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The relationship between anemia and health-related QoL in patients with chronic kidney disease receiving hemodialysis treatment

Canan Emiroğlu[1], Ebru Gök Oğuz[2], Deniz Aylı[3]

[1]*Department of Family Medicine, Ankara Etlik City Hospital, Ankara, Turkiye*
[2]*Department of Nephrology, Ankara Etlik City Hospital, Ankara, Turkiye*
[3]*Department of Nephrology, Dışkapı Training and Research Hospital, University of Health Sciences, Ankara, Turkiye*

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ABSTRACT

Aims: Anemia is a frequent complication in hemodialysis patients and associated with a poor quality of life (QoL). Our goal was to examine the connection between anemia and health-related QoL (HR-QoL) in those with renal failure receiving hemodialysis treatment.

Methods: In this cross-sectional study, 128 subjects that underwent hemodialysis volunteered. Demographic, clinical, and laboratory parameters and QoL using SF-12 were assessed. Socio-demographic characteristics in patients with and without anemia according to hemoglobin value were compared. The scores obtained from the physical (PCS12) and mental subscales (MCS12) of the SF-health survey were compared with other variables (age, gender, education, smoking, marital status, co-morbidity, BMI, duration of hemodialysis, hemoglobin values). Regression analyses were conducted using PCS12 and MCS12 as the independent variables.

Results: There were 27 (21.1%) patients with Hb values between 10-11 and 38 (29.7%) patients with Hb values below 10. The findings of this study indicated that an early age (p=0.001) and higher education (p=0.009) were linked to improved QoL, while no association was found with anemia (p=0.228). Smoking was also found to be significant (p=0.01) for better scores. Univariate linear regression analysis was performed to evaluate the interaction or relationship between age and smoking. Smoking was found to be an effective risk factor in patients younger than 65 years, but not in patients older than 65 years. The comparison of socio-demographic characteristics between patients with and without anemia revealed that married patients exhibited statistically significant higher hemoglobin levels (p=0.001).

Conclusion: A notable association was identified between the physical aspect of the SF-12 survey and both younger age and higher educational level, whereas no such relationship was observed for the mental aspect. The findings indicated that younger individuals with higher education levels experienced an improved physical QoL. However, no link has been found between anemia and QoL.

Keywords: Chronic kidney disease, chronic renal failure, hemodialysis, anemia, health-related quality of life

INTRODUCTION

Chronic kidney disease (CKD) represents a significant global health issue. A meta-analysis suggests that around 13.4% of the global population is affected by CKD, with 79% of these individuals being in the advanced stages of the condition (stage 3-5).[1] The incidence of CKD is rising swiftly in both Western nations and Turkiye, which is driven by the aging population and the increasing rates of heart disease, metabolic syndrome, diabetes, and hypertension.[1,2]

Hemodialysis treatment is vital in patients with end-stage CKD, and is mostly used in people who have no chance of organ transplantation or who cannot receive peritoneal dialysis treatment. According to the statistics of the Turkish Society of Nephrology as of 2024, over 68.000 patients in our country are receiving dialysis treatment for end-stage renal failure. Of these patients, 64.300 were treated with hemodialysis, 3.250 were treated with peritoneal dialysis, and 1.300 were treated with home hemodialysis.[1,2]

Anemia frequently occurs in CKD and serves as a distinct risk factor that negatively impacts health-related quality of life (HR-QoL).[3] Anemia in CKD is mainly attributed to a relative lack of erythropoietin, a hormone primarily synthesized by the kidneys in adults. Additionally, factors such as reduced red blood cell lifespan and iron deficiency further exacerbate anemia associated with CKD.[4,5] Iron deficiency in CKD patients is categorized into absolute and functional iron deficiency. Absolute iron deficiency has significantly

Corresponding Author: Canan Emiroğlu, cananmemiroglu@gmail.com

diminished or nonexistent iron reserves in the body. Functional iron deficiency, characterized by the presence of normal or elevated total iron stores that cannot be utilized for the production of erythroid precursors, is necessary for erythropoiesis. This condition primarily arises from elevated hepcidin, which hinder the mobilization of iron reserves for the process of erythropoiesis. Iron metabolism is regulated by hepcidin, which is a 25-amino acid peptide released by the liver, with subsequent filtration and degradation occurring in the kidney.[3,6] In CKD, hepcidin levels rise and inversely correlate with the glomerular filtration rate (GFR).[6]

