Original article

Relationship between socio-demographic, clinical factors, and quality of life in adults living with diabetic nephropathy

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ARTICLE INFO

Keywords:

Quality of life
Diabetes mellitus
Chronic kidney disease
Diabetic nephropathy
Physical health
Mental health

ABSTRACT

Objective: The study determines the relationship between the socio-demographic, clinical factors and quality of life among adults with diabetic nephropathy and undergoing hemodialysis.

Methods: This was a cross-sectional, descriptive study conducted among adults diagnosed with diabetic nephropathy receiving hemodialysis in a dialysis unit. The kidney specific quality of life and the general quality of life (KDQOL-SF) was used to collect data between January 2015 to July 2016. A hundred and forty participants completed the survey from the selected sample of 185 adults.

Results: Adults with complex comorbidities, stage 3, 4 and 5 chronic kidney disease, higher body mass index, and uncontrolled glycemic control were significantly associated with lower quality of life, physical and mental component summary scores.

Conclusions: Poor physical functioning, role-physical, body pain, role-emotional, emotional well-being, general health, mental health scores significantly affected the quality of life in high-risk adults with diabetic nephropathy. The study demonstrated the significance of patient reported outcomes for adults with diabetic nephropathy and planning healthy lifestyle changes to improve the quality of life.

1. Introduction

Diabetic Nephropathy is characterized with albuminuria (ratio of urine albumin to creatinine $\geq 30\text{mg/g}$), impaired estimated glomerular filtration rate ($\text{eGFR} < 60 \text{ mL/min/1.73 m}^2$), or both, in adults with Diabetes Mellitus. Diabetic Nephropathy (DN) is a progressive worsening chronic kidney disease (CKD) subsequently developing complications like hypertension, congestive heart failure and CKD stage 5 (End Stage Renal Disease). This requires renal replacement therapy like dialysis or transplantation and leading to poor health status affecting physical abilities and mental functioning ^{1,2,3,4}. The incidence of DN and CKD are attributable to the growing burden of non-communicable diseases in the Middle East.

The global prevalence of chronic kidney disease is estimated to be 10–13%. Approximately 35% of the adults with DN commence hemodialysis.⁵ DN is the leading cause of end stage renal disease with the prevalence of 30% in Bahrain, 14.5% in Oman, and 60% in Saudi

Arabia.⁶ DN and CKD share common risk factors that enhance the risk of progressive disease and adverse outcomes, 50% of the adults with DM are affected by CKD.^{2,7} DN and CKD in Oman are increasing, and the health care expenditures are about 3.8–5.3 million Omani Riyals (OMR) per year for renal replacement therapy.⁸ The kidney disease deaths in Oman reached 3.32% of the total deaths with the age-adjusted death rate estimated at 25.79 per 100,000 of population.⁹ DN and CKD directly affects the quality of life and productivity and cause exhaustion of health care resource and financial stress.¹⁰ This condition requires lifelong renal replacement therapy and causes an immediate decline in the quality of life (QOL).

An adult with DN and CKD impact their psychological, emotional, mental, and physical health and well-being. Adults with DN and CKD have to adhere to restrictive therapeutic regimens, and cope with advanced complications.¹¹ Hemodialysis have shown to improve self-care management in adults with DN and CKD.¹² Long-term hemodialysis affects the adults through loss of dependence, disruption of family

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<https://doi.org/10.1016/j.cegh.2019.08.019>

Received 26 July 2019; Received in revised form 11 August 2019; Accepted 28 August 2019

Available online 31 August 2019

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social life, loss of financial and decreased life style. This affects employment, dietary changes, self-esteem, social relationships, and the inability to enjoy life due to physical and psychological aspects of life that are negatively affected.¹³ Hence, there is a gap in understanding the determinants of socio-demographic and clinical factors affecting the quality of life among high-risk populations. The study aimed to determine the relationship between the socio-demographic, clinical factors and quality of life among adults with diabetic nephropathy and undergoing hemodialysis. The study findings will support knowledge translation and evidence informed practice for registered nurses to plan lifestyle interventions for high-risk adults with DN and undergoing hemodialysis.

2. Methods

2.1. Design

This was a cross sectional and a descriptive study conducted with the use of standardised kidney disease quality of life (KDQOL-SF), version 1.3.

