ORIGINAL ARTICLE

FACTORS INFLUENCING HEALTH-RELATED QUALITY OF LIFE IN PATIENTS WITH DIABETIC NEPHROPATHY: A CROSS-SECTIONAL STUDY

Nevi Pasko[1], Teuta Dedej[2], Elvana Rista[3], Ariana Strakosha[1], Alba Xhoku[1], Vilma Cadri[1], Amantia Imeraj[1]

[1]Service of Nephrology Dialysis and Transplantation. University Hospital Center "Mother Teresa" Tirana, Albania

[2]Department of Laboratory, University Hospital Center "Mother Teresa" Tirana, Albania

[3]Service of Nephrology, Hygeia Hospital, Tirana, Albania

Corresponding E-Mail: nevipasko@hotmail.com

ABSTRACT

Introduction. Diabetic nephropathy is a leading cause of chronic kidney disease (CKD) and is associated with significant morbidity. Beyond traditional clinical outcomes, health-related quality of life (HRQoL) has emerged as an important patient-centered measure.

Objectives. The study aimed to evaluate health-related quality of life (HRQoL) in patients with diabetic nephropathy using the KDQOL-36 questionnaire and to identify the clinical and laboratory factors associated with its impairment.

Material and Methods. This cross-sectional study included 105 patients with diabetic nephropathy. HRQoL was assessed using the KDQOL-36 questionnaire. Demographic, clinical, and laboratory data were collected, and multivariable regression analyses were performed to identify factors associated with impaired HRQoL.

Results. The majority of patients reported moderate to poor HRQoL across all domains. Physical functioning, mental health, and disease burden were particularly affected. Advanced CKD stages (4–5) (aOR 3.45, 95% CI: 1.74–6.83) and dialysis (aOR 3.10, 95% CI: 1.52–6.30) were strongly associated with poor overall HRQoL. Additional predictors included ≥2 comorbidities (aOR 2.30), duration of diabetic nephropathy >10 years (aOR 2.05), and age >70 years (aOR 2.00). Among laboratory variables, anemia (hemoglobin <10 g/dL; aOR 3.25) was the strongest predictor, followed by poor glycemic control (HbA1c ≥9%; aOR 3.05), elevated creatinine (≥3.5 mg/dL; aOR 2.95), hypoalbuminemia (<3.0 g/dL; aOR 2.70), and elevated C-reactive protein (CRP >50 mg/L; aOR 2.60).

Conclusions. HRQoL is significantly impaired in patients with diabetic nephropathy and is influenced by multiple clinical and laboratory factors. These findings highlight the need for comprehensive, patient-centered management strategies targeting metabolic control, anemia, inflammation, and disease burden to improve overall patient outcomes.

Keywords: Diabetic nephropathy, health-related quality of life, KDQOL-36

FAKTORËT QË NDIKOJNË NË CILËSINË E JETËS SË LIDHUR ME SHËNDETIN, TE PACIENTËT ME NEFROPATI DIABETIKE: NJË STUDIM CROSS-SECTIONAL

ABSTRAKT

Hyrje. Nefropatia diabetike është një nga shkaqet kryesore të sëmundjes kronike të veshkave (SKV) dhe shoqërohet me rritje të sëmundshmërisë. Përveç faktorëve tradicionale që ndikojnë në ecurinë e pacientëve, vlerësimi i cilësisë së jetës është një parametër i rëndësishëm i vleresimit të pacientit.

Objektivat. Qëllimi i studimit ishte të vlerësojë cilësinë e jetës tek pacientët me nefropati diabetike duke përdorur pyetësorin KDQOL-36, si dhe të identifikojë faktorët klinikë dhe laboratorikë të lidhur me cilësinë e jetës.

Materiali dhe Metodat. Në studim u përfshinë 105 pacientë me nefropati diabetike. Cilvsia e jetës u vlerësua duke përdorur pyetësorin KDQOL-36. U mblodhën të dhëna demografike, klinike dhe laboratorike, dhe u kryen analiza regresioni multivariat për të identifikuar faktorët që ndikojnë në cilësinë e jetës.

