committee of the Federal University of Espírito Santo under number 2.104.942 and CAAE 68528817.4.0000.5060 and is in accordance with all regulations. Before data collection, patients were informed of all stages of the study and after acceptance, participants signed the Informed Consent Form.

Study population

Individuals of both sexes and over 18 years old, with a diagnosis of CKD were included in the medical record. Individuals in contact precautions, individuals who did not undergo dialysis in the metropolitan region of Southeastern Brazil, and who presented with acute or chronic conditions that limited their ability to understand and answer questions, were excluded. The total number of individuals undergoing hemodialysis at metropolitan region of Southeastern Brazil at the time of data collection was 1.351. However, 304 patients were excluded for not meeting the inclusion criteria, (137 were in contact precaution, 67 were hospitalized, 40 were unable to respond to the questionnaire, 19 had severe impairments of auditory or speech communication, 19 were very weak or had serious physical difficulties, 15 died, and 7 transferred to another hemodialysis center). Only 23 (2.2%) individuals refused to participate in the research. Thus, the study population consisted of 1,024 patients on hemodialysis.

Measures Quality of life

QOL was assessed using the 36-Item Short Form Health Survey (SF-36) questionnaire, which was applied during the hemodialysis session. It is a questionnaire translated, validated, and culturally adapted for the Brazilian population by Ciconelli et al. (1999).[13] The SF-36 is a multidimensional questionnaire, formed by 36 questions, comprising 8 domains: physical functioning, role physical functioning, bodily pain, general health perception, vitality, social functioning, role emotional functioning and mental health, which can be categorized in two dimensions: physical component summary and mental component summary.[14] In the present study, the eight domains of QOL and the two components were used. The score for each domain ranges from 0 to 100, so the higher the score, the better the QOL.

Nutritional Status

Anthropometric measurements

The individuals were weighed barefoot and wearing as few clothes as possible on portable scales with a capacity of 150 kg and a precision of 0.1 kg (OMRON, Omron Healthcare Inc., China). Height was measured on a portable stadiometer with a precision of 1 mm (Sanny, Brazil). Individuals were instructed to remain standing in an upright position with their arms extended along the body.[15] Waist circumference was measured at the midpoint between the lower margin of the last rib and the iliac crest.[15] When it was not possible to measure the midpoint, the measurement was made 2 cm above the umbilical scar.[16] The perimeter of the arm was measured at the midpoint between the acromion and the olecranon.[15] The tricipital skinfold was measured on the back of the arm, at the midpoint used for the circumference of the arm, and by applying the adipometer (Lange, Cambridge Scientific, Cambridge) 1 cm above the marked midpoint.[15]

Nutritional status classifications were performed based on anthropometric data. The Body Mass Index (BMI) was calculated using the formula BMI = Weight (kg) / Height (m^2).[17] Waist circumference was classified according to the WHO (2000).[17] The corrected arm muscle area (AMA) was obtained from the values of arm perimeter (CP) and tricipital skinfold (DCT) using the formula for men and women:

Men: AMA (cm^2) = [CB (cm) - π x PCT (mm) ÷ 10] 2 - 10/4 π. Women: AMA (cm^2) = [CB (cm) - π x PCT (mm) ÷ 10] 2 - 6.5 / 4 π. Classifying as "adequate" or "depletion".[18,19]

Biochemical data

Serum albumin, collected from medical records, was used as a biochemical marker of nutritional status. Classified as "adequate" when ≥ 3.5g / dL and "inadequate" when < 3.5g / dL.[20]

Pilot Study

A pilot study was carried out to assess the reproducibility of the QOL questionnaire (SF-36). The collection of data for the pilot study occurred in January 2019 and included an analysis of the information of 57 users on hemodialysis at a center that was different from the ones in the present study, but following all the methodological criteria presented. The pilot test was divided into two moments—test and retest—with a difference of 15 days between them and in which SF-36 was applied to the same patients, at both times.

The test and retest analyses were performed using the Kappa coefficient and McNemar's test. The WinPepi and SPSS 22.0 programs were used, and the confidence interval adopted was 95% and $p < 0.05$.

