Original Article

Socioeconomic, clinical and nutritional factors on interdialytic weight gain in haemodialysis users

Fatores socioeconômicos, clínicos e nutricionais no ganho de peso interdialítico em usuários de hemodiálise

Factores socioeconómicos, clínicos y nutricionales en el aumento de peso interdialítico en usuarios de hemodiálisis

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Abstract

Objectives: The study aimed to evaluate the factors associated with interdialytic weight gain in users of haemodialysis services in a metropolitan region of Brazil.

Methods: This is an cross-sectional epidemiological study with 1,024 individuals with chronic kidney disease on haemodialysis in Brazil. Interdialytic weight gain was evaluated by the percentage weight gain between one haemodialysis session and another. The variables included in the binary logistic regression analysis were selected by considering p< 0.10 in the bivariate test.

Results: We demonstrated that having more years of study (OR=0.537;CI 95% = 0.310–0.931; p=0.027) and be overweight (OR=0.661;CI 95% = 0.461–0.948; p=0.024) or obese (OR=0.387;CI 95% = 0.246–0.608; p=<0.001) reduced the chances of users having high interdialytic weight gain. Those who did not have paid work (OR=2.025;CI 95% = 1.218–3.365; p=0.007) and not adopting measures to reduce salt increased (OR=1.694;CI 95% = 1.085–2.645; p=0.020) increased the chances of interdialytic weight.

Conclusion: The results point to an association between the increase in interdialytic weight gain and the absence of paid work and the non-adoption of measures to reduce salt intake in the diet. Therefore, the need for knowledge about these associated factors can be an important alternative for the individual targeting of this population.

Resumo

Objetivo: Avaliar os fatores associados ao ganho de peso interdialítico em usuários de serviços de hemodiálise em uma Região Metropolitana do Brasil.

Métodos: Estudo epidemiológico transversal envolvendo 1.024 indivíduos com doença renal crônica em hemodiálise no Brasil. O ganho de peso interdialítico foi avaliado pelo percentual de ganho de peso entre uma sessão de hemodiálise e outra. As variáveis incluídas na análise de regressão logística binária foram selecionadas considerando p< 0,10 no teste bivariado.

Resultados: Demonstramos que ter mais anos de estudo (OR=0,537;IC 95% = 0,310–0,931; p=0,027) e sobrepeso (OR=0,661;IC 95% = 0,461–0,948; p=0,024) ou obesidade (OR=0,387;IC 95% = 0,246–0,608; p=<0,001) reduziu as chances de os usuários apresentarem alto ganho de peso interdialítico. Usuários sem trabalho remunerado (OR=2,025; IC 95% = 1,218–3,365; p=0,007) e que não adotavam medidas para reduzir o sal (OR=1,694; IC 95% = 1,085–2,645; p=0,020) tiveram maiores chances de ganho de peso interdialítico.

Conclusão: Os resultados apontam para associação entre o aumento do ganho de peso interdialítico e a ausência de trabalho remunerado e a não adoção de medidas para reduzir a ingestão de sal na dieta. Portanto, o conhecimento sobre esses fatores associados pode ser uma alternativa importante para o direcionamento individualizado dessa população.

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Conflicts to interest: nothing to declare.

Resumen

Objetivo: Evaluar los factores asociados al aumento de peso interdialítico en usuarios de servicios de hemodiálisis en una región metropolitana de Brasil.

Métodos: Estudio epidemiológico transversal que incluyó 1.024 individuos con enfermedad renal crónica en hemodiálisis en Brasil. El aumento de peso interdialítico se evaluó mediante el porcentaje de aumento de peso entre una sesión de hemodiálisis y otra. Las variables incluidas en el análisis de regresión logística binaria fueron seleccionadas considerando p< 0,10 en la prueba bivariada.

Resultados: Se demostró que tener más años de estudio (OR=0,537;IC 95 % = 0,310–0,931; p=0,027) y sobrepeso (OR=0,661;IC 95 % = 0,461–0,948; p=0,024) u obesidad (OR=0,387;IC 95 % = 0,246–0,608; p=<0,001) redujo las chances de que los usuarios presenten un elevado aumento de peso interdialítico. Usuarios sin trabajo remunerado (OR=2,025; IC 95 % = 1,218–3,365; p=0,007) y que no adoptaban medidas para reducir la sal (OR=1,694; IC 95 % = 1,085–2,645; p=0,020) tuvieron más chances de aumento de peso interdialítico.