Rezultatet. Shumica e pacientëve raportuan cilësi të jetës mesatare deri të dobët në të gjitha dimensionet. Veçanërisht të prekur ishin funksioni fizik, shëndeti mendor dhe barra e sëmundjes. Pacientët ne stadet e avancuara të SKV (4–5) (OR 3.45, CI 95%: 1.74–6.83) dhe apo në dializë (OR 3.10, CI 95%: 1.52–6.30) u karakterizuan nga cilësi më të dobët të jetës. Faktorë të tjerë që ndikonin ishin prania e ≥2 komorbiditete (OR 2.30), kohëzgjatja e nefropatisë diabetike >10 vjet (OR 2.05) dhe mosha >70 vjeç (OR 2.00). Ndër parametrat laboratorikë që u vlerësuan, anemia (hemoglobina <10 g/dL; OR 3.25) ishte prediktori më i fortë, ndjekur nga kontrolli i dobët glicemik (HbA1c ≥9%; aOR 3.05), kreatinina e lartë (≥3.5 mg/dL; OR 2.95), hipoalbuminemia (<3.0 g/dL; OR 2.70) dhe proteina C-reaktive e lartë (CRP >10 mg/L; OR 2.60).

Përfundime. Cilësia e jetës është e dëmtuar ndjeshëm tek pacientët me nefropati diabetike dhe ndikohet nga faktorë të shumtë klinikë dhe laboratorikë. Këto gjetje theksojnë nevojën për strategji gjithëpërfshirëse dhe të orientuara drejt pacientit, që synojnë përmirësimin e kontrollit metabolik, menaxhimin e anemisë dhe inflamacionit, me qëllim reduktimin e barrës së sëmundjes për të përmirësuar rezultatet e përgjithshme të pacientëve.

Fjalë kyç. Nefropatia diabetike, cilësia e jetës e lidhur me shëndetin, KDQOL-36.

INTRODUCTION

Diabetes mellitus represents a major global health burden and remains the leading cause of chronic kidney disease (CKD) and end-stage renal disease (ESRD) worldwide (1,2,3,29). The increasing prevalence of type 2 diabetes has been accompanied by a growing incidence of diabetic kidney disease (DKD), one of the most severe microvascular complications and a major contributor to morbidity and mortality (4,5,6). Despite advances in glycemic control and the introduction of renoprotective therapies, including SGLT2 inhibitors, a substantial proportion of patients continue to progress toward CKD and require renal replacement therapy (7,8).

Beyond its clinical manifestations, DKD has a profound impact on patients' daily functioning and well-being. Individuals with diabetes and CKD frequently experience fatigue, reduced functional capacity, and psychological distress, all of which contribute to impaired health-related quality of life (HRQoL) (9,10). Importantly, reduced HRQoL has been associated with adverse clinical outcomes, including increased hospitalization, poor treatment adherence, accelerated disease progression, and higher mortality (11,12).

According to the World Health Organization (WHO), quality of life (QoL) is defined as an individual's perception of their position in life within the context of their cultural and social environment (13). This concept emphasizes the multidimensional nature of QoL, encompassing physical, psychological, and social domains, which are significantly affected in chronic diseases such as diabetes and CKD.

HRQoL assessment has therefore become an essential component of patient-centered care (14,19). The KDQoL™-36 questionnaire is a validated instrument widely used in CKD populations, combining generic and disease-specific domains to provide a comprehensive evaluation of patient well-being (15-17). Its practicality supports its use in both clinical practice and research settings.

This study aimed to evaluate HRQoL in patients with diabetic nephropathy using the KDQOL-36 questionnaire and to identify the clinical, demographic, and laboratory factors associated with its impairment.

MATERIALS AND METHODS

Study population

The study population consisted of 105 patients diagnosed with diabetic nephropathy based on established clinical and laboratory criteria, who were admitted to the Nephrology or Endocrinology Service at the University Hospital Center "Mother Teresa". The inclusion criteria for the study were adult patients with type 2 diabetes mellitus and a confirmed diagnosis of diabetic nephropathy, with complete clinical data and fully complete questionnaires. Exclusion criteria included patients with kidney injury unrelated to diabetes, incomplete laboratory or clinical data, and those who declined to participate in the quality-of-life assessment. All participants were informed about the purpose of the study and provided written informed consent prior to participation. Participation was voluntary, and the confidentiality and anonymity of patient data were maintained throughout the study.

Measures and data collections

Data were collected from medical records and through the administration of the KDQOL-36 questionnaire. For each patient, demographic variables (age, sex, and place of residence) were recorded, along with disease-related characteristics and additional chronic comorbidities were also documented. Laboratory parameters included glycated hemoglobin (HbA1c), low-density lipoprotein (LDL) cholesterol, serum albumin, total protein, urea, creatinine,

complete blood count, and C-reactive protein (CRP). In addition, data regarding the need for renal replacement therapy were collected. The KDQOL-36 questionnaire was administered to all participants in accordance with standardized procedures, ensuring completeness and reliability of responses. The original scores were linearly converted to a range of 0–100. A high score represents better HRQoL.