The results of the adjusted Kappa ranged from 0.80 to 1.00, showing high agreement of the questionnaire in both moments. In the McNemar test, values of $p > 0.05$ were obtained, demonstrating high agreement and low disagreement with the SF-36, and characterizing its good reproducibility.

Statistical analysis

The variables of the study were described as means and standard deviations or percentages. Cronbach's alpha reliability test was performed to assess the internal consistency of the SF-36 questionnaire. To check the normality of the quantitative variables, the Kolmogorov-Smirnov normality test was performed. Since all variables were classified as non-parametric, the Mann-Whitney U test was performed for variables with two categories, and the Kruskal-Wallis test was performed when the variable had three or more categories. To identify the differences, the Mann-Whitney U test was performed two by two. To test the associations between the independent variables and QOL, multiple linear regression was used. The variables that showed statistical significance in up to 20% in the Mann-Whitney U and Kruskal-Wallis tests were analyzed by regression. Adjustment variables were used in the regression analyses, they included socio-demographic variables: sex, age group, education, race / color, income, profession, and health care. Lifestyle variables: physical activity, alcoholism and smoking, and clinical variables: HD time, CKD time, number of diseases and number of complications.

For all analyses, the level of significance adopted was 5% and performed using the statistical software IBM SPSS statistics version 22.0 (IBM Corp, Armonk, NY, USA).

RESULTS

Of the 1,024 individuals, 48.9% (n = 500) were overweight, 45.0% (n = 461) were eutrophic, and 6.0% (n = 62) were thin. According to the waist circumference, most individuals, 77.2% (n = 784), had an inadequate waist circumference, that is, higher than recommended. Regarding the reserve of muscle mass, represented by the corrected AMA, approximately half of the individuals, 50.0%, (n = 512), showed depletion and 49.9% had adequacy. In relation to serum albumin, the majority 85.7% (n = 793) exhibit adequate value.

The reliability of the SF-36 questionnaire for the study population was confirmed by means of Cronbach's alpha coefficient, because the coefficients ranged from 0.72 to

0.89. QOL, assessed by the SF-36 domains, showed that the lowest score was physical functioning (26.78) and the highest score was mental health (72.16). Regarding the physical and mental components summaries, a higher score was obtained for the mental component summary (47.98) when compared to the physical component summary (35.19), Table 1.

Regarding BMI, the domains of physical functioning (p = 0.001), bodily pain (p = 0.002), vitality (p = 0.007), role emotional functioning (p = 0.039), and the physical component summary (p = 0.004) showed significant associations in which overweight individuals obtained lower scores (Table 2).

Regarding waist circumference, the variables of physical functioning (p < 0.001), bodily pain (p = 0.008), vitality (p = 0.024), and the physical component summary (p < 0.001) had significant associations in which individuals with appropriate waist circumference had better QOL.

Concerning albumin, it was positively associated with physical functioning (p < 0.001), role physical functioning (p < 0.001), bodily pain (p = 0.004), vitality (p = 0.007), social functioning (p = 0.005), mental health (p = 0.007), and the physical component summary (p < 0.001). Thus, individuals who had adequate albumin obtained better QOL (Table 2).

After multiple linear regressions, albumin remained associated, even after adjustment, in six of the eight QOL domains and with the physical component summary, with the exception of the domains of general health perception and role emotional functioning.

Thus, for the domains corresponding to physical health, albumin was a predictor of physical functioning (p = 0.000), role physical functioning (p = 0.000), and bodily pain (p = 0.004). BMI was a predictor of the bodily pain domain (p = 0.037). In turn, waist circumference, was a predictor of physical functioning (p = 0.000) and general health perception (p = 0.037) after adjusting for the study variables (Table 3).

For the domains corresponding to mental health, BMI was a predictor of vitality (p = 0.004) and role emotional functioning (p = 0.039). Waist circumference showed no association, whilst albumin was a predictor of all domains corresponding to mental health, with the exception of role emotional functioning (Table 4).

Regarding the two summaries of quality of life, the measurements of waist circumference, corrected AMA and albumin were predictors of the physical component summary, while no measure of nutritional status influenced the mental component summary (Table 5).