Iron deficiency anemia frequently occurs in patients with CKD due to reduced iron absorption and heightened iron loss, regardless of whether they are undergoing dialysis therapy.[3,4,6] Anemia, a complication of chronic renal failure, is associated with decreased QoL[5], and increased mortality and morbidity.[7]

Current treatment strategies involve the use of oral/intravenous iron and erythropoiesis-stimulating agents (ESAs), with the recent addition of hypoxia-inducible factor prolyl hydroxylase inhibitors (HIF-PHIs), thereby expanding the range of therapeutic options available. Since it is treatable, we wanted to draw attention to the importance of anemia in hemodialysis patients. The goal of this report was to investigate the relationship for anemia and HR-QoL in CKD subjects undergoing hemodialysis.

METHODS

This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Informed consents of all patients were obtained before administration of the QoL scale. The study was conducted with the permission of Ankara Etlik City Hospital Scientific Researches Evaluation Ethics Committee (Date: 31.01.2024 Decision No: AEŞH-BADEK-2024-054).

In this observational study of a cross-sectional and descriptive nature, the medical histories and examination documentation, along with the results of blood tests, were meticulously analyzed from the records of 128 patients who participated in the hemodialysis unit at a tertiary hospital and Ankara Hemodialysis Center during the period from February 1, 2024, to May 31, 2024.

Participants in the study were individuals aged 18 years and above who underwent two or three hemodialysis sessions weekly. Exclusions were made for patients with cognitive impairments, those on continuous tube feeding, individuals in the acute phase of illness, hospitalized patients, and those who had experienced a stroke. As this was a descriptive study, no sampling was conducted.

We evaluated the patients based on their demographics, marital status, level of education, and smoking status. Anthropometric measurements were taken, which included height in centimeters and weight in kilograms. BMI was determined by dividing weight (kg) by height squared (m2) and obesity was determined as BMI≥24.0 kg/m2.[8] Hemodialysis year and comorbidities were recorded. The laboratory data obtained from medical records included hemoglobin (Hb), mean corpuscular volume (MCV), ferritin, iron levels, total iron binding capacity (TIBC), transferrin saturation (TSAT), as well as B12, and folic acid. According to the Kidney Disease Improving Global Outcomes (KDIGO) clinical practice guidelines, anemia of CKD is defined as Hb<13 mg/dl for men and <12 mg/dl for women.[9] Since the same guidelines generally recommend that erythropoiesis-stimulating agent (ESAs) should not be used to maintain an Hb concentration above 11.5 g/dl (115 g/L) in adult patients with CKD, anemia was defined as Hb<11.5 g/dl in this study. Anemic patients exhibiting serum ferritin below 50 ng/ml were classified as having "absolute iron deficiency anemia." In contrast, those with ferritin levels exceeding 50 ng/ml underwent evaluation of serum iron, TIBC, and TS. Anemic individuals presenting with normal serum iron levels (greater than 60 µ/dl), normal or reduced TIBC ranging from 250 to 450 µg/dl, and normal TS levels above sixteen percent were categorized as having "unknown anemia." Those exhibiting ferritin levels exceeding 100 ng/ml, along with reduced TS and reduced total iron-binding capacity, were classified as having "anemia of chronic disease".[10,11]

QoL was assessed using SF-12.[12] The validity and reliability assessment of this scale in Turkiye was carried out by Soylu and Küçük[13] from the Department of Psychology at Ege University, Faculty of Literature. This questionnaire serves as a standardized tool for assessing physical (PCS12) and mental (MCS12) health across eight distinct areas: physical function, limitations in roles due to physical health issues, pain, overall health, vitality (energy and fatigue), social function, limitations in roles due to emotional challenges, and mental health (psychological distress and well-being). The SF-12, which is a condensed version of the SF-36, comprises only 12 items. These items are divided into two categories—physical and mental—each containing six items. Quality of life (QoL) scores for these domains range from 0 to 100, with higher scores indicating better QoL.