Statistical analysis

The collected data were processed and analyzed using standard statistical software (IBM SPSS Statistics, version 27). Descriptive statistics were used to summarize the variables, including means and standard deviations for continuous variables, and frequencies and percentages for categorical variables.

To evaluate associations between clinical, laboratory, and HRQoL variables, statistical tests were applied as appropriate. The chi-square (χ^2) test was used for comparisons between categorical variables, while continuous variables were analyzed using the independent samples t-test or the Mann–Whitney U test, depending on data distribution. Analysis of variance (ANOVA) was performed for comparisons across multiple groups. Multivariable linear and logistic regression analyses were conducted to identify independent predictors of HRQoL outcomes. Statistical significance was defined as a two-tailed p-value < 0.05.

RESULTS

Demographic and disease-related characteristics of patients

The study population included 105 patients with diabetic nephropathy. The majority of patients were aged between 61-70 years (29.5%), followed by those aged 51–60 years (25.7%), while only 8.6% were ≤40 years (Table 1). Males predominated (58.1%), and most participants resided in urban areas (62.9%). The duration of diabetes was most commonly 11–15 years (33.3%), followed by >15 years (29.5%), indicating a predominantly long-standing disease course.

In terms of kidney disease, 44.8% of patients had a known disease duration of less than 5 years, while 19.0% had a duration exceeding 10 years. The distribution of CKD stages showed a predominance of advanced disease, 78.2% of patients in stages 3–5 with stage 4 being the most frequent (30.5%).

Comorbidities were highly prevalent, with 46.7% of patients presenting with two or more chronic conditions, while only 13.3% had no comorbidities. Regarding renal replacement therapy, 34.3% of patients were undergoing dialysis.

Table 1. Demographic, clinical, and disease-related characteristics of the study population (n = 105)

Variable	Category	n (%)
Age (years)	Mean ± SD	58.6 ± 12.4
	≤40	9 (8.6)
	41–50	19 (18.1)
	51–60	27 (25.7)
	61–70	31 (29.5)
	>70	19 (18.1)
Sex	Male	61 (58.1)
Residence	Urban	66 (62.9)
Duration of diabetes (years)	Mean ± SD	12.3 ± 6.8
	≤5	13 (12.4)
	6–10	26 (24.8)
	11–15	35 (33.3)
	>15	31 (29.5)
Duration of diabetic nephropathy (years)	Mean ± SD	6.7 ± 4.5
	<5	47 (44.8)
	5–10	38 (36.2)
	>10	20 (19.0)
CKD stage	Stage 1	7 (6.7)
	Stage 2	16 (15.2)
	Stage 3	28 (26.7)
	Stage 4	32 (30.5)
	Stage 5	22 (21.0)
Comorbidities	None	14 (13.3)
	One	42 (40.0)
	≥2	49 (46.7)
Renal replacement therapy	Dialysis	46 (44.8)

CKD: chronic kidney disease. Data are presented as mean ± standard deviation (SD) or n (%), as appropriate.

Laboratory findings of patients

The majority of patients had HbA1c levels ≥9.0% (42.9%), while 36.2% were in the range of 7.0–8.9%, and 21.0% had HbA1c <7.0%. Normal serum albumin levels (≥3.5 g/dL) were observed in 25.7% of patients, whereas hypoalbuminemia was present in 74.3%, including mild (29.5%), moderate (26.7%), and severe (18.1%) forms. Total serum protein levels were 6.0–6.9 g/dL in 37.1% of patients and 7.0–7.9 g/dL in 33.3%, while 20.0% had levels <6.0 g/dL and 9.5% had levels ≥8.0 g/dL. Anemia was common, with 27.6% of patients having

hemoglobin <10 g/dL and 39.0% within 10.0–11.9 g/dL; only 8.6% had hemoglobin ≥14 g/dL.

Evaluation of the quality of life of patients

Table 2 presents the distribution of KDQOL-36 scores across its main domains, including physical functioning, mental health, symptom burden, effects of kidney disease on daily life, and perceived burden of disease, as well as the overall score. The results are categorized into four levels (poor, moderate, good, and very good) based on a 0–100 scoring system, and expressed as frequencies and percentages.

Table 2. Quality of life of study participants.

