

Psychological Profile of Patients Undergoing Hemodialysis and Its Association with Physiological Parameters

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Abstract

Background: End-stage renal disease (ESRD) is a chronic, progressive condition requiring maintenance hemodialysis, which imposes substantial physiological, psychological, and social burdens on patients. While physiological indicators are routinely monitored during treatment, the influence of psychological factors on these indicators and patients' quality of life remains inadequately explored, particularly in the Indian context.

Objective: To investigate the relationship between psychological variables (depression, anxiety, illness intrusiveness, and quality of life) and physiological indicators (serum albumin, serum creatinine, interdialytic weight gain, and physical activity) among patients with ESRD undergoing maintenance hemodialysis. **Methods:** A cross-sectional descriptive-correlational study was conducted among 127 patients undergoing maintenance hemodialysis at tertiary care hospitals. Participants were selected using purposive sampling. Psychological variables were assessed using standardized and validated questionnaires, while physiological data were obtained from patients' medical records. Descriptive statistics, Pearson's correlation, and linear regression analyses were performed to evaluate the associations between psychological and physiological variables, with statistical significance set at $p < 0.05$. **Results:** Significant associations were observed between several psychological and physiological parameters. Serum albumin demonstrated a significant negative correlation with anxiety ($r = -0.222$, $p < 0.01$). Serum creatinine was positively associated with illness intrusiveness ($r = 0.253$, $p < 0.01$) and depression ($r = 0.204$, $p < 0.05$). Interdialytic weight gain was positively correlated with illness intrusiveness ($r = 0.247$, $p < 0.01$) and anxiety ($r = 0.203$, $p < 0.05$). Physical activity was negatively associated with depression ($r = -0.209$, $p < 0.05$). Additionally, depression and anxiety exhibited a significant positive correlation ($r = 0.348$, $p < 0.01$), highlighting the

close interaction between psychological distress and clinical outcomes in hemodialysis patients. **Conclusion:** The findings demonstrate a significant relationship between psychological distress and physiological health indicators in patients undergoing maintenance hemodialysis. Integrating routine psychological assessment and psychosocial interventions into standard nephrology care may improve treatment adherence, quality of life, and overall clinical outcomes. These results support the implementation of multidisciplinary care models that address both the psychological and physiological needs of individuals with ESRD.

Keywords: End-stage renal disease, Hemodialysis, Depression, Anxiety, Quality of life, Serum albumin, Serum creatinine, Interdialytic weight gain, Psychological health.

Introduction

End-stage renal disease (ESRD) represents the terminal stage of chronic kidney disease (CKD), characterized by irreversible loss of kidney function that necessitates renal replacement therapy in the form of hemodialysis, peritoneal dialysis, or kidney transplantation. Among these treatment modalities, maintenance hemodialysis remains the most widely used therapy worldwide, particularly in developing countries where access to kidney transplantation is limited. Although hemodialysis effectively removes metabolic waste products and maintains physiological homeostasis, it does not completely restore normal renal function, leaving patients vulnerable to a wide range of physical, psychological, and social challenges[1].

Patients undergoing maintenance hemodialysis experience substantial treatment-related burdens, including strict dietary and fluid restrictions, frequent hospital visits, financial stress, reduced physical functioning, dependence on dialysis machines, and uncertainty regarding disease progression. These long-term challenges often contribute to psychological distress, with depression and anxiety being among the most prevalent psychiatric disorders reported in patients with ESRD. Previous studies have shown that psychological disorders not only diminish quality of life but also adversely affect treatment adherence, nutritional status, immune function, hospitalization rates, and overall survival. In addition to psychological distress, physiological indicators such as serum albumin, serum creatinine, interdialytic weight gain (IWG), and physical activity are routinely used to evaluate the clinical condition of patients receiving hemodialysis. Serum albumin is recognized as an important marker of nutritional status and mortality, while serum creatinine reflects muscle mass and residual renal function. Similarly, excessive interdialytic weight gain indicates poor adherence to fluid restrictions and is associated with cardiovascular complications and increased mortality. Emerging evidence suggests that these physiological parameters may be influenced by psychological and behavioral factors, highlighting the complex interaction between mental health and physical outcomes in patients undergoing dialysis[2].