Conclusión: Los resultados señalan una relación entre el aumento de peso interdialítico y la ausencia de trabajo remunerado y la no adopción de medidas para reducir la ingesta de sal en la dieta. Por lo tanto, el conocimiento sobre estos factores asociados puede ser una alternativa importante para la orientación individualizada de esta población.

Introduction

Chronic kidney disease is considered to be a complex disease and recognized as one of the biggest public health problems in the world.[1,2] Chronic non-communicable diseases such as diabetes, arterial hypertension and obesity are important risk factors for the development of chronic kidney disease that contribute most to the increase in the global burden of disease, these being larger in developing countries.[3]

Among the treatments for chronic kidney disease, haemodialysis is the method of renal replacement therapy adopted by 92% of individuals with the disease.[4] Data from the 2020 Brazilian Dialysis Census indicate a 3.6% increase in individuals on chronic dialysis in 2020 compared to 2019.[5] In this scenario, the southeastern region of Brazil has the highest prevalence of dialysis users.[4]

The haemodialysis treatment requires controlling weight gain between sessions.[6] Interdialytic weight gain (IDWG) is related to an increased risk of morbidity and mortality[7] and cardiovascular complications, as well as reduced quality of life.[8,9] These facts are important as epidemiological data show significant increases in the number of individuals on haemodialysis who have IDWG above the recommended level, making it important to investigate the factors involved in IDWG for populations on dialysis.

Studies indicate that high IDWG can cause complications such as hypertension, acute pulmonary oedema, increased morbidity and even mortality from all cardiovascular causes.[7,10,11] As recommended by the guidelines for chronic kidney disease, the IDWG between haemodialysis sessions should be 2–4% in relation to dry weight.[7]

The main cause of high IDWG is the excessive intake of liquids and/or food. However, it is estimated that 30–60% of individuals on haemodialysis do not adhere to a regimen of fluid restriction.[9,12-14] Several factors may be related to this lack of adherence to fluid restriction, such as: lack of knowledge or understanding of what was provided by health professionals; insufficient support from family and/or friends; psychological issues; reduced ability to assess their fluid and/or salt intake;[9,12,14] feeling thirsty; xerostomia;[15] age; time on haemodialysis;[16] education;[6] nutritional status; and eating habits.[10]

Thus, given the relevance of knowledge on the factors that can influence IDWG, the study aimed to evaluate the factors associated with interdialytic weight gain in users of haemodialysis services in a metropolitan region of Brazil.

Methods

This is a cross-sectional epidemiological census that collected data in all hemodialysis centers in a metropolitan region in southeastern Brazil in 2019 according to previous studies published.[6,14] The study involved males and females aged over 18 years undergoing haemodialysis who met the following inclusion criteria: confirmed diagnosis of chronic kidney disease and on haemodialysis therapy for at least 3 months. The following individuals were excluded from study: individuals hospitalized, under contact precaution, those with ascites, those trans-

ferred to other hemodialysis units not belonging to the research region and those who had limitations to answer the questionnaire and/or perform the anthropometric assessment.

Initially, 1,416 haemodialysis users were included during the data collection period, but 304 (22.5%) of these were excluded for not meeting the inclusion criteria: 137 were on contact precautions, 67 were hospitalized, 40 were unable to answer the questionnaire, 19 had hearing and speech impairments, 19 had physical difficulties, 15 died and 7 were transferred to other haemodialysis units. The refusal rate was only 2.2% (n = 23) and 1.024 users finally completed the survey.

Data collection took place between February and September 2019 in 11 dialysis centers. A semi-structured questionnaire was applied by previously trained researchers on sociodemographic, clinical, lifestyle and eating habits. After the end of the dialysis session, an anthropometric assessment was performed and pre-dialysis and post-dialysis weights were collected from the medical records, covering 15 haemodialysis sessions.

In this study, the IDWG was calculated from the sum of the difference between the entry weight and the output weight of 15 haemodialysis sessions, using the following formula for the average IDWG: Pre-haemodialysis weight of the current day – Post-haemodialysis weight from the previous day ÷ Number of sessions. The relative IDWG was obtained by the ratio between the average IDWG and the respective dry weight according to the formula: Average IDWG ÷ Dry weight x 100. The IDWG was considered 'adequate' when the mean IDWG was less than or equal to 4% and 'high' when it was greater than 4% of the dry weight.[2]

Independent variables included sociodemographic variables (gender, age group, marital status, education, race/color, family income, profession and type of care), lifestyle (smoking, alcohol intake and physical activity), clinical characteristics (length of chronic kidney disease, duration of haemodialysis replacement therapy and number of medications), eating habits (consumption of salt) and nutritional status (body mass index: BMI).