QoL Domain	0–39 (poor)	40–59 (moderate)	60–79 (good)	80–100 (very good)
Physical Functioning	28 (26.7)	39 (37.1)	27 (25.7)	11 (10.5)
Psychological Well-being	25 (23.8)	36 (34.3)	29 (27.6)	15 (14.3)
Symptoms / Problems	20 (19.0)	33 (31.4)	34 (32.4)	18 (17.1)
Effects of Kidney Disease on Daily Life	31 (29.5)	42 (40.0)	23 (21.9)	9 (8.6)
Burden of Kidney Disease	34 (32.4)	38 (36.2)	22 (21.0)	11 (10.5)
Overall KDQOL-36 Score	29 (27.6)	40 (38.1)	25 (23.8)	11 (10.5)

KDQOL-36: Kidney Disease Quality of Life-36 questionnaire. Data are presented as n (%). Higher scores indicate better health-related quality of life. Score categories: 0–39 (poor), 40–59 (moderate), 60–79 (good), 80–100 (very good).

Physical functioning was rated as very good (≥80) in only 10.5% of patients and good (60–79) in 25.7%, while the majority reported moderate (40–59; 37.1%) or poor (≤39; 26.7%) levels. Mental health showed a similar pattern, with 14.3% reporting very good and 27.6% good emotional well-being, compared to 34.3% moderate and 23.8% poor scores. Regarding symptoms, 17.1% of patients reported very good and 32.4% good status, whereas 31.4% and 19.0% experienced moderate and poor symptom burden, respectively. The impact of kidney disease on daily life was considerable, with 40.0% and 29.5% of patients reporting moderate and poor levels, respectively, and only 21.9% achieving good or very good scores. Similarly, a high disease burden was reported, with 32.4% of patients in the poor category and 36.2% in the moderate category, while only 31.5% reported good or very good outcomes. Overall, only 10.5% of patients had very good quality of life and 23.8% good quality, whereas the majority were classified as moderate (38.1%) or poor (27.6%).

Multiple linear regression models were applied to see which factors influence the different components of the KDQoL-36. The graph in Fig 1 illustrates the association between selected clinical variables and the KDQOL-36 total score, presented as adjusted odds ratios (ORs)

with 95% confidence intervals, where values above 1 indicate a higher likelihood of impaired quality of life.

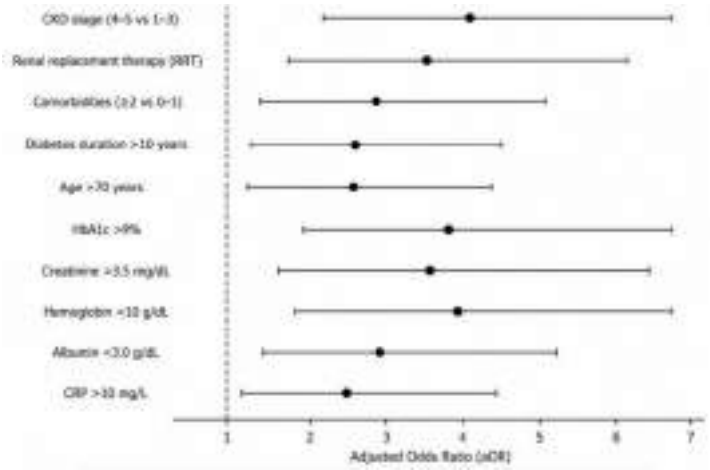

Figure. 1. Association between KDQOL-36 total score and laboratory findings.

The data demonstrates the cumulative impact of several laboratory factors on quality of life. HbA1c ≥9% (OR 3.05) and creatinine ≥3.5 mg/dL (OR 2.95) were strong indicators of poor quality of life, highlighting the importance of metabolic control and renal function. Anemia (hemoglobin <10 g/dL) emerged as the strongest overall predictor (OR 3.25), consistently affecting multiple domains. Hypoalbuminemia <3.0 g/dL (OR 2.70) and elevated CRP >50 mg/L (OR 2.60) further reinforced this pattern, suggesting that quality of life in diabetic nephropathy is influenced by a complex interplay of metabolic, nutritional, and inflammatory factors.

The overall quality of life score was significantly influenced by CKD stages 4–5 (OR 3.45, 95% CI: 1.74–6.83) and dialysis (OR 3.10, 95% CI: 1.52–6.30), indicating that disease progression and renal replacement therapy are major determinants of poor QoL. Additionally, the presence of ≥2 comorbidities (OR 2.30, 95% CI: 1.17–4.52), duration of diabetic nephropathy >10 years (OR 2.05, 95% CI: 1.02–4.12), and age >70 years (OR 2.00, 95% CI: 1.00–3.98) were also associated with worse overall QoL.