Table 1 – Score of the eight domains and summary of the Quality of Life components of users of hemodialysis services in a metropolitan region of southeastern Brazil

SF-36 Domains	Cronbach's alpha coefficient	Mean ± standard deviation	Observed minimum and maximum value	Median	Interquartile range (p25 – p75)
Physical functioning	0,89	46,04 ± 29,18	0 – 100	45,00	20 – 70
Role- physical functioning	0,83	26,78 ± 36,26	0 – 100	0	0 – 50
Bodily pain	0,82	63,47 ± 30,71	0 – 100	62,00	41 – 100
General health perception	0,76	48,21 ± 23,03	5 – 97	47,00	30 – 65
Vitality	0,79	53,76 ± 22,39	0 – 100	55,00	40 – 70
Social functioning	0,72	67,98 ± 27,89	0 – 100	75,00	50 – 100
Role- emotional functioning	0,86	42,41 ± 44,33	0 – 100	33,33	0 – 100
Mental health	0,78	72,16 ± 21,40	0 – 100	76,00	60 – 88
Physical Component Summary	-	35,19 ± 9,88	13,62 – 58,69	34,41	27,75 – 42,29
Mental Component Summary	-	47,98 ± 11,47	11,90 – 74,99	48,42	40,11 – 56,87

N= 1024.

Table 2 – Association of Quality of Life with measures of nutritional status of users of the hemodialysis service in a metropolitan region of southeastern Brazil

Variables	PF	RPF	BP	GH	VT	SF	REF	MH	PCS	MCS
BMI*[1] (n)										
Thinness (62)	48,0±34,1	27,0±37,6	69,1±31,3[b]	51,9±25,3	59,7±22,8[d]	27,9±28,3	51,0±45,0	72,5±20,8	36,3±11,0	49,4±11,4
Eutrophic (461)	49,7±29,2[a]	27,9±36,5	66,3±30,6[c]	48,3±22,7	55,0±22,6[e]	69,3±28,3	44,8±44,9[f]	72,3±21,5	36,2±10,2[g]	48,1±11,4
Overweight (500)	42,4±28,0[a]	25,6±35,8	60,2±30,3[b,c]	47,6±23,0	51,8±21,9[d,e]	67,2±27,2	38,7±43,3[f]	71,9±21,4	34,1±9,2[g]	47,6±10,8
p value	**0,001**	0,662	**0,002**	0,439	**0,007**	0,368	**0,039**	0,942	**0,004**	0,307
WC[2] (n)										
Adequate (231)	56,4±29,8	29,0±37,5	67,9±31,1	50,5±24,1	56,7±23,2	68,0±28,1	43,5±45,4	73,0±20,6	38,0±10,2	47,3±11,2
Inadequate (784)	43,0±28,3	26,2±35,9	62,1±30,4	47,6±22,7	52,9±22,0	68,2±27,7	42,1±44,0	71,8±21,6	34,3±9,6	48,1±11,1
p value	**<0,001**	0,460	**0,008**	0,114	**0,024**	0,961	0,821	0,630	**<0,001**	0,431
CAMA (n)										
Adequate (511)	44,9±29,2	25,5±35,3	62,5±30,4	47,8±23,3	54,2±23,0	67,9±28,2	41,1±44,1	71,9±21,7	34,7±9,9	48,0±11,3
Depletion (512)	47,1±29,1	28,0±37,1	64,3±30,9	48,6±22,7	53,2±21,7	68,4±27,4	43,5±44,4	72,3±21,0	35,6±9,8	47,9±10,9
p value	0,228	0,432	0,326	0,573	0,378	0,888	0,403	0,925	0,184	0,829
Abumin[3] (n)										
Adequate (793)	47,5±29,2	28,6±37,0	63,8±30,5	48,6±22,7	54,5±22,3	68,5±27,8	43,6±44,6	72,8±21,1	35,6±9,9	48,2±11,0
Inadequate (132)	33,9±26,3	14,5±27,1	55,0±30,9	44,6±26,1	48,4±23,5	61,0±29,0	37,3±42,8	67,1±23,3	30,9±8,8	46,5±12,0
p value	**<0,001**	**<0,001**	**0,004**	0,066	**0,007**	**0,005**	0,185	**0,007**	**<0,001**	0,067