The variables related to life habits were self-reported. Smoking was categorized as 'no' (those who never smoked), 'ex-smoker' and 'yes'. The habit of consuming alcoholic beverages was categorized as 'yes' or 'no'. To assess physical activity, the World Health Organization classification was used: 'yes' for individuals who reported physical activity within the recommended range (i.e. at least 30 minutes of physical activity per day on at least 5 days per week, of moderate intensity, performed continuously or cumulatively), 'sometimes' for individuals who exercised below the recommended level; and 'no' for those who did not perform any type of physical activity.

To assess nutritional status, the BMI calculated from dry weight (kg) and height (m) was calculated using the formula: BMI = Weight/Height^2. The following cut-off points were used to classify individuals according to their BMI (kg/m^2): < 18.5, thinness; 18.5–24.9, eutrophy; 25.0–29.9, overweight; and ≥30.0, obesity.

Regarding eating habits, information regarding the consumption of salt was assessed through the question: 'Have you taken any measures to reduce your salt consumption?'. The answers were categorized as 'yes' or 'no'. This information is important, as failure to adopt measures to reduce salt intake increases the chances of an individual having a high IDWG, in addition to increased sodium intake being associated with mortality on dialysis.[9]

Descriptive analyses included absolute values and percentages. To test the associations between qualitative variables, the chi-square test (x^2) was used. When the expected values in the table cells were less than 5 or when the sum of the column values was less than 20, Fisher's exact test was used. The crude and adjusted binary logistic regression model was used to investigate the association between the independent variables and the IDWG. The variables included in the binary logistic regression analysis were selected by considering $p < 0.10$ in the bivariate tests. The 'Enter' variable selection method with the likelihood ratio test was used. The assumptions of absence of multicollinearity, minimum sample size for the number of model variables, absence of outliers and model quality were evaluated using the Hosmer and Lemeshow test.

Data were organized and analyzed using the statistical program IBM SPSS Statistics for Windows,

version 22.0 (Armonk, NY: IBM Corp) and the significance level adopted was $\alpha \leq 5\%$.

The study was approved by the university's ethics and research. The individuals' participation was voluntary and consent was given in writing by signing the free and informed consent form. During data collection and analysis, the principles of confidentiality and privacy were guaranteed. The development of the study complied with national ethical standards involving studies with human beings (4.178.200 – CAAE: 68528817.4.0000.5060).

Results

The study population consisted of 1024 individuals comprised mostly males (n = 581; 56.4%) aged 30–59 years (n = 528; 51.5%). There was also a predominance of participants who lived with a partner (n = 570; 55.7%), had eight years of schooling or less (n = 523; 51.6%), declared themselves to be brown skinned (n = 496; 49.1%) and had an income of less than or equal to two minimum wages per month (n = 555; 56.2%). Of the total, 75.7% (n = 774) used the United Health System, which is the public healthcare system in Brazil (Table 1). Regarding lifestyle habits, 5.2% (n = 53) were smokers, 9.3% (n = 95) were alcoholics and 77.6% (n = 794) were not physically active. Regarding clinical history, 48.5% (n = 494) had chronic kidney disease for at least 5 years and 38.1% (n = 368) had undergone haemodialysis for 2 years, using five or more medications (29.6%; n = 280). A total of 30.5% (n = 311) showed high IDWG. The majority (n = 888; 87.8%) reported adopting measures aimed at reducing sodium consumption (Table 1).