These findings suggest that quality of life in patients with diabetic nephropathy is multifactorial, reflecting not only the role of CKD progression but also the cumulative burden of comorbidities, treatment-related factors, and demographic characteristics.

DISCUSSION

The present study demonstrates that health-related quality of life (HRQoL) is markedly impaired in patients with diabetic nephropathy, with the majority of participants reporting moderate to poor scores across all KDQOL-36 domains. These findings are consistent with previous studies indicating that CKD, particularly in the context of diabetes, significantly compromises physical, psychological, and social well-being (15,17). The observed

impairment in physical functioning and mental health in our cohort is in line with prior research showing that HRQoL declines progressively with advancing CKD stages and worsens further after the initiation of dialysis (16,17). This deterioration likely reflects the combined effects of uremic symptoms, reduced physical capacity, and the burden of long-term disease management. Symptom burden, including fatigue, pain, and sleep disturbances, has been consistently identified as a key determinant of reduced HRQoL in CKD populations (18). A central finding of this study is the strong association between advanced CKD (stages 4–5) and dialysis with poor overall quality of life. These results are consistent with previous evidence indicating that disease progression and renal replacement therapy are major predictors of HRQoL impairment (16,17). Although dialysis is life-sustaining, it imposes substantial physical and psychosocial constraints, including treatment-related fatigue, time dependency, and reduced social participation (20).

In addition, our findings highlight the impact of comorbidities, disease duration, and age on HRQoL. Patients with multiple comorbidities and longer duration of diabetic nephropathy were more likely to report poorer quality of life, reflecting the cumulative burden of chronic disease. These observations are consistent with previous studies identifying multimorbidity and aging as key determinants of HRQoL in CKD populations (21,16). Importantly, laboratory parameters emerged as strong predictors of HRQoL impairment. Poor glycemic control (HbA1c ≥9%) and reduced renal function (elevated creatinine) were significantly associated with worse outcomes, supporting the established role of metabolic and renal dysfunction in disease progression (22,23). Anemia was identified as the strongest predictor across multiple domains, in agreement with previous reports linking anemia to fatigue, reduced exercise tolerance, and diminished quality of life in CKD patients (24). Furthermore, hypoalbuminemia and elevated CRP were independently associated with poorer HRQoL, demonstrating the role of nutritional status and chronic inflammation. These findings support the concept that HRQoL in diabetic nephropathy is influenced by a complex interplay of metabolic, nutritional, and inflammatory factors, as previously described in CKD populations (25,26).

This study has several limitations that should be considered when interpreting the findings. First, the single-center design may limit the generalizability of the results to broader populations. Second, the cross-sectional nature of the study does not allow for the establishment of causal relationships between clinical variables and health-related quality of life (HRQoL). Third, the relatively small sample size may reduce the statistical power of the study. Additionally, although the KDQOL-36 is a validated and widely used instrument, it relies on self-reported data, which may be subject to bias and individual perception variability. Furthermore, certain potentially relevant factors, such as socioeconomic status, educational level, and detailed treatment adherence, were not systematically assessed and may have influenced HRQoL outcomes. Despite these limitations, the study provides valuable insights into the multidimensional determinants of quality of life in patients with diabetic nephropathy.

CONCLUSIONS

Health-related quality of life is significantly impaired in patients with diabetic nephropathy and is influenced by a complex interplay of clinical, laboratory, and demographic factors. Advanced CKD stages, dialysis, comorbidities, and poor metabolic control emerged as key determinants of reduced HRQoL. These findings highlight the importance of a comprehensive, patient-centered approach that extends beyond traditional clinical management to include optimization of metabolic control, correction of anemia and nutritional deficits, and targeted interventions aimed at reducing the burden of disease and improving overall well-being.

Overall, our results confirm that HRQoL in patients with diabetic nephropathy is multifactorial, reflecting not only disease severity but also the cumulative effects of comorbidities, treatment burden, and systemic complications. These findings emphasize the need for a comprehensive, patient-centered approach that integrates optimal metabolic control, management of anemia and inflammation, and strategies aimed at reducing the burden of renal replacement therapy.

Conflict of interest: Nothing to declare

Acknowledgments. All authors contributed to the preparation of the manuscript and approved the final version. No external funding was received for this study.