2.2. Population and sample

The study was conducted at Bowsheer Community Clinic, Ministry of Health, Muscat, Sultanate of Oman. The Sultanate of Oman is administratively divided into four governorates, and five regions. Muscat and Al-Batinah regions are the most populated areas with almost 55% of Oman population, while 21% of the population lives in rural regions and 5% live in the mountains.¹⁴ Most of the people in Oman have access to the public health clinic. This clinic is 42-bedded multi-specialty polyclinic with 42 high-tech hemodialysis units operated round the clock with four shifts of hemodialysis. The target population was adults diagnosed with DN, and receiving hemodialysis in Bowsheer clinic.

2.3. Sample size and power

A simple random sampling technique was employed, where the adults with DN and undergoing hemodialysis and attending the dialysis clinic were included in the inclusion criteria. The sample size was calculated based on the equation $n = \frac{z^2 p(1-p)}{\epsilon^2}$, where, n = sample size, z = value for the z distribution (1.96) based on desired level of confidence (95%), p = The estimated proportion of a parameter was calculated from earlier studies, it is the proportion of population that fall into a certain category that need to be estimated.⁶ It is recommended to use 14.5, ϵ = error of the estimate and it was assumed to be 0.05. Using the sample size formula, $n = \frac{1.96^2 \times 0.14(1 - 0.14)}{0.05^2} = 185$. Allowing 10% for attrition, the total sample size was 185 adults with DN and undergoing hemodialysis between January 2015 to July 2016.

2.4. Inclusion criteria

An adult with Diabetic nephropathy, Chronic kidney disease stage 3a, 3b, 4 and 5, and undergoing hemodialysis on a scheduled basis, able to understand either English or Arabic and willing to volunteer or participate were included in the study.

2.5. Exclusion criteria

An adult with diagnosed with diabetic nephropathy, Chronic kidney disease stage 3a, 3b, 4 and 5, and undergoing haemodialysis on a scheduled basis, able to understand either English or Arabic and willing to volunteer or participate were included in the study.

2.6. Measurement outcomes

Quality of life (QOL) of adults with DN and undergoing hemodialysis is measured with the kidney specific quality of life and the general quality of life (KDQOL-SF).^{15,16} In this study, the general QOL consisted of the physical and the emotional quality of life. Each of these characteristics were measured through the different questions administered with the kidney specific quality of life and the general quality of life (KDQOL-SF). Each question was allocated the scores of between 0 and 100 on the basis of the well-defined guidelines SF-36 general quality of life developed by World Health Organization. The higher score indicated a better state of health and the lower the score indicating the more disability (i.e., a score of zero is equivalent to maximum disability and a score of 100 is equivalent to no disability). In each question, the scores were transformed into a 0–100 scale on the assumption that each question carries equal weight. In measuring a particular variable, through n different questions, the average of the scores of 'n' questions was used assuming that each question carries equal weight. The physical QOL among adults with DN and undergoing hemodialysis contained five characteristics: physical functioning, role physical, pain, general health, and fatigue. The emotional QOL of adults with DN and undergoing hemodialysis contained three characteristics: emotional well-being, role-emotional, and social function. The KDQOL-SF for each measuring variable with the Cronbach's alpha (α) was in the range 0.70–0.84.

Sociodemographic characteristics consist of age, gender, income, education, and living status. Clinical characteristics include complex co-morbidity (two or more acute or chronic complications), physical activity, body mass index (BMI), estimated glomerular filtration rate (eGFR), albumin-creatinine ratio (ACR) and glycosylated hemoglobin (HbA1c). Estimated glomerular filtration rate (eGFR) categories are classified as Stage 1 with mildly decreased eGFR, normal GFR ($\text{GFR} > 90.0 \text{ mL/min/1.73 m}^2$) with kidney damage (proteinuria and hematuria), Stage 2 mild mildly decreased eGFR CKD ($\text{GFR} > 60.0\text{--}89.9 \text{ mL/min/1.73 m}^2$) with complications (proteinuria and hematuria), Stage 3a moderately decreased eGFR, CKD ($\text{GFR} < 45 \text{ mL/min/1.73 m}^2$), Stage 3b moderately decreased eGFR ($\text{GFR} 30\text{--}44 \text{ mL/min/1.73 m}^2$), Stage 4 advance decreased eGFR/CKD ($\text{GFR} > 15.0\text{--}29.9 \text{ mL/min/1.73 m}^2$) and Stage 5 renal failure with an $\text{eGFR} < 15.0 \text{ mL/min/1.73 m}^2$ with irreversible loss of kidney function, accumulation of wastes and fluid, electrolyte imbalance.¹⁷ Albumin creatinine ratio (ACR) was classified as normal to mild increased ($< 3 \text{ mg/g}$), moderately increased albuminuria (ACR $30\text{--}300 \text{ mg/g}$) and severely increased albuminuria (ACR > 300).