Table 1. Sociodemographic characterization, life habits, clinical history, eating habits and nutritional status of users of hemodialysis services

Variables	n(%)
Gender (n=1.024)	
Female	443(43.3)
Male	581(56.7)
Age Group (n=1.024)	
19 to 29 years	59(5.8)
30 to 59 years	528(51.5)
60 years or older	437(42.6)
Marital Status (n=1.024)	
With partner	570(55.7)
Without partner	454(44.3)
Schooling (n=1.013)	
≤ 8 years of study	523(51.6)
> 8 a ≤ 11 years of study	332(32.8)
> 11 years of study	158(15.6)
Color/Race (n=1.011)	
White	274(27.1)
Black	241(23.8)
Brown	496(49.1)
Income (n=998) †	
≤ 2 minimum wages	555(56.2)
> 2 minimum wages	433(43.8)
Occupation (n=1.009)	
With work activity	348(34.5)
Old-age pensioner or away due to illness	547(54.2)
Without paid work	114(11.3)
Assistance modality (n=1.023)	
Public	774(75.7)
Private	224(21.9)
Mixed	25(2.4)
Smoking (n=1.018)	
No	593(58.3)
Ex smoker	372(36.5)
Yes	53(5.2)
Alcohol intake (n=1.024)	
No	929(90.7)
Yes	95(9.3)
Physical Activity Level (n = 1.023)	
Within the recommended	118(11.5)
Below recomendado	111(10.9)
Does not practice physical activity	794(77.6)
Time of chronic kidney disease (n=1.019)	
< 5 years	525(51.5)
≥ 5 years	494(48.5)
Time of renal replacement therapy (n=967)	
0 to 2 years	368(38.1)
3 to 5 years	252(26.1)
6 to 10 years	198(20.5)
Over 10 years	149(15.4)
Medicines used (n=947)	
< 5 medicines	667(70.4)
≥ 5 medicines	280(29.6)
Adopts measures to reduce salt (n=1.011)	
Yes	888(87.8)
No	123(12.2)
BMI (n=1.023)	
< 18.5 kg/m²	62(6.1)
18.5 to 24.9 kg/m²	461(45.1)
25 to 29.9 kg/m²	306(29.9)
> 30 kg/m²	194(19.0)
Interdialytic weight gain (n=1.020)	
Adequate	709(69.5)
High	311(30.5)

BMI - body mass index; † - The minimum wage is the lowest wage a company can pay an employee according to the number of hours worked. It is established by law and is re-evaluated every year based on the cost of living of the population, its creation was based on the minimum amount a person spends to ensure their survival. In the year 2019 a minimum wage was R$ 998

The highest IDWG was seen among the youngest (19–29 years; p = 0.014), those who self-reported being black (p = 0.009), with public healthcare (p = 0.004), alcohol intake (p = 0.046), who had a longer haemodialysis treatment (p = 0.012), who did not adopt measures to reduce salt consumption (p = 0.002) and who were eutrophic (p = 0.000) (Table 2).

After multiple analyses (Table 3), the education and occupational situation of these individuals, the habit of adopting measures to reduce salt consumption and their nutritional status remained associated with IDWG. It can be observed that having more than 11 years of schooling, compared to those who had less than 8 years of study, reduced the chances of users having high IDWG by 46.3% (OR = 0.537; 95%CI = 0.310–0.931; p = 0.027). In relation to those who had work, not having paid work practically doubled these chances (OR = 2.025; 95%CI = 1.218–3.365; p = 0.007). In addition, not adopting measures to reduce salt increased the chances of high IDWG in participants by 69.4% (OR = 1.694; 95%CI = 1.085–2.645; p = 0.020) in relation to those who reported adopting measures to control salt intake. In relation to BMI, being overweight (OR = 0.661; 95%CI = 0.461–0.948; p = 0.024) or obese (OR = 0.387; 95%CI = 0.246–0.608; p = <0.001) reduced the chances of users having increased IDWG by 33.9% and 61.3%, respectively, compared with eutrophic individuals.

Discussion

The IDWG in haemodialysis is influenced by several factors and in our study we identified an association with socioeconomic, lifestyle and nutritional predictors. Among these, a low level of schooling and the absence of paid work, in addition to simple measures such as not adopting measures to reduce salt and excess weight according to the BMI, are important factors associated with IDWG.

In the present investigation, it was possible to identify that 30.5% of haemodialysis users had high

Table 2. Distribution of sociodemographic data, life habits, clinical history, eating habits and nutritional status according to interdialytic weight gain of users of hemodialysis services