PF= Physical Functioning; RPF= Role Physical Functioning; BP= Bodily Pain; GH= General Health perception; VT= Vitality; SF= Social Functioning; REF= Role Emotional Functioning; MH= Mental Health; PCS= Physical Component Summary; MCS= Mental Component Summary.
BMI= Body Mass Index. WC: Waist Circunference. CAMA= Corrected Arm Muscle Area.
*Kruskal Wallis test (p<0,05). Mann-Whitney test (p<0,05).
N= 1024. n^1= 1023. n^2= 1022. n^3= 925.
[a] = Difference between eutrophic and overweight. [b] = difference between thinness and overweight. [c] = difference between eutrophic and overweight. [d] = difference between thinness and overweight. [e] = difference between eutrophic and overweight. [f] = difference between eutrophic and overweight. [g] = difference between eutrophic and overweight.

Table 3 – Multiple linear regression considering nutritional status variables associated with domains related to physical health

SF-36 Domains	P value	Beta	CI (95%)	P value	Beta	CI (95%)
					Adjusted	
Physical Functioning						
BMI[1]						
Thinness						
Eutrophic	0,242	0,082	-3,24 – 12,83	0,881	0,010	-7,12 – 8,30
Overweight	0,716	0,026	-6,80 – 9,89	0,509	-0,046	-10,70 – 5,30
Waist Circumference[2]						
Adequate						
Inadequate	**0,000**	-0,160	-15,87 – -6,18	0,111	-0,055	-8,856 – 0,881
Albumin[3]						
Adequate						
Inadequate	**0,000**	-0,148	-17,63 – -7,06	**0,003**	-0,093	-12,89 – -2,72
Role Physical Functioning						
Albumin[1]						
Adequate						
Inadequate	**0,000**	-0,136	-20,64 – -7,42	**0,018**	-0,080	-14,91 – -1,38
Bodily Pain						
BMI[1]						
Thinness						
Eutrophic	0,533	-0,044	-11,30 – 5,85	0,821	-0,017	-7,79 – 9,81
Overweight	**0,037**	-0,155	-18,38 – -0,56	0,190	-0,100	-15,25 – 3,03
Waist Circumference[2]						
Adequate						
Inadequate	0,434	-0,028	-7,22 – 3,11	0,939	0,003	-5,19 – 5,62
Albumin[3]						
Adequate						
Inadequate	**0,004**	-0,094	-13,88 – -2,60	**0,050**	-0,066	-11,60 – -0,005
General Health perception						
Waist Circumference[1]						
Adequate						
Inadequate	0,059	-0,064	-7,03 – 0,13	**0,037**	-0,073	-7,80 – 0,25
Albumin[2]						
Adequate						
Inadequate	0,120	-0,051	-7,77 – 0,89	0,319	-0,034	-6,69 – 2,18

Multiple linear regression ($p<0,05$).
BMI= Body Mass Index.
N= 1024. n^1= 1023. n^2= 1022. n^3= 925.
Physical Functioning: Adjusted for sex, age group, education, income, profession, health care, smoking, alcohol consumption, physical activity, HD time, number of diseases and number of complications.
Role Physical Functioning: Adjusted for sex, age group, education, income, smoking, alcohol consumption, physical activity, HD time, number of diseases and number of complications.
Bodily Pain: Adjusted for sex, age group, education, marital status, income, profession, health care, physical activity, HD time, number of diseases and number of complications.
General Health: Adjusted for sex, age group, alcohol consumption, physical activity, HD time, number of diseases and number of complications.

Table 4 – Multiple linear regression considering nutritional status variables associated with domains related to mental health