2.7. Data collection

Recruitment strategies included bulletin advertisements and announcement brochures for eligible participants admitted in the dialysis unit. The registered nurses provided the study introduction and initial contact to the eligible participants. The eligible adults who met the inclusion criteria were screened and identified with the assistance of the research assistants to avoid power dynamics. The eligible adults who volunteered to participate were drawn into a common sampling pool and a simple random selection was utilised. An informed verbal and written consent was obtained after with the study information, introductory letter, invitation letter, study and study questionnaires were distributed to the participants. The human and ethical principles of ensuring privacy, dignity, confidentiality and anonymity were maintained throughout the study. A comfortable, calm, safe, and supportive environment was provided to the volunteering participants in the study. The researchers signed an oath of confidentiality agreement. The data collection was conducted between January 2015 to July 2016.

2.8. Statistical analysis

Continuous and binary data were stated as a percentage, mean and standard deviation (SD) or a geometric mean (95% confidence interval), with distribution range; and categorical data were shown by actual frequency and percentage. The associations between the independent variables and summary scores were analyzed using multiple linear regression models using the SPSS 25 statistical software. A statistical value of $p < 0.05$ was considered significant.

2.9. Ethical considerations

Ethical approval was obtained from the Institutional Research Ethics Board of the University and Hospital.

3. Results

A total of 140 adults with DN and undergoing hemodialysis completed the survey from a selected sample size of 185 adults, the response rate was 75.7%.

3.1. Association of sociodemographic and clinical characteristics with KDQOL scores

The majority of the adults were 40–49 years (32.14%), were men (62.14%), and the majority had an income of < 1000 Omani Riyals (OMR) (57.14%) (Table 1). Most of the adults had nephropathy, CKD complex comorbidity (30%), had stage 3b CKD (43.57%) with eGFR (30–44 mL/min/1.73m²) and had a high HbA1c of > 8% (49.29%). We found a significant association between adults who had < 1000 OMR income ($p < 0.01$), married ($p < 0.30$), had a complex co-morbidity ($p < 0.04$), had eGFR of 30–44 mL/min/1.73m² ($p < 0.04$), and an uncontrolled HbA1c ($p < 0.02$) had lower QOL scores of adults with

DN. Adults with lower income, married, presence of complex co-morbidity, stage 3b CKD, and an uncontrolled HbA1c were significantly associated with a lower QOL score.

3.2. Crude and adjusted SF-36 and KDQOL sub scores

Omani adults had higher adjusted scores on the physical component summary [25.6 (24.7–29.4), $p < 0.04$], and mental health summary [30.4 (28.4–33.50), $p < 0.05$] (Table 2). Low adjusted SF36 sub scores were observed in the physical functioning, role physical, body pain, role-emotional, emotional well-being, and mental health. The average KDQOL summary score [56.2 (54.2–57.5), $p < 0.03$] and satisfaction [77.4 (75.1–79.7), $p < 0.02$] had significantly low. Low KDQOL scores were observed for the symptoms, effects, burden, work status, and sleep. Poor physical functioning, role-physical, body pain, role-emotional, emotional well-being, general health, and mental health scores significantly affected the quality of life in high-risk adults with diabetic nephropathy and undergoing hemodialysis.

3.3. Multivariate linear regression

The multiple linear regression (MLR) model showed that Bachelors/Masters education, complex comorbidity, married, higher eGFR (< 44 mL/min/1.73m²) and a higher HbA1c (8%) were associated with a lower physical component summary (PCS), mental component summary (MCS), SF-36 and KDQOL scores (Table 3). There was a positive association between Bachelor/Master's degree ($\beta = 5.6$, $p = 0.01$; $\beta = 4.7$, $p < 0.03$; $\beta = 0.4$, $p < 0.01$), complex comorbidity ($\beta = 0.3$, $p = 0.01$; $\beta = 0.05$, $p < 0.05$; $\beta = 0.3$, $p < 0.04$), married ($\beta = 3.5$, $p = 0.05$; $\beta = 4.5$, $p < 0.03$; $\beta = 2.2$, $p < 0.04$), eGFR ($\beta = -3.7$, $p = 0.05$; $\beta = 1.8$, $p < 0.04$; $\beta = -0.3$, $p < 0.05$), and HbA1c of 7.01–7.99% ($\beta = -0.05$, $p = 0.04$; $\beta = -4.7$, $p < 0.02$; $\beta = -4.4$, $p < 0.01$) with the physical component summary, mental health

Table 1

Association of sociodemographic and clinical characteristics with QOL in adults with diabetic nephropathy N = 140.