REFERENCES

1. Thomas MC, Cooper ME, Zimmet P. Changing epidemiology of type 2 diabetes mellitus and associated chronic kidney disease. Nat Rev Nephrol. 2016;12(2):73-81.
2. Sun H, Saeedi P, Karuranga S, et al. IDF Diabetes Atlas: global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. Diabetes Res Clin Pract. 2022;183:109119.
3. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in diabetes prevalence and treatment from 1990 to 2022. Lancet. 2024;404:2077-2093.
4. Selby NM, Taal MW. An updated overview of diabetic nephropathy. Diabetes Obes Metab. 2020;22(suppl 1):3-15.
5. Koye DN, Shaw JE, Reid CM, et al. Incidence of chronic kidney disease among people with diabetes. Diabet Med. 2017;34:887-901.
6. Bermejo S, Pascual J, Soler MJ. The spectrum of renal disease in diabetic patients. Clin Kidney J. 2017;10:255-256.
7. Jha V, Wang AY, Wang H. The burden of CKD. Nephrol Dial Transplant. 2012;27(suppl 3):iii32-iii38.
8. Singhal R, Hechanova LA. SGLT2 Inhibitors: Benefits for CKD and Cardiovascular Disease in Type 2 Diabetes. Curr Cardiol Rep. 2022; 24(3):183-189.
9. Zimbudzi E, Lo C, Ranasinha S, et al. HRQoL in CKD and diabetes. BMJ Open Diabetes Res Care. 2020;8:e000842.

10. Kalantar-Zadeh K, Unruh M. Health-related quality of life in CKD patients. Int Urol Nephrol. 2005;37:367-378.
11. Cruz MC, Andrade C, Urrutia M, et al. Quality of life in CKD patients. Clinics (Sao Paulo). 2011;66:991-995.
12. Pagels AA, Söderkvist BK, Medin C, et al. HRQoL in CKD stages and dialysis initiation. Health Qual Life Outcomes. 2012;10:71.
13. World Health Organization. WHOQOL: measuring quality of life. Soc Sci Med. 1995;41:1403-1409.
14. Hays RD, Kallich JD, Mapes DL, et al. Development of the kidney disease quality of life (KDQOL) instrument. Qual Life Res. 1994;3(5):329-38.
15. Kumar R, Krishan P, Jhajj R. HRQoL in diabetic nephropathy patients. Int J Res Med Sci. 2016;4(5):1511-1517.
16. Kolarić V, Svirčević V, Bijuk R, et al. Chronic complications of diabetes and quality of life. Acta Clin Croat. 2022;61(3):520-527.
17. Aggarwal HK, Jain D, Pawar S, et al. Health-related quality of life in different CKD stages. QJM. 2016;109:711-716.
18. Fletcher BR, Damery S, Aiyegbusi OL, et al. Symptom burden and health-related quality of life in chronic kidney disease: A global systematic review and meta-analysis. PLoS Med. 2022;19(4):e1003954.
19. D'Arrigo G, Marino C, Pizzini P, et al. Quality of life and kidney function in CKD patients: a longitudinal study. Clin Kidney J. 2025;18(4):sfae429.
20. Ghafourifard M, Mehrizade B, Hassankhani H, et al. Hemodialysis patients perceived exercise benefits and barriers: the association with health-related quality of life. BMC Nephrol. 2021;22(1):94.
21. Fraser SDS, Phillips T. Quality of life in people with chronic kidney disease: focusing on modifiable risk factors. Curr Opin Nephrol Hypertens. 2024;33(6):573-582.
22. Fasipe OJ, Akhideno PE, Owhin SO, et al. Comorbidity profile among CKD patients. Int Arch Health Sci. 2019;6:46-51.
23. Phillips T, Harris S, Aiyegbusi OL, et al. Potentially modifiable factors associated with health-related quality of life among people with chronic kidney disease: baseline findings from the National Unified Renal Translational Research Enterprise CKD (NURTuRE-CKD) cohort. Clin Kidney J. 2024;17(2),sfae010.
24. Spinowitz B, Pecoits-Filho R, Winkelmayer WC, et al. Economic and quality of life burden of anemia on patients with CKD on dialysis: a systematic review. J Med Econ. 2019;22(6):593-604.
25. Lowrie EG. Acute-phase inflammatory process contributes to malnutrition, anemia, and possibly other abnormalities in dialysis patients. Am J Kidney Dis 1998;32 (6 Suppl. 4): 105–12
26. Kalender B, Mutlu B, Ersöz M, et al. The effects of acute phase proteins on serum albumin, transferrin and haemoglobin in hemodialysis patients. Int J Clin Pract 2002;56: 505–8.