SF-36 Domains	P value	Beta	CI (95%)	P value	Beta	CI (95%)
					Adjusted	
Vitality						
BMI[1]						
Thinness						
Eutrophic	0,208	-0,090	-10,41 – 2,27	0,108	-0,122	-11,20 – 1,10
Overweight	**0,041**	-0,152	-13,45 – -2,27	**0,015**	-0,177	-14,36 – 1,57
Waist Circumference[2]						
Adequate						
Inadequate	0,362	-0,033	-5,60 – 2,04	0,984	-0,001	-3,69 – 3,77
Albumin[3]						
Adequate						
Inadequate	**0,006**	-0,090	-10,01 – -1,66	0,199	-0,041	-6,64 – 1,38
Social Functioning						
Albumin[1]						
Adequate						
Inadequate	**0,004**	-0,094	-12,74 – -2,41	**0,032**	-0,072	-11,11 – -0,49
Role Emotional Functioning						
BMI[1]						
Thinness						
Eutrophic	0,206	-0,090	-20,49 – 4,43	0,374	-0,071	-20,12 – 7,56
Overweight	**0,039**	-0,147	-25,48 – -0,64	0,108	-0,128	-25,30 – 2,50
Albumin[2]						
Adequate						
Inadequate	0,168	-0,045	-13,95 – 2,42	0,371	-0,033	-13,55 – 5,06
Mental Health						
Albumin[2]						
Adequate						
Inadequate	**0,005**	-0,093	-9,65 – -1,73	**0,050**	-0,063	-7,84 – 0,00

Multiple linear regression ($p<0,05$).
BMI= Body Mass Index.
N= 1024. n^1= 1023. n^2= 1022. n^3= 925.
Vitality: Adjusted for sex, age group, education, marital status, income, profession, physical activity, CKD time, number of diseases and number of complications.
Social Functioning: Adjusted for sex, education, race / color, income, profession, physical activity, CKD time, number of diseases and number of complications.
Role Emotional Functioning: Adjusted for sex, age group, education, marital status, race / color, income, health care, drinking, physical activity, HD time, number of medications, number of diseases and number of complications.
Mental Health: Adjusted for sex, age group, education, marital status, income, alcohol consumption, physical activity, number of diseases and number of complications.

Table 5 – Multiple linear regression considering nutritional variables associated with Physical Component Summary and Mental Component Summary

SF-36 Domains	P value	Beta	CI (95%)	P value	Beta	CI (95%)
					Adjusted	
Physical Component Summary						
BMI[1]						
Thinness						
Eutrophic	0,478	0,050	-1,74 – 3,71	0,699	0,028	-2,20 – 3,28
Overweight	0,744	-0,024	-3,30 – 2,35	0,367	-0,067	-4,15 – 1,53
Waist Circumference[2]						
Adequate						
Inadequate	**0,001**	-0,125	-4,56 – -1,28	0,078	-0,065	-3,14 – 0,16
Corrected AMA						
Adequate						
Depletion	**0,026**	0,072	0,174 – 2,68	**0,028**	0,072	0,15 – 2,65
Albumin[3]						
Adequate						
Inadequate	**0,000**	-0,146	-5,93 – -2,33	**0,013**	-0,081	-4,10 – -0,49
Mental Component Summary						
Albumin[1]						
Adequate						
Inadequate	0,105	-0,053	-3,75 – 0,35	0,070	-0,063	-4,16 – 0,16

Multiple linear regression (p<0,05).
BMI= Body Mass Index. Corrected AMA= Corrected Arm Muscle Area.
N= 1024. n[1]= 1023. n[2]= 1022. n[3]= 925.
Physical Component Summary: Adjusted for sex, age group, education, income, profession, smoking, alcohol consumption, physical activity, CKD time, number of medications, number of diseases and number of complications.
Mental Component Summary: Adjusted for sex, age group, education, marital status, race / color, income, profession, physical activity, HD time, number of diseases and number of complications.

DISCUSSION

Our findings prove the impact of nutritional status on QOL, identifying the nutritional predictors of users of hemodialysis services in a metropolitan region of Southeastern Brazil. From the nutritional status indicators evaluated, simple anthropometric measurements, such as BMI and waist circumference, were shown to be associated with QOL. Albumin stands out as a predictor of both physical and mental health of this population.

In this study, better mental health was observed at the expense of physical health, a common finding in this population.[7,21] Better mental health portrays how individuals cope with the disease, based on the reframing of the disease. Moreover, it enables the transformation of a reality better than the disease itself, adapting to it over time, and directly influencing the mental health of these individuals.[21]

In contrast, the worst QOL was represented by the physical aspects domain. In this context, the impairment of nutritional status represents a negative impact on the QOL of this population.[6,7,8] In our findings, most individuals were overweight. Obesity is commonly described as beneficial for the individual on hemodialysis, being configured as a protective factor for mortality. Due to this association, the so-called "obesity paradox" is commonly observed in these individuals.[22]

Although obesity has a favorable effect on the mortality of individuals on HD, Moreira et al. (2013) showed a negative correlation with QOL,[23] as in the present study, overweight by BMI was a predictor of worse vitality, emotional aspect, and pain.