Variables	IDWG		p-value
	Adequate n(%)	High n(%)	
Gender (n=1.024)			0.681*
Female	304(68.8)	138(31.2)	
Male	405(70.1)	173(29.9)	
Age Group (n=1.024)			0.014
19 to 29 years	35(59.3)	24(40.7)	
30 to 59 years	353(67.0)	174(33.0)	
60 years or older	321(74.0)	113(26.0)	
Marital Status (n=1.024)			0.682*
With partner	391(69.0)	176(31.0)	
Without partner	318(70.2)	135(29.8)	
Schooling (n=1.013)			0.078
≤ 8 years of study	352(67.7)	168(32.2)	
> 8 a ≤ 11 years of study	229(69.0)	103(31.0)	
> 11 years of study	121(77.1)	36(22.9)	
Color/Race (n=1.011)			0.009
White	208(76.5)	64(23.5)	
Black	155(64.3)	86(35.7)	
Brown	339(68.6)	155(31.4)	
Income (n=998)			0.094*
≤ 2 minimum wages	373(67.3)	181(32.7)	
> 2 minimum wages	311(72.3)	119(27.7)	
Occupation (n=1.009)			0.063
With work activity	240(69.0)	108(31.0)	
Old-age pensioner or away due to illness	389(71.6)	154(28.4)	
Without paid work	69(60.6)	45(39.5)	
Assistance modality (n=1.023)			0.004
Public	516(66.9)	255(33.1)	
Private	170(76.2)	53(23.8)	
Mixed	22(88)	3(12.0)	
Smoking (n=1.018)			0.426
No	411(69.3)	182(30.7)	
Ex smoker	260(70.5)	109(29.5)	
Yes	32(61.5)	20(38.5)	
Alcohol intake (n=1.024)			0.046*
No	652(70.5)	273(29.5)	
Yes	57(60.0)	38(40.0)	
Physical Activity Level (n = 1.023)			0.492
Within the recommended	81(69.8)	35(30.2)	
Below recomendado	71(64.5)	39(35.5)	
Does not practice physical activity	556(70.1)	237(29.9)	
Time of chronic kidney disease (n=1.019)			0.221*
< 5 years	373(71.2)	151(28.8)	
≥ 5 years	332(67.6)	159(32.4)	
Time of renal replacement therapy (n=967)			0.012
0 to 2 years	273(74.6)	93(25.4)	
3 a 5 years	181(71.8)	71(28.2)	
6 to 10 years	126(64.0)	71(36.0)	
Over 10 years	94(63.1)	55(36.9)	
Medicines used (n=947)			0.588*
< 5 medicines	460(69.2)	205(30.8)	
≥ 5 medicines	199(71.1)	81(28.9)	
Adopts measures to reduce salt (n=1.011)			0.002*
Yes	631(71.3)	254(28.7)	
No	70(56.9)	53(43.1)	
BMI (n=1.023)			<0.001
< 18.5 kg/m²	286(62.4)	172(37.6)	
18.5 to 24.9 kg/m²	43(69.4)	19(30.6)	
25 to 29.9 kg/m²	222(72.8)	83(27.2)	
> 30 kg/m²	158(81.4)	36(18.6)	

IDWG - interdialytic weight gain; BMI - body mass index

Table 3. Multiple analysis according to interdialytic weight gain of users of hemodialysis services

Variables	Crude				Adjusted			
	p-value	OR	$CI_{95\%}$ Under	$CI_{95\%}$ Upper	p-value	OR	$CI_{95\%}$ Under	$CI_{95\%}$ Upper
Age Group (n=1.024)								
19 to 29 years		1				1		
30 to 59 years	0.240	0.719	0.415	1.246	0.309	0.704	0.358	1.384
60 years or older	0.020	0.513	0.293	0.900	0.078	0.526	0.257	1.075
Schooling (n=1.013)								
≤ 8 years of study		1				1		
> 8 a ≤ 11 years of study	0.695	0.942	0.701	1.268	0.375	0.847	0.587	1.222
> 11 years of study	0.026	0.623	0.412	0.944	0.027	0.537	0.310	0.931
Color/Race (n=1.011)								
White		1				1		
Black	0.003	1.803	1.227	2.649	0.237	1.308	0.838	2.041
Brown	0.022	1.486	1.059	2.085	0.415	1.178	0.794	1.748
Income (n=998)								
≤ 2 minimum wages		1				1		
> 2 minimum wages	0.092	0.789	0.598	1.039	0.336	1.192	0.833	1.707
Occupation (n=1.009)								
With work activity		1				1		
Old-age pensioner or away due to illness	0.393	0.880	0.656	1.180	0.613	0.915	0.649	1.290
Without paid work	0.097	1.449	0.934	2.248	0.007	2.025	1.218	3.365
Assistance modality (n=1.023)								
Public		1				1		
Private	0.008	0.631	0.448	0.889	0.252	0.776	0.502	1.198
Mixed	0.038	0.276	0.082	0.931	0.089	0.269	0.059	1.220
Smoking (n=1.018)								
No		1				1		
Ex smoker	0.036	1.592	1.031	2.458	0.247	1.350	0.812	2.244
Alcohol intake								
No		1				1		
Yes	0.036	1.592	1.031	2.458	0.177	1.413	0.856	2.331
Time of renal replacement therapy (n=967)								
0 to 2 years		1				1		
3 to 5 years	0.444	1.151	0.802	1.653	0.520	1.138	0.768	1.685
6 to 10 years	0.008	1.654	1.138	2.405	0.221	1.300	0.853	1.981
Over 10 years	0.009	1.718	1.143	2.582	0.151	1.393	0.886	2.191
Adopts measures to reduce salt (n=1.011)								
Yes		1				1		
No	0.001	1.881	1.279	2.765	0.020	1.694	1.085	2.645
BMI (n=1.023)								
< 18.5 kg/m²	0.291	0.735	0.415	1.302	0.342	0.735	0.389	1.387
18.5 to 24.9 kg/m²		1				1		
25 to 29.9 kg/m²	0.003	0.622	0.454	0.852	0.024	0.661	0.461	0.948
> 30 kg/m²	<0.001	0.379	0.252	0.570	<0.001	0.387	0.246	0.608

