

Nutritional assessment of patients undergoing hemodialysis at dialysis centers in Belo Horizonte, MG, Brazil

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SUMMARY

Objective: This study aims to assess the nutritional status of patients undergoing hemodialysis at dialysis centers in Belo Horizonte, MG, Brazil using the Subjective Global Assessment (SGA), and associate it with socioeconomic, demographic and clinical variables. **Methods:** A total of 575 patients were evaluated at 12 dialysis centers in Belo Horizonte, MG, Brazil. Socioeconomic, demographic, and clinical variables were gathered through interviews using a questionnaire specifically developed for this purpose. The logistic regression model was used to determine the effect or influence of each variable on the nutritional status. **Results:** Malnutrition was significantly prevalent (19.5%). Generally, the study population had low socioeconomic status, limited access to private health services, high rate of comorbidities, and received a large number of dietary recommendations, which were not necessarily appropriate. According to multivariate analysis, the risk factors for malnutrition were age over 60 years, family income at or below one minimum wage, presence of depression, and retirement. **Conclusion:** Malnutrition is prevalent among patients undergoing hemodialysis. Differences in socioeconomic, demographic, clinical, and general characteristics can be used to identify patients who require more attention due to the risk of malnutrition, particularly in the elderly, retirees, and those with depression and low socioeconomic status.

Keywords: Malnutrition; nutritional status; renal dialysis; chronic renal failure.

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INTRODUCTION

Chronic kidney disease (CKD) is currently a public health problem^{1,2}. CKD is a slow, progressive, and irreversible loss of kidney function². Because this loss is slow and progressive, it results in an adaptive process in which the patient remains asymptomatic for some time³. However, when the kidneys can no longer adequately remove the metabolic degradation products, dialysis treatment should be initiated⁴.

Hemodialysis (HD) is the most common renal treatment today⁵. The Brazilian Society of Nephrology (Sociedade Brasileira de Nefrologia – SBN) held a census in 2009 and reported a prevalence of 405 patients per million inhabitants, with HD being the predominant method of treatment (89.6%)⁵.

Despite the benefits of HD in prolonging the survival of patients with CKD, the conditions imposed by the disease and dialysis therapy result in a series of organic changes⁶, with acute and chronic complications and nutritional changes. Additionally, dialysis treatment is associated with high rates of hospitalization and increased mortality⁷. Individuals undergoing dialysis have a significant prevalence of malnutrition, which is classified as mild, moderate, and severe⁸. The cause of malnutrition is multifactorial and includes: inadequate food intake, hormonal and gastrointestinal disorders, dietary restrictions, drugs that alter nutrient absorption, insufficient dialysis, and constant presence of associated diseases. Furthermore, uremia, acidosis, and HD procedure *per se* are hypercatabolic and associated with the presence of an inflammatory state^{9,10}.

Malnutrition is considered a marker of poor prognosis in CKD^{10,11}. The patients' nutritional status is inversely associated with increased risk of hospitalization and mortality; thus constituting an important risk factor for the outcome of these patients¹². Therefore, assessing the nutritional status of patients is essential both to prevent malnutrition and to indicate appropriate intervention in malnourished patients^{7,8}. The success of dialysis is dependent on adequate nutrition¹¹.

The present work aims to assess the nutritional status of patients undergoing HD therapy at dialysis centers attending patients of the National Health System (Sistema Único de Saúde – SUS) in Belo Horizonte. It also aims to evaluate the association between nutritional status and socioeconomic and demographic variables related to the general condition of patients and the dietary recommendations already received.

METHODS

This is a cross-section study inserted in a larger, longitudinal study that focused on the social determinants (individual and contextual) of access to renal transplantation

in Belo Horizonte, Minas Gerais, Brazil. This study was developed by the Health Economics Research Group of the Universidade Federal de Minas Gerais. Data collection was performed in 12 dialysis centers attending patients from SUS in the city of Belo Horizonte. The study protocol and informed consent were previously submitted and approved by the Research Ethics Committee of the Universidade Federal de Minas Gerais (No. ETIC 492/06).

The study sample consisted of 585 patients who started HD between January 2006 and December 2007. All patients were previously informed about the research, and their inclusion occurred after they signed the informed consent.

Inclusion criteria were: patients at least 18 years old; who started dialysis between January 2006 and December 2007 at dialysis centers attending to SUS patients in Belo Horizonte, MG; with a minimum expected dialysis treatment time \geq three months; with no history of prior renal transplantation; and who agreed to participate in the study by signing the informed consent.