Variables	Categories	Frequency (f)	Percentage (%)	Mean $\pm$ SD	p value < 0.05
Gender	Male	87.00	62.14	43.4 $\pm$ 14.5	0.26
	Female	53.00	37.86	40.9 $\pm$ 12.4	
Age (years)	20–29 years	17.00	12.14		0.68
	30–39 years	41.00	29.29		
	40–49 years	45.00	32.14	43.5 $\pm$ 14.3	
	> 50 years	37.00	26.43	41.8 $\pm$ 16.5	
	> 1001 OMR	60.00	42.86	46.5 $\pm$ 15.3	
Income (Omani Riyals/OMR)	< 1000 OMR	80.00	57.14	36.4 $\pm$ 16.1	0.01*
	> 1001 OMR	60.00	42.86	46.5 $\pm$ 15.3	
Education	No schooling/Primary school	28.00	20.00		0.05*
	High school/Grade 12	66.00	47.14	36.5 $\pm$ 13.5	
	Bachelors/master's degree	46.00	32.86	44.4 $\pm$ 14.2	
Complex co-morbidity	Ischemia Stroke, Neuropathy	34.00	24.29	35.9 $\pm$ 12.7	0.04*
	Nephropathy, Chronic kidney disease	42.00	30.00	37.9 $\pm$ 13.4	
	Hypertension, Heart failure	22.00	15.71	38.8 $\pm$ 16.7	
	Married	86.00	61.43	43.3 $\pm$ 45.6	
Living status	Single	54.00	38.57	40.9 $\pm$ 14.3	0.03*
	Married	86.00	61.43	43.3 $\pm$ 45.6	
Physical activity	Sedentary	41.00	29.29	35.1 $\pm$ 12.1	0.41
	Moderate activity	99.00	70.71	43.0 $\pm$ 15.7	
Body mass index (kg/m ²)	< 18.5 kg/m ² Underweight	27.00	19.29	51.4 $\pm$ 16.6	0.19
	18.5–24.9 kg/m ² Normal	38.00	27.14	46.3 $\pm$ 14.4	
	> 25 kg/m ² Obese	49.00	35.00	43.2 $\pm$ 14.7	
	> 30 kg/m ² Overweight	26.00	18.57	39.2 $\pm$ 14.3	
	> 30 kg/m ² Overweight	26.00	18.57	39.2 $\pm$ 14.3	
Estimated Glomerular Filtration Rate (eGFR) (mL/min/1.73m ²)	Stage 3a: < 45 mL/min/1.73m ²	20.00	14.29	45.6 $\pm$ 12.7	0.04*
	Stage 3b: 30–44 mL/min/1.73m ²	61.00	43.57	43.2 $\pm$ 13.2	
	Stage 4: 15–29 mL/min/1.73m ²	40.00	28.57	41.5 $\pm$ 14.9	
	Stage 5: 15 mL/min/1.73m ²	19.00	13.57	40.9 $\pm$ 43.6	
	Stage 5: 15 mL/min/1.73m ²	19.00	13.57	40.9 $\pm$ 43.6	
Albumin creatinine ratio (mg/g)	< 300 mg/g	19.00	13.57	36.1 $\pm$ 13.1	0.52
	> 300 mg/g	121.00	86.43	30.2 $\pm$ 13.8	
Glycated haemoglobin HbA1c (%)	$\leq 7\%$	22.00	15.71	35.5 $\pm$ 12.4	0.02*
	7.01–7.99%	49.00	35.00	37.3 $\pm$ 14.6	
	$\geq 8\%$	69.00	49.29	48.2 $\pm$ 16.3	

* $p < 0.05$ for significant value.

Table 2

Crude and adjusted SF36 and KDQOL subscores for adults with diabetic nephropathy N = 140.