However, in addition to the BMI, the distribution of adiposity must be considered.[8] Because of the negative metabolic consequences of excess abdominal fat, waist circumference measurement becomes an important and specific nutritional assessment tool to monitor hemodialysis patients.[6] Higher adiposity is associated with worse physical function in HD patients, whereas greater muscle mass contributes to better physical functioning.[24] Accordingly, in our findings, most individuals had a waist circumference above the recommended and was a predictor of worse functional capacity and summary of physical component.

Despite the high prevalence of obesity in the hemodialysis population, loss of muscle mass is also commonly observed and is the result of multiple mechanisms inherent in CKD, including reduced food intake, loss of nutrient during dialysis treatment, hormonal disorders, comorbidities, and systemic inflammation.[6,25]

Such mechanisms of wasting protein energy are directly related to fragility and reduced QOL.[26]

Previous studies[6,8,27] used the muscle circumference of the arm as a parameter for muscle tissue reserve, highlighting it as an important predictor of prognosis in hemodialysis patients.

Because of the importance of assessing muscle tissue reserve and the prevalence of muscle depletion in the hemodialysis population,[8] we chose to use the corrected AMA in the present study because it represents the reserve of corrected muscle tissue for bone mass. In our findings, half of the individuals presented muscle depletion, reflecting the physical health of this population because this depletion was configured as a predictor of a worse physical component. In a previous study, Ishiara et al. (2010)[28] identified AMA depletion in hemodialysis patients over 30 years old while other nutritional parameters remained unchanged.

In this context, assessment of nutritional status with anthropometric and biochemical measures has been highlighted as an important way to identify the individual's nutritional risk.[7] It is known that in the CKD population on hemodialysis, serum albumin is considered an important marker of nutritional status and is confirmed as a predictor of adverse events or death.[12]

Regarding QOL, albumin has been proven to be the nutritional parameter with the strongest correlation[29] and has been identified as an important parameter in depression.[30] In our findings, although most individuals (85.7%) had adequate levels of albumin, the inadequacy of albumin was a predictor for six of the eight domains of QOL and the summary of the physical component. This demonstrates that the low levels of this biochemical marker of nutritional status negatively affect both the physical and mental health of individuals undergoing hemodialysis.

Thus, albumin stands out as an important tool for nutritional status because of its influence on the QOL in the hemodialysis population and because a low QOL is associated with a poor prognosis for these individuals.[5,17,29,30]

Limitations and strengths of the study are noted. Among the limitations, the cross- sectional and observational nature of the study limits its ability to establish a causal relationship of the findings. In addition, it is worth noting the absence of inflammatory markers to verify whether anthropometric and biochemical measurements are influenced by inflammation. The study sample, representative of the population; the use of all domains; and the summaries of the physical and mental components of the QOL questionnaire stand out as strengths, guaranteeing that the assessment considers all its multidimensionality. The use of anthropometric and biochemical measures is important for a complete nutritional assessment and for the identification of nutritional predictors of QOL adjusted for sociodemographic variables, lifestyle, and clinical characteristics.

CONCLUSION

Therefore, in this study, the association between nutritional status and QOL of users of hemodialysis services was confirmed. It was possible to identify how the impairment of nutritional status is related to worse physical and mental health, since excess weight, high waist circumference, depletion of AMA, and inadequate albumin were predictors of worse QOL. This study highlights the importance of not only monitoring the nutritional status of individuals undergoing hemodialysis, but also the use of different nutritional tools, anthropometric and biochemical, to ensure greater efficiency of the nutritional diagnosis. It is noteworthy that the QOL was associated with simple and viable measures for clinical practice, thereby contributing to an adequate nutritional status of these individuals and guaranteeing a better health outcome because a low QOL, in addition to being a predictor of mortality, is one of the main problems of this population.

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