We excluded patients who were unable to answer the questionnaire (difficulty in understanding questions, visual or hearing impairment); those who refused to answer the screening criteria for inclusion; those absent after three approach attempts; those admitted to the hospital or discharged from dialysis (defined as having acute renal failure); those transferred for renal failure monitoring in another city or without identification of the transfer site; and those who answered less than 50% of the questionnaire.

The estimated population of the study was obtained from the list of patients to whom a High Cost/High Complexity Outpatient Procedure Authorization (Autorização de Procedimentos Ambulatoriais de Alta Complexidade/Custo – APAC/TRS) was issued between January 1, 2006 and December 31, 2007 by the Nephrology Department Commission of the Secretaria Municipal de Saúde de Belo Horizonte (SMS-BH). In addition, we used the list of patients on renal replacement therapies (RRT) provided by the 12 dialysis centers of Belo Horizonte, according to the study inclusion criteria.

Both lists were cross-checked to obtain more reliable information. However, some difficulties were found when establishing the final population in this study:

- Patients who were on the list of dialysis service in APAC, but were not found there;
- Transferred patients with no identification of the transfer location;
- Difficulty in the review of patient's medical history, complicating the distinction between acute and chronic cases, as the date of first treatment in a clinic did not necessarily coincide with the start date of patient's dialysis.

Thus, it was decided to approach all patients at the 12 dialysis centers in Belo Horizonte to define the final study population. Patients were interviewed during the dialysis session using a questionnaire to gather demographic, socioeconomic, and clinical data. Data collection was conducted from February to April 2008.

The variables sex, age, marital status, race, education, and income were assessed. Data on personal and per capita family income were presented as minimum wages (MW) (value in 2008: R\$ 415.00). Health insurance status, predialysis visit with nephrologist, hospital admissions and their duration, number of medications used, presence of common comorbidities associated with CKD, and dietary recommendations were also assessed.

Nutritional status was evaluated by specifically trained professionals using the Subjective Global Assessment (SGA) at the time of the interview. SGA has been validated in a pilot study using the Kappa test as a method for checking the degree of concordance (unpublished data).

The SGA proposed by Detsky¹³ addresses aspects related to weight loss in the last six months, changes in food intake, gastrointestinal symptoms (nausea, vomiting, diarrhea, loss of appetite), and functional capacity. Functional capacity refers to the patient's physical condition, such as being bedridden, in outpatient treatment, or performing poorly at work. Physical examination was performed for the assessment of subcutaneous fat loss, muscle loss, malleolar edema, presacral edema, and ascites, which were classified as unchanged, mild, moderate, or severe. Patients were classified as well nourished, with suspected malnutrition/moderately malnourished, or severely malnourished. The relationship between nutritional status and other variables was assessed through the results obtained by the SGA.

The statistical significance level of 5% was adopted, and data analysis followed the subsequent criteria: qualitative variables were described in frequency tables; quantitative variables were calculated by mean, standard deviation (SD), median, and maximum and minimum values. The Shapiro-Wilk test was used to assess the normality of variables' distribution; numerical variables, when considered within the normal range, were tested by parametric ANOVA or Student's *t*-test. In the absence of normality, the nonparametric Kruskal-Wallis test or the Mann-Whitney test were used; for comparison between nourished and malnourished patients and categorical variables, the chi-square test was used. Odds ratios (ORs), and their respective confidence intervals (CIs), were calculated.

The logistic regression model was used to determine the effect or influence of each variable on the nutritional status (nourished/malnourished). All variables were tested by simple logistic regression model. Variables significantly related to nutritional status were used in the multiple

logistic regression model. Therefore, a multiple logistic regression model with fewer independent variables was proposed. This model was considered appropriate according to the Hosmer and Lemeshow test. ORs and their respective CIs were calculated for significant variables. Data analysis was performed using the Statistical Package for Social Science software – SPSS, version 15.0¹⁴.

Both the study protocol and informed consent were previously submitted to and approved by the Research Ethics Committee of the Universidade Federal de Minas Gerais (No. ETIC 492/06).