SF36 sub scores	Least square mean (95% Confidence Interval)			KDQOL sub scores	Least square mean (95% Confidence Interval)		
	Crude (Model 1)	Adjusted ⁺ (Model 2)	P value		Crude (Model 1)	Adjusted ⁺ (Model 2)	P value
Physical Functioning	20.8 (19.4–24.1)	22.8 (20.4–25.3)	0.41	Symptoms	55.2 (53.3–58.3)	55.8 (54.6–60.8)	0.23
Role-physical	8.9 (6.6–11.3)	10.1 (9.0–14.3)	0.15	Effects	45.3 (43.4–48.3)	44.6 (43.3–48.9)	0.12
Body Pain	39.3 (36.5–41.1)	36.8 (34.9–39.1)	0.45	Burden	25.7 (23.0–27.5)	25.9 (23.6–28.3)	0.34
Vitality	41.3 (40.6–45.0)	45.3 (45.0–49.6)	0.34	Work status	8.9 (6.8–10.9)	7.9 (5.2–9.7)	0.56
Role-emotional	14.6 (13.6–18.6)	14.4 (12.3–17.6)	0.15	Cognitive function	61.9 (59.1–64.0)	67.9 (65.5–70.4)	0.45
Emotional well-being	15.6 (12.6–18.6)	15.4 (11.3–19.6)	0.14	Quality of social interaction	64.8 (62.1–67.5)	63.7 (62.4–67.8)	0.37
Social function	35.7 (33.7–38.6)	37.5 (35.1–39.8)	0.26	Sexual functioning	69.5 (65.9–70.0)	69.3 (66.2–71.4)	0.48
Role-physical	35.7 (34.7–39.6)	38.5 (36.1–41.8)	0.38	Sleep	46.8 (44.1–49.5)	45.4 (43.4–49.6)	0.51
General health	30.5 (28.5–33.5)	32.2 (31.9–36.4)	0.46	Social support	72.5 (70.5–75.8)	75.7 (72.9–78.5)	0.01**
Mental health	24.2 (22.4–27.9)	25.3 (24.2–29.5)	0.37	Staff encouragement	71.5 (69.1–74.9)	72.7 (69.8–75.5)	0.38
Physical component summary (PCS)	23.9 (21.3–26.6)	25.6 (24.7–29.4)	0.04**	Satisfaction	73.9 (71.1–76.7)	77.4 (75.1–79.7)	0.02**
Mental component summary (MCS)	29.6 (28.0–33.3)	30.4 (28.4–33.5)	0.05**	KDQOL average	51.6 (49.5–55.7)	56.2 (54.9–57.5)	0.03**

⁺ Least square mean SF36 and KDQOL sub scores were calculated using the analysis of covariance in adults with diabetic nephropathy with crude data (model 1) and adjusted for age, gender, education, income, body mass index, albumin creatinine level, eGFR, complex comorbidities, and HbA1c (model 2).

**p < 0.05 for adults with total SF36 and KDQOL scores.

summary, and the KDQOL scores respectively. Hence, physical, mental component summary and KDQOL scores were significantly associated with Bachelors/Master's degree (p < 0.01) complex comorbidity (p < 0.04), marital status (p < 0.04), BMI of 18.5–24.9 kg/m² (p < 0.03), eGFR of 30–44 mL/min/1.73 m² (p < 0.05), and HbA1c of 7.01–7.99% (p < 0.01) in high-risk adults with diabetic nephropathy and undergoing hemodialysis.

3.4. Sociodemographic and clinical characteristics associated with KDQOL scores in multiple linear regression

Sociodemographic and clinical characteristics were included as

independent variables in the MLR model (Table 4). In multiple linear regression, QOL scores were associated with education ($\beta = 0.13$, p < 0.01), living status ($\beta = 0.09$, p < 0.05), complex comorbidities ($\beta = 0.05$, p < 0.05), body mass index ($\beta = 0.04$, p < 0.05), eGFR ($\beta = 0.37$, p < 0.01), and HbA1c ($\beta = 0.06$, p < 0.02). Higher education, lower complex comorbidities, lower body mass index, lower eGFR, and lower HbA1c were associated with a higher QOL score and were significant predictors of QOL scores in high-risk adults with diabetic nephropathy and undergoing hemodialysis.

Table 3

Multivariate linear regression in adults with diabetic nephropathy and undergoing hemodialysis N = 140.