A power analysis was performed to determine whether the sample size of 128 patients was sufficient to determine the effect size and the power of the study was 0.96. Since this value was greater than 0.80, it was concluded that the power of the study was sufficient.

Statistical Analysis

Statistics were conducted with SPSS v11.5 (SPSS Inc., USA). Descriptive statistics were presented as mean±standard deviation or median (minimum–maximum) for continuous variables, and frequency (percentage) for categorical variables. The Shapiro-Wilk test was used to assess the normality of distribution for the PCS12 and MCS12 component summary scores. Both PCS12 and MCS12 scores were found to deviate from normal distribution. Therefore, non-parametric comparisons between groups were performed using the Mann-Whitney U test. Categorical variables were compared using Chi-square or Fisher's exact tests as appropriate. Univariate and multivariate linear regression analyses were conducted to determine the association between independent variables and PCS12 or MCS12 scores. A two-tailed p-value <0.05 was considered statistically significant. In addition, a post-hoc power analysis was performed to evaluate whether the sample size (n=128) was adequate to detect a clinically meaningful

difference. Assuming a medium effect size (Cohen's d=0.5), an alpha level of 0.05, and using a two-tailed test, the calculated statistical power was 0.88. Since this exceeds the commonly accepted threshold of 0.80, the sample size was considered sufficient for detecting moderate effects in PCS12 and MCS12 scores.

RESULTS

The comparison of socio-demographic characteristics in patients with and without anemia according to Hb value is given in Table 1.

In the study, there were 27 (21.1%) patients with Hb values between 10-11, and 38 (29.7%) patients with Hb values below 10. In addition, there were 68 (87.2%) males with Hb less than 13 and 42 (84.0%) females with Hb less than 12.

When serum iron, TIBC and ferritin of 122 patients with anemia were examined, results were consistent with 'absolute iron deficiency' in three patients, 'anemia of unknown cause' in 10 patients and 'anemia of chronic disease' in the other 109 patients were obtained.

All parameters analyzed from these patients are shown in Table 2.

Table 2. Laboratory values recorded for the study sample

Variables	Total		
	n (%)	Mean±SD	Median (min.-max.)
Hb	128 (100.0)	10.83±1.75	10.95 (5.60-15.00)
MCV	128 (100.0)	94.06±6.77	94.80 (75.50-118.00)
Serum iron	122 (95.3)	49.02±23.29	46.00 (8.00-117.00)
SIBC	122 (95.3)	162.49±52.17	157.50 (60,00-315.00)
TSAT	122 (95.3)	33.98±20.35	30.10 (4.80-94.30)
Ferritin	123 (96.1)	550.77±280.80	612.00 (15.40-1209.00)
Vitamin B12	32 (25.0)	507.31±323.45	400.00 (155.00-1471.00)
Folic acid	116 (90.6)	9.71±38.89	5.55 (1.70-424.00)
Vitamin D	7 (5.5)	26.73±25.14	18.00 (6.34-76.00)

SD: Standard deviation, Hb: Hemoglobin, Min: Minimum, Max: Maximum, SIBC: Serum iron binding capacity, TSAT: Transferrin saturation, MCV: Mean corpuscular volume

In Table 3, the scores obtained from PCS12 and MCS12 of the SF-health survey were compared with other variables. Significant differences for age and smoking (p=0.004 and p=0.008) were found for PCS12. The PCS12 scores for patients less than 65 years of age were significantly higher than those aged 65 and older. The PCS12 score of smoking subjects was increased compared to non-smokers.