RESULTS

The mean age of patients was 54.1 ± 15.4 years, and the median was 55 (18-90) years; mostly male, married/living with a partner, mixed-race, having elementary education, retired, with family income above minimum wage, and no private health plan. Hypertension and diabetes mellitus were their main comorbidities. Most patients had a previous visit with a nephrologist, took more than three medications per day, and had not been hospitalized in the last 12 months.

The nutritional status of this population was characterized as 80.5% nourished individuals, 17% with suspected malnutrition or moderately malnourished, and 2.5% severely malnourished. The prevalence of malnutrition was significantly higher in older patients (Table 1).

Malnourished individuals had a median personal income significantly lower than the nourished individuals. In fact, those individuals with personal income less than or equal to one MW were 1.6 to 4.2 times more likely to be malnourished than those with incomes higher than one MW. Besides monthly personal income, education and main source of income also had a significant relationship with malnutrition. Illiterate individuals were 1.4 to 8.6 times more likely to be malnourished than those with higher education (complete/incomplete). Retired individuals were 1.3 to 5.9 times more likely to be malnourished than patients who had other activities as a primary source of income. There was no relationship between retirement and the age group of individuals.

Table 2 shows the clinical characteristics of patients (at least one hospitalization for any reason, visit to a nephrologist, and the number of medications used) and the relationship with nutritional status.

Malnourished individuals were hospitalized more often in the last 12 months ($p < 0.05$) and had a longer hospital stay than nourished individuals ($p < 0.05$). The presence of hospital admission *per se* had a significant relationship with nutritional status. Patients who were hospitalized at least once for any reason were 1.1 to 2.5 times more likely to suffer from malnutrition than those who had never been hospitalized (Table 2).

Table 1 – Socioeconomic and demographic characteristics of the population and prevalence of malnutrition by SGA, Belo Horizonte, MG, Brazil, 2009

Characteristics	Frequency (%)	Prevalence of malnutrition (%)	Odds ratio	Confidence interval
Gender				
Men	57.7	17.8		
Women	42.3	21.8	1.3	0.9-2.0
Age				
< 60 years	60.9	16.6*		
≥ 60 years	38.6	23.9	1.6	1.0-2.4
Marital status				
Married/living with partner	57.6	16.6*		
Single	19.3	19.8	1.2	0.7-2.1
Divorced/separated	9.2	22.6	1.5	0.7-3.0
Widower	13.7	29.1	2.1	1.2-3.6
Race				
Mixed-race	45.4	15.7*		
White	29.2	22.0	1.5	0.9-2.5
Black	17.2	21.2	1.4	0.8-2.6

Chi-square test, *p < 0.05 (significant).

Table 2 – Prevalence of malnutrition by SGA, family members who have or had CKD, hospitalizations, and number of medications used, Belo Horizonte, MG, Brazil, 2009

Characteristics	Frequency (%)	Prevalence of malnutrition (%)	Odds Ratio	Confidence interval
Family members with CKD				
No	69.7	22.1		
Yes	28.3	17.7	1.3	0.8-2.1
Hospitalizations				
No	53.9	15.9*		
Yes	40.7	23.9	1.7	1.1-2.5
Number of medications				
≥ 3	84.5	18.3		
< 3	8.5	20.4	0.9	0.4-1.8

Chi-square test, *p < 0.05 (significant). Family members with CKD, if patients have family members with chronic kidney disease; Hospitalizations, if patients were admitted to hospital at least once after dialysis initiation; Number of medications, number of different types of drugs used.

Most patients reported having some type of comorbidity (97.6%), but the presence of comorbidity had no significant relationship with nutritional status, age, hospitalizations, or number of medications taken. The prevalence of comorbidities was significant, with 89.4% of patients presenting with high blood pressure (HBP), and 35.1% with diabetes mellitus. HBP and depression were significantly related to nutritional status. HBP was a protective factor, as the hypertensive individuals were 0.2 to 0.8 times less likely to suffer from malnutrition than those without hypertension. In contrast, individuals with depression were 1.3 to 3.3 times more likely to suffer from malnutrition.

Dietary recommendations received by patients are shown in Figure 1. Whether or not patients have received dietary recommendations had no association with the nutritional status. All recommendations analyzed addressed restriction of water and nutrients. Most individuals (49.9%) reported always these recommendations. The prevalence of malnutrition was not influenced by the frequency with which patients followed the dietary recommendations (never/rarely, sometimes, and always).