Variables ^a	SF-36 sub scores	Physical component summary (PCS)		Mental component summary (MCS)		KDQOL	
	Categories	β	p	β	P value ^b	β	p
Gender	Male	3.2	0.63	2.5	0.23	−1.8	0.12
	Female	Reference	Reference	Reference	Reference	Reference	Reference
Age (years)	20–29 years	Reference	Reference	Reference	Reference	Reference	Reference
	30–39 years	−4.4	0.22	0.15	0.95	0.6	0.13
	40–49 years	−0.28	0.32	−0.4	0.14	−0.4	0.24
	> 50 years	2.5	0.82	0.2	0.91	2.6	0.46
Income (Omani Riyals/OR)	< 1000 OMR	Reference	Reference	Reference	Reference	Reference	Reference
	> 1001 OMR	−5.7	0.34	−5.6	0.76	−3.2	0.52
Education	No schooling/Primary school	Reference	Reference	Reference	Reference	Reference	Reference
	High school/Grade 12	−7.9	0.45	−7.2	0.67	−2.7	0.45
	Bachelors/master's degree	5.6	0.01*	4.7	0.03*	0.4	0.01*
Complex co-morbidities	Ischemia Stroke, Neuropathy	−5.7	0.23	6.4	0.34	3.4	0.45
	Nephropathy, Chronic kidney disease	0.3	0.01*	0.05	0.05*	0.3	0.04*
	Hypertension, Heart failure	Reference	Reference	Reference	Reference	Reference	Reference
Living status	Married	3.5	0.05*	4.5	0.03*	2.2	0.04*
	Single	Reference	Reference	Reference	Reference	Reference	Reference
Physical activity	Sedentary	Reference	Reference	Reference	Reference	Reference	Reference
	Moderate activity	−4.4	0.58	−0.95	0.63	2.1	0.12
Body mass index (kg/m ²)	< 18.5 kg/m ² Underweight	Reference	Reference	Reference	Reference	Reference	Reference
	18.5–24.9 kg/m ² Normal	−5.7	0.01*	−6.5	0.05*	−3.4	0.03*
	> 25 kg/m ² Obese	0.9	0.62	1.7	0.44	−1.9	0.26
	> 30 kg/m ² Overweight	0.2	0.98	−1.6	0.53	−0.7	0.64
eGFR (mL/min/1.73m ²)	< 45 mL/min/1.73m ²	Reference	Reference	Reference	Reference	Reference	Reference
	30–44 mL/min/1.73m ²	−3.7	0.05*	1.8	0.04*	−0.3	0.05*
	15–29 mL/min/1.73m ²	−1.0	0.72	−2.50	0.34	−2	0.28
	< 15 mL/min/1.73m ²	1.7	0.32	1.8	0.32	< 0.001	0.42
Albumin-creatinine ratio (mg/g)	< 300 mg/g	Reference	Reference	Reference	Reference	Reference	Reference
	> 300 mg/g	100	0.34	6.2	0.59	0.34	0.81
HbA1c (%)	≤7%	Reference	Reference	Reference	Reference	Reference	Reference
	7.01–7.99%	−0.05	0.04*	−4.7	0.02*	−4.4	0.01*
	≥8%	4.2	0.43	7.2	0.14	3.5	0.35

*p < 0.05 is the level of significance.

Table 4

Sociodemographic and clinical characteristics associated with QOL scores in multiple linear regression.

Variables ^a	Unstandardized coefficients (β)	Standard Error	Standardised coefficients (β)	p value*	95% confidence interval for β
Gender	−0.07	1.23	−0.21	0.23	−1.06 to 0.13
Age	−1.03	0.35	−0.05	0.44	−2.09 to 0.04
Income	0.04	1.34	0.06	0.25	0.03 to 0.10
Education	5.01	0.02	0.13	0.01*	5.01 to 0.09
Occupation	2.04	2.54	0.04	0.44	−2.06 to 0.13
Living status	0.15	0.06	0.09	0.05*	−1.30 to 0.01
Physical activity	−1.04	1.65	−0.04	0.49	−1.15 to 0.07
Complex co-morbidity	3.03	0.04	0.05	0.05*	3.04 to 0.11
Body mass index (kg/m ²)	2.03	1.06	0.04	0.05*	2.06 to 0.13
eGFR (mL/min/1.73m ²)	2.01	2.03	0.37	0.01*	2.01 to 0.02
Albumin-creatinine ratio (mg/g)	−0.04	0.22	−0.13	0.23	−1.02 to 0.08
HbA1c (%)	−1.04	1.03	0.06	0.02*	−0.03 to 0.10

^aUnivariate factors with p values < 0.05 were entered into the multiple linear regression, *p values < 0.05 significance level.