Table 1. Characteristics of the study sample according to hemoglobin level

Variables		Total	Hb <11.5	Hb ≥11.5	p value
		n (%)	n (%)	n (%)	
Age	<65	78 (60.9)	46 (60.5)	32 (61.5)	0.908[a]
	≥65	50 (39.1)	30 (39.5)	20 (38.5)	
Gender	Female	50 (39.1)	30 (39.5)	20 (38.5)	0.908[a]
	Male	78 (60.9)	46 (60.5)	32 (61.5)	
Smoking	No	104 (81.2)	59 (77.6)	45 (86.5)	0.205[a]
	Yes	24 (18.8)	17 (22.4)	7 (13.5)	
Marital status	Single	41 (32.0)	34 (44.7)	7 (13.5)	<0.001[a]
	Married	87 (68.0)	42 (55.3)	45 (86.5)	
Education	Illiterate	20 (15.6)	13 (17.1)	7 (13.5)	0.622[b]
	Literate	2 (1.6)	2 (2.6)	0 (0.0)	
	Primary school	41 (32.0)	22 (28.9)	19 (36.5)	
	Secondary school	12 (9.4)	9 (11.8)	3 (5.8)	
	High school	34 (26.6)	18 (23.7)	16 (30.7)	
	University	19 (14.8)	12 (15.9)	7 (13.5)	
BMI	<24	60 (46.9)	38 (50.0)	22 (42.3)	0.392[a]
	≥24	68 (53.1)	38 (50.0)	30 (57.7)	
Duration of hemodialysis	<5	72 (56.2)	45 (59.2)	27 (51.9)	0.414[a]
	≥5	56 (43.8)	31 (40.8)	25 (48.1)	
Comorbidity	No	44 (34.4)	23 (30.3)	21 (40.4)	0.236[a]
	Yes	84 (65.6)	53 (69.7)	31 (59.6)	
Hypertension	No	71 (55.5)	41 (53.9)	30 (57.7)	0.675[a]
	Yes	57 (44.5)	35 (46.1)	22 (42.3)	
Type II DM	No	111 (86.7)	64 (84.2)	47 (90.4)	0.312[a]
	Yes	17 (13.3)	12 (15.8)	5 (9.6)	

Hb: Hemoglobin, BMI: Body-mass index, DM: Diabetes mellitus, a: Chi-Square test, b:Fisher-exact test

Table 3. Characteristics of the study sample according to SF-12 subscales

Variables		SF12			
		PCS12		MCS12	
		Median (min-max)	p value	Median (min-max)	p value
Age	<65	37.17 (24.24-56.19)	0.004[a]	40.08 (21.71-53.93)	0.912[a]
	≥65	35.44 (16.37-51.95)		38.71 (28.37-53.97)	
Gender	Female	36.15 (24.24-47.20)	0.510[a]	39.24 (24.91-53.45)	0.942[a]
	Male	37.02 (16.37-56.19)		39.00 (21.71-53.97)	
Smoking	No	36.15 (16.37-56.19)	0.008[a]	39.30 (21.71-53.97)	0.716[a]
	Yes	38.94 (25.77-54.80)		38.53 (25.01-53.93)	
Marital status	Single	36.53 (25.77-56.19)	0.363[a]	38.40 (25.01-53.93)	0.314[a]
	Married	36.43 (16.37-53.48)		39.45 (21.71-53.97)	
Education	Illiterate	36.47 (16.37-47.05)	0.053[a]	39.09 (27.59-52.67)	0.431[a]
	Literate	29.27 (24.24-34.30)		41.80 (30.15-53.45)	
	Primary school	35.70 (25.77-53.48)		38.62 (21.71-53.93)	
	Secondary school	34.50 (29.60-56.19)		37.66 (24.91-50.47)	
	High school	37.44 (26.53-54.80)		41.30 (29.62-53.97)	
	University	39.21 (30.25-52.42)		37.24 (30.60-48.25)	
BMI	<24	36.38 (24.24-54.80)	0.357[a]	37.15 (21.71-53.97)	0.082[a]
	≥24	36.63 (16.37-56.19)		40.38 (27.59-52.67)	
Duration of hemodialysis	<5	36.15 (24.24-56.19)	0.770[a]	38.95 (21.71-53.45)	0.781[a]
	≥5	37.16 (16.37-52.87)		39.45 (25.47-53.97)	
Comorbidity	No	37.60 (25.77-53.48)	0.162[a]	40.28 (25.47-50.47)	0.710[a]
	Yes	36.08 (16.37-56.19)		38.68 (21.71-53.97)	
Hb	<11.5	36.83 (24.24-56.19)	0.304[a]	38.50 (25.01-53.97)	0.509[a]
	≥11.5	36.29 (16.37-52.87)		40.27 (21.71-51.97)	