Risk factors associated with nutritional status were identified by logistic regression analysis. The variables associated with nutritional status (p < 0.05) by simple

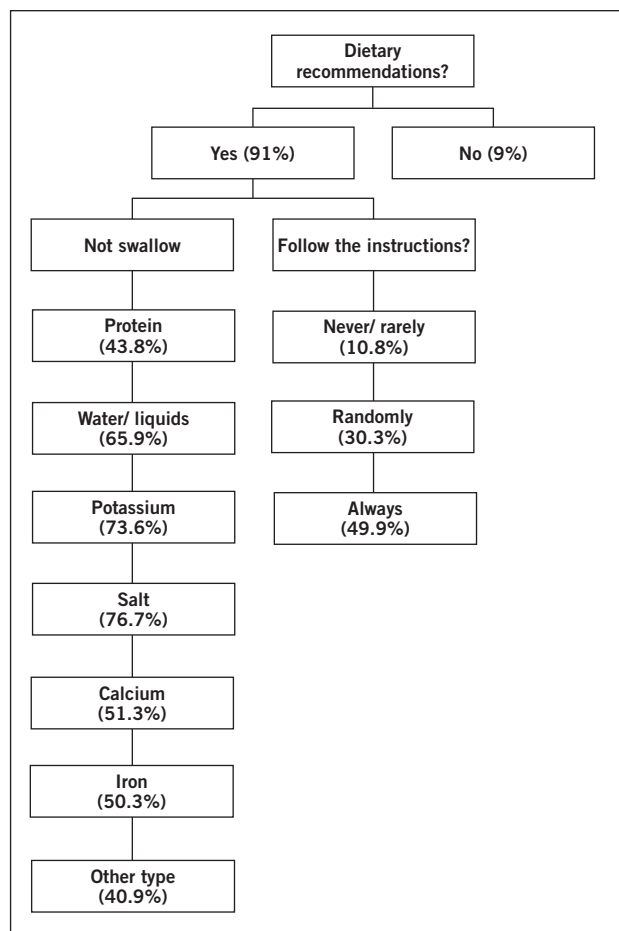


Figure 1 – Dietary recommendations received by the patients, Belo Horizonte, MG, Brazil, 2009.

logistic regression analysis (represented with their respective dichotomization) were age (≥ 60 / < 60 years), marital status (widowed/married), education (illiterate/higher education), monthly personal income (< 1 MW/ ≥ 1 MW), source of income (retirement/other), hospitalization (yes/no), hypertension (yes/no), and depression (yes/no). After multivariate analysis, the variables age, monthly personal income, depression, and source of income were confirmed as risk factors for malnutrition (Table 3). Thus, individuals aged ≥ 60 years, with personal income < 1 MW, depressed, and who had retirement as their source of income were considered most likely to develop malnutrition.

DISCUSSION

METHOD

The assessment of hemodialysis patient's nutritional status is a challenge^{7,15-19}. SGA, although subjective, seems to be a valid and reliable method^{17,20,21}. It has good correlation with other nutritional markers and significant prognostic value for morbidity and mortality in patients with chronic kidney disease^{7,15,16,17,21}. Furthermore, the method is recommended by international organizations

Table 3 – Multivariate logistic regression analysis to estimate odds ratios and calculate confidence intervals, with variables considered risk factors for malnutrition, Belo Horizonte, MG, Brazil, 2009

	Odds ratio	Confidence interval
Age (≥ 60 years)	2.1*	1.2-3.4
Monthly personal income (< 1 SM)	2.9*	1.6-4.4
Source of income (retirement)	2.9*	1.3-7.0
Depression	2.1*	1.2-3.7

* $p < 0.05$ (significant); Hosmer and Lemeshow test, $p = 0.641$.

for nutritional assessment and malnutrition detection in adult dialysis patients²²⁻²⁴.

In this study, the original SGA was applied because it was considered the easiest for use by multiple professionals specifically trained for the task. Several authors have also used this assessment form in the context of renal disease^{17,25}. In contrast, others advocate the use of modified techniques¹⁹⁻²¹. Some of the adapted versions include items that would hinder data collection in studies such as this, take longer to be applied, and require greater specificity and qualification of the applicants. In discussing and comparing the present results with those in literature, a distinction between the SGA adaptations used in several studies was not made, as the analysis of these adaptations was not the goal.

On the other hand, the great variability of evaluators in this study was a limitation. The inter-evaluator agreement measured in the pilot study was classified as moderate, even after training. Thus, the rate of malnutrition found seems to be underestimated compared with results from other studies^{17-19,25}.