3.5. Relationship between physical QOL and emotional QOL scores

There is a positive correlation among the socio-demographic and clinical variables that measure the physical and emotional QOL (Fig. 1). Assuming each measure has the same weightage, the overall physical QOL in this study was 45.66 (44.29–49.04, $p < 0.04$). In this study, a linear relationship was observed between these QOL measures given in the linear equation with R square 49%, where, Emotional QOL = $4.32 + 2.05$ Physical QOL. These figures are lower than the QOL of adults in the general population^{18,19}.

4. Discussion

In our study adults with lower income and leading a single status were significantly associated with a lower QOL score. Our study showed that middle and higher age (above 40 years) was associated with lower QOL due to an increased duration of illness. This finding is supported by other studies.^{18,19} Our study showed that male gender was found to be associated with poor QOL, also cited in another study.^{20,21} In our study adults with families, having a marital life had better QOL score. This study shows that marital status emphasize spouse and family support to control illness with the expectations of the care for therapeutic renal therapy. Social support is higher due to larger size of Arab families and extended family lives in close proximity.²²

In our study, men with DN has lower income and lower QOL and significantly lower physical summary and mental health summary. Adults with a lower income was a predictor of poor QOL due to lack the knowledge in early self-management of CKD, and low literacy rate. Adults with lower income had lower QOL in terms of physical functioning, pain, physical, mental and social aspects. Other studies reflected these findings.^{23–25} In our study lower QOL scores for work among Omani adults can be attributed to the lower rate of labor force participation, and poor family support. Employed adults with a lower annual income are strongly associated with a lower QOL score. Low work status are related to low education, difficulties in adopting healthy habits, and poor mental health after the diagnosis of DN and undergoing hemodialysis.

In our study adults with complex comorbidities, stage 4 and 5 CKD, and uncontrolled glycemic control or HbA1c were significantly associated with a lower QOL score. The mean QOL score in adults with moderate to advanced CKD was due to low eGFR of 15–44 mL/min/1.73 m² in adults due to higher economic burden, poor clinical outcomes, greater impact of the disease, and long-term dependence on hemodialysis care for high-risk adults with DN with CKD. This study shows that the severity of complications was significantly associated with a lower QOL in adults with DN. Increased body mass index (> 25 kg/m²) was associated with low QOL scores as seen in other studies.²⁶

Fig. 1. Relationship between physical (PQoL) and emotional (EQoL) quality of life in adults with diabetic nephropathy.

Omani adults had lower adjusted scores on the Physical component summary and Mental health summary due to lower scores on the poor physical functioning, role-physical, body pain, role-emotional, emotional well-being, general health, and mental health. The KDQOL summary score had significantly lower adjusted scores on social support, staff encouragement, and satisfaction. Physical component summary (PCS), mental component summary (MSC), and KDQOL scores were associated with Bachelors/Master's degree, DN/CKD comorbidity, married life, BMI (18.5–24.9 kg/m²), eGFR (30–44 mL/min/1.73 m²), and HbA1c (7.01–7.99%). The QOL scores were low to moderate physical and mental component summary scores due to the impact of the disease burden on the mental status of adults and having a less focus on emotional and psychological well-being. The PCS and MSC was most affected among high-risk adults with DN and undergoing hemodialysis.²⁷

Our study showed that the QOL of the adults with diabetic nephropathy with moderate to advanced CKD was poor. Moderate socioeconomic status, marital life, male gender were found to be associated with higher QOL scores. Gender, age, income status, complex comorbidity, and CKD stage 3, 4 and 5 were significantly associated with poor QOL due to low eGFR of 15–44 mL/min/1.73 m². Higher age, lower education, higher duration of DM, and poor exposure to patient education were significant determinants of HbA1c.²⁸ Low QOL is associated with changes in the clinical and sociodemographic characteristics of the adults with DN. Other studies²⁹ described a positive association between HRQOL scores and age.

The variance of HbA1c (31.6%) and the variance of the total QOL (30.6%) was determined by age, gender, education, income, duration of illness, and education.²⁷ Physical functioning, role physical, body pain, vitality, role emotional, social function, role physical, general health and mental health were low. Physical and mental health composites of QOL were higher due to increased energy, emotional wellbeing and work status. The negative effect of the disease process on the physical activity and the mental health is due to ageing as a gradual and progressive reduction in their functional capacity, limiting their daily activities and leading to poor QOL. These factors were reported to be associated with QOL among hemodialysis due to religious, and health beliefs of accepting pain, sickness, and suffering as their fate by 'Allah'.³⁰ Our study findings observed a linear relationship between the physical and emotional QOL, the Omani adults have different perceptions of health beliefs, sickness and suffering as an expression of externalizing faith and culture.³¹ Our study substantiated that lower education, single status, complex comorbidities, higher body mass index, lower eGFR, and higher HbA1c were associated with a lower QOL scores and these social determinants were significant predictors of QOL scores.