PCS12: Scores obtained from the physical, MCS12: Mental subscales, Min: Minimum, Max: Maximum, Hb: Hemoglobin, BMI: Body-mass index, a: Mann-Whitney U test

Predictor variables for PCS12 were analyzed in Table 4. Age, smoking and educational status were significant (p=0.001, p=0.010 and p=0.009). The PCS12 score for those less than 65 years of age was 3.704 points more compared to patients aged 65 and over. Age alone explained 7.8% of the change in PCS12 score. The PCS12 score of smokers was 3.767 points higher than that of non-smokers. Smoking alone explained 5.2% of the change in PCS12 score. Univariate linear regression analysis was performed to evaluate the effect of smoking in patients younger and older than 65 years of age. While smoking was found to be an effective risk factor in patients younger than 65 years of age, smoking was not found to be an effective risk factor in patients older than 65 years of age.

For each improvement in educational status, the PCS12 score increased by 0.928 units. In particular, PCS12 of literate subjects was 0.928 more than illiterate patients. The PCS12 score of primary school graduates was 0.928 points higher than that of literate patients. Education alone explained 5.3% of the variation in PCS12 score.

In Table 5; A multivariate linear regression model was constructed to evaluate the independent effects of age, smoking status, and educational level on PCS12 scores. The model demonstrated an R^2 value of 0.135, indicating that approximately 13.5% of the variance in physical QoL could be explained by these three variables. Being under the age of 65 was associated with a 2.90-point increase in PCS12 scores (p=0.008; 95% CI: -5.08 to -0.72), while current smoking was associated with a 2.80-point increase (p=0.045; 95% CI: 0.05 to 5.55). Additionally, each incremental increase in educational attainment was linked to a 0.75-point improvement in PCS12 scores (p=0.018; 95% CI: 0.10 to 1.40). These findings suggest that younger age, smoking status, and higher education levels

Table 4. Predictors of PCS12 using univariate regression analysis

Variables	β	SE	R^2	p value	95% CI for β	
					Lower bound	Upper bound
Age	-3.704	1.134	0.078	0.001	-5.948	-1.461
Gender	1.274	1.175	0.009	0.280	-1.052	3.600
Smoking	3.767	1.437	0.052	0.010	0.922	6.611
Marital status	-1.502	1.227	0.012	0.223	-3.931	0.927
Education	0.928	0.349	0.053	0.009	0.238	1.619
BMI	1.088	1.150	0.007	0.346	-1.188	3.365
Duration of hemodialysis	-0.395	1.161	0.001	0.734	-2.692	1.902
Comorbidity	-2.072	1.199	0.023	0.086	-4.444	0.301
Hb	-1.387	1.146	0.011	0.228	-3.654	0.880

PCS12: Scores obtained from the physical, SE: Standard error, CI: Confidence interval, Hb: Hemoglobin, BMI: Body-mass index

are independent predictors of better physical QoL among hemodialysis patients.

Table 5. Multivariate regression analysis for PCS12

Variables	β	SE	R^2	p value	95% CI (lower)	95% CI (upper)
Constant	35.1	1.3	0.135	<0.001	32.5	37.7
Age (<65)	-2.9	1.1		0.008	-5.08	-0.72
Smoking (yes)	2.8	1.4		0.045	0.05	5.55
Education (↑ each level)	0.75	0.33		0.018	0.1	1.4

PCS12: Scores obtained from the physical, SE: Standard error, CI: Confidence interval

In Table 6, the predictor variables for MCS12 were analyzed and none of the variables were statistically significant. Therefore, MLR analysis could not be performed.