BMI - Body Mass Index; Crude and adjusted binary logistic regression. Variables with significance of up to 10% were included in the model ($p < 0.1$) in the bivariate tests. Hosmer and Lemeshow test: 0.232. R squared Nagelkerke: 0.115. OR: Odds Ratio; $CI_{95\%}$: Confidence interval of 95%

IDWG, a result similar to that found by other studies.[10,17,18] These findings are worrisome and need to be highlighted because there is a proven relationship between high IDWG and the resulting complications, such as arterial hypertension, myocardial infarction, severe cerebrovascular events, congestive heart failure and even death.[19-21] Futhermore, it is important to clarify that the removal of this excess fluid during haemodialysis sessions can result in discomfort in the form of episodes of muscle cramps, nausea, headache and hypotension.[9]

The brown color, prevalent in the study, also predominates in most studies carried out in Brazil with individuals on hemodialysis[1-3] and it may result both from social and economic issues and from its relationship with the higher prevalence of systemic arterial hypertension in people with black and brown skin color,[8] considering that it can be

both a basic disease for the development of CKD and a consequence of hemodialysis.[5]

In addition, younger individuals were those with the highest IDGP, corroborating the findings of Yu et al.[9] and Jalalzadeh et al.[10] which suggest that younger individuals, who are metabolically more active, drink more fluids due to increased physical and social activity, which implies higher IDWG. On the other hand, with advancing age, several physiological changes occur, including a decrease in the sensitivity of osmoreceptors, which can have repercussions on the decrease in the sensation of thirst and, thus, affect fluid intake in the elderly.[9]

In our study, we found that individuals who consume alcohol are the ones with the highest IDWG. This can be explained by the fact that alcohol compromises excretory, regulatory and endocrine functions, in addition to leading to excessive fluid intake.[12] It is verified in the literature that individuals who spend more time on dialysis tend to have less diuresis or anuria, which can have a direct impact on interdialytic weight gain,[13] this corroborates our results and other studies on dialysis.[9,13] Added to this, it appears that the fact that the treatment has dietary restrictions and is lifelong are complementary factors that make it difficult for individuals to maintain long-term nutritional treatment.[14]

When evaluating the factors associated with excess IDWG in this population, it was observed that individuals with more than 11 years of schooling had less chance of high IDWG, which is similar to the results found in another study that evaluated adherence to fluid restrictions in 200 individuals on haemodialysis.[18-22] The relationship between education and treatment adherence is widely analysed, given that findings in the literature show that individuals with higher levels of education have better general adherence to the treatment of chronic non-communicable diseases.[23] The little access to information associated with the level of education has a negative influence, promoting precarious and unfavourable conditions for life and the treatment of chronic kidney disease.[3]

As we identified in our study, hemodialysis can lead to changes in the routine of individuals, especially in work activities. Due to the difficulty in maintaining an adequate working day, as there may be conflicts with the schedules of dialysis sessions. In addition to displacements to perform the treatment in a city other than their residence. As a result, most individuals with CKD on hemodialysis do not engage in paid work and, when they do, they need specific hours and understanding from the employer.[16]