Limitations. The study is limited by a cross-sectional study reducing the interpretation of casual relationships between a few characteristics. A socioecological model could be used for understanding the effectors and predictors between the sociodemographic and clinical factors. The study can adopt an experimental design to evaluate the self-management behaviors and self-efficacy on the QOL among adults with DN and undergoing hemodialysis. Selection bias may be due to non-response rate among eligible participants, gender and cultural norms, inclusion or exclusion adults, or a non-random selection of participants.

5. Conclusion

Our study showed that the high-risk populations with stage 3, 4 and 5 (advanced CKD) with low income, male gender, and marital life, were associated with a lower QOL score and were significant predictors of QOL scores. Adults with complex comorbidities, stage 3, 4 and 5 CKD (moderate to advanced), higher BMI, and uncontrolled HbA1c were significantly associated with a lower QOL, physical summary, and mental health summary scores. Poor physical functioning, role-physical, body pain, role-emotional, emotional well-being, general health,

mental health scores significantly affect the quality of life and are contributory factors of quality of life in high-risk adults with diabetic nephropathy and undergoing hemodialysis.

The predictors of QOL were lower socioeconomic and higher clinical characteristics, that contributed to lower mental and physical health in adults with DN and undergoing hemodialysis. These factors were found to have significant direct and indirect effects on changes in QOL in high-risk adults with DN and undergoing hemodialysis. A lower QOL in high-risk adults was significantly determined by the relevant socio-demographic and clinical factors and the root cause of varying QOL. The study will influence patient reported outcomes and knowledge translation for registered nurses who are caring for adult's diabetic nephropathy and undergoing hemodialysis. This study will guide registered nurses to guide high-risk adults with informed decision making to make healthy lifestyle modifications to improve the quality of life.

6. Summary statement

What is already known about this topic

- Self-efficacy and self-care activities are critical components in quality of life for adults with diabetic nephropathy.
- Uncontrolled glycemic control and high blood pressure lowers the quality of life in adults with diabetic nephropathy.
- Long-term hemodialysis affects self-dependence, family, social life, financial and life style.

What this paper adds

- Higher age, lower income, female gender, and poor education were significant predictors of quality of life scores.
- Adults with complex comorbidity, stage 3, 4 and 5 chronic kidney disease, higher body mass index, and uncontrolled glycemic control were significantly associated with reduced physical and mental component summary scores.
- Poor physical functioning, role-physical, body pain, role-emotional, emotional well-being, general health, and mental health scores contribute to the lower quality of life.

Implications for clinical practice

- Patient reported outcomes for adults with diabetic nephropathy and planning healthy lifestyle changes helps to improve the quality of life.
- Family, physical, and social determinants of health and functioning affect quality of life among adults with diabetic nephropathy.
- Healthy lifestyle modifications promote improved quality of life among adults with diabetic nephropathy and undergoing hemodialysis.

Authorship statement

MSD, KSN, LJL and PK have made substantial contributions on the conception, design, acquisition of data, and analysis and interpretation of data. MSD, KSN, LJ and PK have drafted the article and revised it critically for important intellectual content. All authors have agreed on the final version of the submitted paper. Melba Sheila D'Souza (MSD), Leodoro Jabien Labrague (LJL), Subrahmanya Nairy Karkada (KSN), and Pramod Kamble (PK).

Ethical approval of studies and informed consent

This study was supported by College of Nursing, Sultan Qaboos University grant (IG/SQU/CN/21/07/08). The views expressed in this study do not necessarily represent the views of Sultan Qaboos University.

Funding support statement

This research received a grant (IG/SQU/CN/21/07/08) from the Sultan Qaboos University College of Nursing. The sponsors played no role in the design, execution, analysis, data interpretation, writing reports or decision to submit the paper for publication.

Declaration of conflict of interest statement

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the original research work reported. There are no financial, personal or other conflicts of interest has been declared by the authors. ICMJE form for disclosure of potential conflicts of interest will be submitted by the authors to meet the journal requirements.

Acknowledgements

We are grateful to the consultants, content validators, research assistants, bi-linguistics for translation and language editors. All participants gave informed consent for the research, and that their anonymity was preserved.

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