Table 6. Predictors of MCS12 using univariate regression analysis

Variables	β	SE	R^2	p value	95% CI for β	
					Lower bound	Upper bound
Age	0.164	1.235	0.001	0.894	-2.281	2.609
Gender	-0.225	1.235	0.001	0.856	-2.669	2.220
Smoking	-0.608	1.543	0.001	0.694	-3.663	2.446
Marital status	1.335	1.286	0.008	0.301	-1.211	3.881
Education	0.242	0.375	0.003	0.520	-0.499	0.983
BMI	1.932	1.196	0.020	0.109	-0.434	4.299
Hemodialysis	0.575	1.214	0.002	0.637	-1.828	2.978
Comorbidity	-0.100	1.269	0.001	0.938	-2.611	2.412
Hb	0.341	1.205	0.001	0.777	-2.044	2.727

MCS12: Mental subscales, SE: Standard error, CI: Confidence interval, BMI: Body-mass index, Hb: Hemoglobin

DISCUSSION

The SF-12 instrument was employed to evaluate the influence of anemia on the QoL among patients undergoing hemodialysis. The findings indicated that younger age and greater educational achievement correlated with improved QoL, while anemia itself did not show a significant association. A review of existing literature reveals that hemodialysis patients with higher educational backgrounds tend to experience enhanced health-related QoL.[14-16] Another study showed that a higher level of education positively affects not only physical health quality but also mental health quality.[17] In a study conducted in Greece, similar to our results, it was shown that younger patients and patients of higher educational status presented better QoL scores.[18]

International guidelines for managing anemia associated with CKD recommend maintaining target Hb levels at or below 11.5 g/dl, while also allowing for personalized adjustments to slightly higher Hb targets to enhance QoL.[9] Since the publication of the 2012 KDIGO; anemia guideline which provided recommendations for the diagnosis and treatment of anemia related to CKD, new therapies for the treatment of anemia have emerged; therefore, a reevaluation of the 2012 KDIGO guideline was required. Following conferences starting in 2019 and continuing in December 2021, KDIGO reported in 2023 on the new evidence and its potential impact on anemia management in clinical practice.[19]

A recent meta-analysis of randomized trials indicates that erythropoietin-stimulating agent therapy aimed at achieving higher Hb levels does not lead to a significant enhancement in QoL.[20] Here, we found no association between anemia and QoL. Similar to the results of our study, there are studies showing no significant positive correlation between Hb values and QoL.[21] Conversely, there is a study showing that lower Hb values are associated with worse QoL scores.[22] When the patient socio-demographics for those with anemia and those without were compared, only married status was found to be statistically significant. The Hb values of the married patients statistically significantly higher and were on the non-anemic side. Since we could not find a study with similar characteristics in the literature, we could not make a comparison.

Since patients receiving hemodialysis treatment due to CKD are under constant doctor control and follow-up, Hb values can fluctuate very rapidly due to immediate intervention in case of anemia. This could be a contributing factor to the absence of a positive correlation between anemia and QoL.

A significant correlation was identified for smoking status of hemodialysis patients and their QoL. However, contrary to the results of a similar study in the literature, this relationship was in favor of smoking, that is, QoL scores were higher in smokers in our study. Research indicates that smoking is potentially linked to kidney failure, and individuals who smoke heavily tend to report markedly lower QoL scores.[23] We hypothesize that the findings in this study may be attributed to the observation that younger hemodialysis patients in better physical condition were also smokers. The findings of multivariate regression analysis for PCS12 suggest that younger age, smoking status, and higher education levels are independent predictors of better physical QoL among hemodialysis patients. These findings support our hypothesis.

The QoL of adult patients with CKD receiving hemodialysis was compared to a control group without comorbidities using the WHOQOL-BREF scale in a study conducted in Brazil. It was found that smoking negatively affected the perception of QoL of both groups.[24] In this study, it was shown that hemodialysis patients' perception of QoL was positively influenced by marital status-having a spouse-. In our study, Hb values were statistically significantly higher in married patients.

In another study, the 5-level EuroQol-5 Dimension (EQ-5D-5L) tool was applied to 887 CKD patients to measure HR-QoL.[25] In this study it was shown that older age, female sex, former and current smoking status were associated with lower mean EQ-5D-5L utility score.