Nerbass et al.,[24] in their study with 147 individuals on haemodialysis, identified that individuals with a lower level of literacy reported greater difficulty in controlling sodium intake and consequently greater difficulty in controlling IDWG. Based on this information, it is suggested that in order to be more effective in food interventions it is necessary to provide a support network, with the inclusion of people involved in the social circle of the individual undergoing haemodialysis, in addition to the use of individual and appropriate materials for effective transfer of the necessary health and nutrition information.[25]

The IDWG depends mainly on the fluid and sodium intake;[26] this fact is in line with the findings of our study, in which the non-adoption of measures to reduce salt consumption increased the chances of the service user having high IDWG and thus sodium intake is considered to be an independent predictor of mortality in dialysis individuals.[27]

Another study carried out in Brazil reported that 58% of haemodialysis users had salt intake above the recommended level, deriving mainly from additional salt and seasonings containing salt.[8] The results of Nerbass et al.[8] also showed that there was an adverse association between IDWG and blood pressure, pointing out that interventions are needed to increase the adherence to salt restriction in these individuals. As well as Nerbass et al.,[8] other authors also found little adherence to the recommendation for controlling sodium intake.[28] Such a recommendation is important for the control of fluid intake because it is the main stimulus for osmometric thirst, produced by an increase in osmotic pressure of the interstitial fluid in relation to the intracellular medium, resulting in the sensation of thirst and consequently fluid intake.[29]

Regarding BMI, both overweight and obesity were positively associated with a reduction in

IDWG. The same association was found in the evaluation by Nerbass et al.;[6] these authors also found an association between high BMI and lower IDWG, with the malnourished group being the one that remained associated with high IDWG. The authors also cite a preference for liquid or semi-liquid foods in individuals with malnutrition in order to justify the increase in IDWG in this group. Thus, the evidence suggests that overweight can be considered beneficial for individuals on haemodialysis due to the association with reduced risk of morbidity and mortality.[30]

In a longitudinal study with 134 individuals on haemodialysis, it was shown that the higher the IDWG, the better the prognosis of individuals with chronic kidney disease, suggesting that the beneficial effects of IDWG on nutritional status and prognosis are greater than the negative issues of the influence of IDWG on blood pressure.[31] In contrast, other studies[32] have found that the lowest IDWG occurs in individuals with adequate nutritional status or malnutrition. In addition, when evaluating the association between nutritional status and IDWG in individuals with chronic kidney disease, the authors found that a higher BMI was associated with higher IDWG.[18]

Based on the results of the present study, it can be highlighted that chronic kidney disease has a complex nature that requires health professionals to make adaptations in order to guarantee an education directed at the individual health contexts of each individual.[18] Thus, our results suggest that dietary advice, including fluid restriction and adherence to reduced salt consumption, among haemodialysis individuals should be directed at those users at risk, such as individuals with lower body weight, lower level of education and no paid work activities.

As a limitation of our study was the cross-sectional nature, therefore the causal relationship between the variables studied must be viewed with caution, in addition to not having addressed dialysis procedures (sodium dialysate, sodium profile, frequency and duration of treatment), as well as residual renal function. However, the study was carried out with the entire invited population of haemodialysis users and the percentage refusal was low from one of the states in southeastern Brazil, allowing the association of a variable of important clinical interest in this population. However, the clinical history progressed so that the data were not altered in the medical records, thus allowing analysis of the relationship to the patient's status on haemodialysis.

Conclusion

In view of the results presented, interpretation of the IDWG according to sociodemographic, clinical and nutritional indicators may be an alternative. The ability to distinguish between causes of high IDWG related to high fluid intake or dietary salt intake is the basis for clinical monitoring of individuals on haemodialysis, thus enabling relevant interventions either through questionnaires or food records. Individuals on haemodialysis should be constantly advised to limit their salt intake in order to help control thirst and consequently reduce their fluid intake. These results guide future strategies and interventions in the clinical treatment of individuals on haemodialysis for chronic kidney disease.

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Collaborations

Zanandreia M, Cattafesta M, Martins CA, Paixão MPCP, Soares FLP, Peterle FZ, Santos Neto ET and Salaroni LB contributed to study design, data analysis and interpretation, article writing, relevant critical review of intellectual content and approval of the final version to be published.

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