PREVALENCE OF MALNUTRITION

In this study, the prevalence of malnutrition was 19.5%, which was similar to the results of European authors who also evaluated HD outpatients by SGA^{7,21,26}. Other studies have reported a very high prevalence of malnutrition using the SGA, ranging from 31% to 75%^{17-19,25}. The difference in prevalence rates may be a consequence of the variations and adaptations of the different evaluation methods, or the different conditions of the population studied^{18,21}.

NUTRITIONAL STATUS AND ASSOCIATION WITH SOCIOECONOMIC AND SOCIODEMOGRAPHIC VARIABLES

In the present study, the mean age of individuals was 54.1 ± 15.4 years, with 57.7% males. Several studies have found similar mean age, with mostly male patients^{19,21,27,28}.

The prevalence of elderly subjects was 38.6%, similar to that reported by the SBN² census (36.3%). The elderly had significantly higher prevalence of malnutrition than those younger than 60 years. Similarly, some authors^{7,18,21} also found a relationship between malnutrition and older age. Old age is often associated with high rates of malnutrition due to difficulties related to this stage of life, such as difficulty buying food and preparing meals, decreased appetite, poor dentition, decreased taste, more chronic or acute diseases, reduced mobility and cognition, and consequently decreased food intake^{7,25}.

Prevalence of malnutrition was not associated with gender, as found by Santos et al.²⁹ in Brazil, and Elliot and Robb¹⁹ in Europe. Most subjects were married or living with a partner (57.6%), in agreement with the study by Diefenthaler et al.²⁷. There was no significant relationship between marital and nutritional status of individuals. However, the prevalence of malnutrition was slightly higher among those widowed than among married people. Living with a partner or family is a factor that can increase home care. After all, CKD leads to functional loss, compromising the independence and autonomy of individuals, often making them dependent on partial or full care of another person, which occurs more frequently with the elderly^{30,31}.

Most patients (45.4%) were classified as mixed-race. In other studies, especially in different countries, a higher percentage of white individuals was found^{2,21,27,32}. No relationship was found between skin color and nutritional status of individuals in this study. However, one would expect that mixed-race and black individuals had higher percentage of malnutrition. This is justified because the racial groups classified as black, mixed-race, and indigenous in Brazil are situated precariously in terms of social inclusion. They have lower average years of education and monthly income, live in regions with poor level of sanitation, and have higher levels of illiteracy³³.

Most participants in our study had complete/incomplete elementary education (59%), as shown in the work by Kusumoto et al.³², characterizing a population of low education level. Individuals with no education, classified as illiterate, had a higher prevalence of malnutrition than individuals with higher education (complete/incomplete). The median of both personal (R\$ 570.00) and family (R\$ 1,000.00) monthly income was low, characterizing a population of low socioeconomic status. Monthly personal income was correlated with the presence of malnutrition, and those who received less than one MW per month had a higher prevalence of malnutrition than those who received more than one MW. The relationship between socioeconomic status (represented by low education and low monthly income) and nutritional status is expected and appears logical. Poverty,

low income, and lack of knowledge and access to information are generally among the causes of malnutrition in this population^{9,34}.

The low monthly income reported by patients is linked to the means of obtaining this income, such as no formal employment, retirement, healthcare allowance, and donations³². Thus, the main source of individuals' income in this study was retirement (50.3%). However, retirement was not related to the age of individuals, demonstrating the likelihood of retirement by disability. Individuals with retirement as their main source of income had significantly higher prevalence of malnutrition than those who have other sources of income, such as steady employment, business ownership, self employment, family subsidy (Bolsa Família), or others. A chronic disease such as CKD, which is especially limiting due to treatment, is a negative aspect in the labor market, and social options^{32,35}.

Most individuals (61.7%) had no private health insurance, but having health insurance was not related to the prevalence of malnutrition. Rudnick³⁵ reported that people with health insurance have a better quality of life index. Although hemodialysis is fully subsidized by the SUS, treatment of comorbid conditions, tests, and medical visits are usually not covered with the same quality offered by health insurance plans. In this regard, the odds of maintaining an adequate nutritional status are possibly smaller³⁵. However, we found no such relationship in our study.