Limitations

This study has limitations including a small patient population. A larger patient dataset would have enhanced the reliability of the findings. Additionally, the cross-sectional design precludes any causal inferences. Potential biases, such as reporting bias, may have influenced the results, particularly as QoL scores

were elevated among smokers. Another potential selection bias is that the study was conducted in a single-center dialysis unit and excluded patients with cognitive disabilities, which may limit generalizability. Another notable limitation is that SF-12 does not capture dialysis-specific QoL issues such as fatigue, vascular access pain, or post-dialysis recovery, which could have influenced the findings. The use of a dialysis-specific QoL instrument, such as the KDQOL-36, could provide a more comprehensive assessment. Although the regression models identified statistically significant predictors of PCS12 scores, the explained variance (R^2 values) in both models was relatively low (R^2=0.135). This indicates that the included variables account for only a small portion of the total variability in physical QoL scores. However, it is important to note that a low R^2 does not preclude statistical significance of individual predictors. In regression analysis, statistically significant p-values can still be observed for independent variables that show consistent effects, especially when the sample size is adequate. Therefore, while age, smoking, and educational status were found to be significant contributors to PCS12, the modest R^2 values suggest that additional factors—such as nutritional status, depression, physical activity, and dialysis-related clinical parameters—may also influence QoL and should be considered in future models to enhance explanatory power. However, it is considered to be valuable since one of the few similar studies conducted in our country.

CONCLUSION

In this report, our goal was to determine the link between QoL and anemia in CKD patients receiving hemodialysis treatment. A significant relationship as found between the physical domain of the SF-12 survey and younger age and higher education level, but not for mental domain. It was shown that early age and a higher level of education attainment were linked to improved physical QoL. No significant relationship was found between anemia and QoL. In the presence of a higher number of patients, we think it is necessary to evaluate the effect of anemia after adjustments according to age and gender. In multicenter and prospective studies, recording and following up on treatments received by hemodialysis patients related to anemia may provide more reliable data to determine the cause-and-effect relationship.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was conducted with the permission of Ankara Etlik City Hospital Scientific Researches Evaluation Ethics Committee (Date: 31.01.2024 Decision No: AEŞH-BADEK-2024-054).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Evans M, Lewis RD, Morgan AR, et al. A narrative review of chronic kidney disease in clinical practice: current challenges and future perspectives. *Adv Ther.* 2022;39(1):33-43. doi:10.1007/s12325-021-01927-z
2. https://www.aa.com.tr/tr/saglik/turk-nefroloji-dernegi-bobrek-hastaliklarina-ve-yayginligina-dikkati-cekti/3163411. (Accessed on 24.09.2024).
3. Hanna RM, Streja E, Kalantar-Zadeh K. Burden of anemia in chronic kidney disease: beyond erythropoietin. *Adv Ther.* 2021;38(1):52-75. doi:10.1007/s12325-020-01524-6
4. Pramod S, Goldfarb DS. Challenging patient phenotypes in the management of anaemia of chronic kidney disease. *Int J Clin Pract*. 2021;75(11):e14681. doi:10.1111/ijcp.14681
5. Van Haalen H, Jackson J, Spinowitz B, Milligan G, Moon R. Impact of chronic kidney disease and anemia on health-related quality of life and work productivity: analysis of multinational real-world data. *BMC Nephrol*. 2020;21(1):88. doi:10.1186/s12882-020-01746-4
6. Gafter-Gvili A, Schechter A, Rozen-Zvi B. Iron deficiency anemia in chronic kidney disease. *Acta Haematol*. 2019;142(1):44-50. doi:10.1159/000496492
7. Al-Jabi SW, Rajabi NS, Koni AA, Zyoud SH. A multicenter descriptive analysis of anemia management in hemodialysis patients and its association with quality of life. *BMC Nephrol*. 2023;24(1):197. doi:10.1186/s12882-023-03254-7
8. Arnett DK, Blumenthal RS, Albert MA, et al. 2019 ACC/AHA Guideline on the primary prevention of cardiovascular disease: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*. 2019;140(11):e596-e646. doi:10.1161/CIR.0000000000000678
9. KDIGO clinical practice guideline for anemia in chronic kidney disease. https://kdigo.org/2023/ on 21.03.2025).
10. Turgeon ML. Cinical Hematology Theory&Procedures. Fifth edition. 2012. Wolters Kluwer, Lippincott Williams&Wilkins. Chapter 10. Iron deficiency Anemia and Anemia of Chronic Inflammation. pp.173-176.
11. Weiss G, Goodnough LT. Anemia of chronic disease. *N Engl J Med*. 2005;352(10):1011-1023. doi:10.1056/NEJMra041809
12. Ware JE, Kosinski M, Keller SD. SF-12: how to score the SF-12 physical and mental health summary scales. 1995; Boston: The Health Institute, New England Medical Center.
13. Soylu C, Bahtım K. Reliability and Validity of the Turkish Version of SF-12 Health Survey. SF-12 Yaşam Kalitesi Ölçeği'nin türkçe formunun güvenirlik ve geçerlilik çalışması. *Turk Psikiyatri Derg.* 2022;33(2):108-117. doi:10.5080/u25700
14. Doan KVD, Nguyen HTM, Nguyen NTH, Dang KC, Yang SH, Duong TV. Associations of socio-demographic, clinical and biochemical parameters with healthcare cost, health- and renal-related quality of life in hemodialysis patients: a clinical observational study. *Int J Environ Res Public Health*. 2020;17(18):6552. doi:10.3390/ijerph17186552
15. Mahato SKS, Apidechkul T, Sriwongpan P, et al. Factors associated with quality of life among chronic kidney disease patients in Nepal: a cross-sectional study. *Health Qual Life Outcomes*. 2020;18(1):207. doi:10.1186/s12955-020-01458-1
16. Chen JY, Wan EYF, Choi EPH, et al. The health-related quality of life of Chinese Patients on hemodialysis and peritoneal dialysis. *Patient*. 2017;10(6):799-808. doi:10.1007/s40271-017-0256-6
17. Molsted S, Wendelboe S, Flege MM, Eidemak I. The impact of marital and socioeconomic status on quality of life and physical activity in patients with chronic kidney disease. *Int Urol Nephrol*. 2021;53(12):2577-2582. doi:10.1007/s11255-021-02826-6

18. Floria I, Kontele I, Grammatikopoulou MG, Sergentanis TN, Vassilakou T. Quality of life of hemodialysis patients in Greece: associations with socio-economic, anthropometric and nutritional factors. *Int J Environ Res Public Health*. 2022;19(22):15389. doi:10.3390/ijerph192215389
19. Ku E, Del Vecchio L, Eckardt KU, et al. Novel anemia therapies in chronic kidney disease: conclusions from a Kidney Disease: Improving Global Outcomes (KDIGO) Controversies Conference. *Kidney Int*. 2023;104(4):655-680. doi:10.1016/j.kint.2023.05.009
20. Collister D, Komenda P, Hiebert B, et al. The effect of erythropoieitin-stimulating agents on health-related quality of life in anemia of chronic kidney disease: a systematic review and meta-analysis. *Ann Intern Med*. 2016;164(7):472-478. doi:10.7326/M15-1839
21. Staibano P, Perelman I, Lombardi J, et al. Patient-centred outcomes in anaemia and renal disease: a systematic review. *Kidney Dis (Basel)*. 2020;6(2):74-84. doi:10.1159/000502208
22. Pretto CR, Winkelmann ER, Hildebrandt LM, Barbosa DA, Colet CF, Stumm EMF. Quality of life of chronic kidney patients on hemodialysis and related factors. *Rev Lat Am Enfermagem*. 2020;28:e3327. doi:10.1590/1518-8345.3641.3327
23. Jalal SM, Beth MRM, Bo Khamseen ZM. Impact of hospitalzation on the quality of life of patients with chronic kidney disease in Saudi Arabia. *Int J Environ Res Public Health*. 2022;19(15):971. doi:10.3390/ijerph1915918
24. Jesus NM, Souza GF, Mendes-Rodrigues C, Almeida Neto OP, Rodrigues DDM, Cunha CM. Quality of life of individuals with chronic kidney disease on dialysis. *J Bras Nefrol*. 2019;41(3):364-374. doi:10.1590/2175-8239-JBN-2018-0152
25. Busa I, Ordóñez-Mena JM, Yang Y, et al. Quality of life in older adults with chronic kidney disease and transient changes in renal function: findings from the Oxford Renal cohort. *PLoS One*. 2022;17(10):e0275572. doi:10.1371/journal.pone.0275572