The visit and the time of this first visit before the beginning of dialysis therapy may represent the health care provided to the individual prior to treatment. However, no association was found between this variable and nutritional status. The existence, time, and type of pre-dialysis care could have a direct influence on the nutritional status of the individual^{21,36}.

Thus, according to the analysis of these variables, it was concluded that malnutrition in these patients depends on certain external factors, constituting a universal problem. On the other hand, the role of psychological and socioeconomic factors (poverty, disability) can not be neglected, as they have a negative impact on the nutritional status of individuals¹⁵. The negative effects of these factors can be prevented if they are identified and treated early³⁷.

NUTRITIONAL STATUS AND ASSOCIATION WITH CLINICAL VARIABLES

The complications of CKD, comorbidities, and replacement therapy associated with a depleted nutritional status can lead to situations in which the individual must be hospitalized to receive specific medical care. Admissions at dialysis onset, number of hospitalizations, and duration (days) of last hospitalization had a significant relationship with nutritional status. As described by the CANUSA²⁰ study in the United States, better nutritional status is related to lower incidence of hospitalizations and shorter hospital stay.

Most individuals (84.5%) take three or more medications. The number of drugs used by malnourished and nourished patients was not significantly different. The use of large quantities of drugs can interfere with nutrient absorption through drug interaction with food, and cause decreased appetite and food intake due to nausea and vomiting. Thus, it would be a risk factor for malnutrition, as reported by different authors^{9,16,34}. Probably, other factors interfere with the analysis in this study. Malnutrition may worsen comorbidities¹⁶, and the presence of comorbidities associated with CKD and hemodialysis therapy may worsen the condition of the patient's health and increase the risk of malnutrition^{15,19}. Almost all patients reported having some type of comorbidity (97.6%). However, unlike other Brazilian and European studies^{7,21}, the presence of comorbidities associated with CKD was not related to depleted nutritional status, age, hospitalization, or number of medications taken. In contrast, individuals with hypertension had a significantly lower percentage of malnutrition than non-hypertensive individuals. This can be explained by the fact that hypertension is generally associated with excess weight, high intake of salt and saturated fats, among other factors³⁸. Moreover, the presence of overweight and obesity may have contributed to failure in the diagnosis of malnutrition by some examiners less attentive to this fact in the general context of nutritional history^{38,39}.

Only individuals with depression had a significantly greater percentage of malnutrition. Depression is a very common complication in dialysis patients and is associated with increased mortality^{28,40}.

NUTRITIONAL STATUS AND ASSOCIATION WITH DIETARY RECOMMENDATIONS

Malnutrition is related to a complex set of factors, among which dietary restrictions and loss of appetite are relevant. After all, these two factors are often present in HD patients^{15,25}, leading to poor dietary intake^{21,25}. The prescription diet characterized by extreme restriction may aggravate malnutrition¹⁵.

The present study's hypothesis is that patients who received recommendations for restriction of nutrients had decreased intake and consequently were more likely to be malnourished. There was no significant relationship between receiving and following these recommendations and nutritional status. However, even without statistical significance, those individuals who reported always following the recommendations had a slightly higher malnutrition rate. An European study by Sikkes et al.²⁶ showed that patients who underwent HD sessions for longer periods had improved appetite and higher protein and minerals intake due to the possibility of eating an unrestricted diet. This, coupled with adequate metabolic control, resulted in improved nutritional status²⁶.

Receiving and following recommendations for protein and sodium restriction would probably be the factors most associated with nutritional deficits. However, in the present study, receiving and following these recommendations showed no relationship with nutritional status. It is difficult to predict with certainty what individuals consider as "following recommendations", which allows for misinterpretations.

CONCLUSION

The prevalence of malnutrition was significant among patients undergoing HD. This population, in general, has low socioeconomic status, low access to private health services, high level of comorbidities, and receives large number of dietary recommendations, which are not necessarily appropriate.

Nutritional status was influenced by age, monthly personal income, main source of income, and depression. On the other hand, it was not influenced by the other variables analyzed.

Thus, the differences in socioeconomic, demographic, clinical, and general characteristics observed in this study may be used to identify HD patients who need more attention in terms of risk for malnutrition, mainly the elderly, retirees, those with depression, and those with a low socioeconomic status. Therefore, the effective screening of individuals with risk factors for malnutrition, as well as performance of nutritional assessment whenever possible, should enable an early dietary intervention to prevent nutritional depletion and, more importantly, prevent further deterioration.

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