Quality of life has become an essential outcome measure in ESRD management because it reflects patients' perceptions of their physical health, emotional well-being, social functioning, and ability to perform daily activities. Studies have consistently reported that individuals receiving maintenance hemodialysis experience significantly lower health-

related quality of life compared with the general population. Psychological distress, particularly depression and anxiety, has been identified as one of the strongest determinants of impaired quality of life in this population. Despite these findings, routine dialysis care remains predominantly focused on physiological monitoring, with comparatively limited emphasis on psychological assessment and intervention[3].

Although several international studies have explored individual associations between psychological distress and clinical outcomes, relatively few investigations have comprehensively examined the relationship between multiple psychological variables and physiological indicators simultaneously, particularly among Indian patients undergoing maintenance hemodialysis. Understanding these interrelationships is essential for developing patient-centered interventions that integrate psychological support into routine nephrology care and improve overall treatment outcomes[4].

Therefore, the present study aimed to investigate the relationship between key psychological variables, including depression, anxiety, illness intrusiveness, and quality of life, and physiological indicators such as serum albumin, serum creatinine, interdialytic weight gain, and physical activity among patients with end-stage renal disease undergoing maintenance hemodialysis. The findings are expected to provide evidence supporting a multidisciplinary approach to dialysis care that addresses both psychological well-being and physiological health, ultimately contributing to improved quality of life and better clinical outcomes for patients with ESRD[5].

Materials and Methods

Study Design

This cross-sectional, descriptive-correlational study investigated the association between psychological characteristics and physiological indicators in patients with End-Stage Renal Disease (ESRD) receiving maintenance hemodialysis. The primary objective was to determine the association of psychological factors with selected physiological parameters and health-related quality of life.

Study Setting

The study was carried out in the hemodialysis units of tertiary care hospitals in Punjab, India. Data were collected during routine hemodialysis sessions to minimize disruption to patient care and ensure participant convenience.

Participants

Patients diagnosed with ESRD and receiving maintenance hemodialysis were recruited using a purposive sampling technique. Initially, 155 patients were enrolled in the study. During the study period, 28 participants were excluded because of physical discomfort during assessment, voluntary withdrawal, or inability to complete follow-up procedures. Consequently, data from 127 participants were included in the final statistical analysis.

Sample Size

A total of 127 patients undergoing maintenance hemodialysis constituted the final study sample. This sample size was considered adequate to evaluate correlations between psychological and physiological variables using correlation and regression analyses.

Inclusion Criteria

Participants were included if they:

- Were aged 18 years or older.
- Had a confirmed diagnosis of End-Stage Renal Disease (ESRD).
- Had been receiving maintenance hemodialysis for at least three months.
- Were clinically stable during the period of data collection.
- Were able to understand the study procedures and provide written informed consent.

Exclusion Criteria

Participants were excluded if they:

- Had acute kidney injury or acute renal failure.
- Had severe cognitive impairment or psychiatric illness that interfered with questionnaire completion.
- Were critically ill or medically unstable during data collection.
- Declined to participate or withdrew consent during the study.

Study Variables

The study evaluated both psychological and physiological variables.

Psychological variables

- Depression
- Anxiety
- Illness intrusiveness
- Quality of Life–Physical (QOL-P)
- Quality of Life–Health Survey (QOL-H)

Physiological variables

- Serum albumin
- Serum creatinine
- Interdialytic weight gain (IWG)
- Physical activity

Data Collection Tools

Psychological status was assessed using standardized and validated instruments. Depression and anxiety were evaluated with the Beck Depression Inventory (BDI) and the Beck Anxiety Inventory (BAI), respectively. Illness intrusiveness was measured using the Illness Intrusiveness Rating Scale (IIRS). Health-related quality of life was assessed with the Kidney Disease Quality of Life–Short Form (KDQOL-SF), which encompasses both kidney disease-specific and general health dimensions. Functional status and physical activity were evaluated using the Karnofsky Performance Status (KPS) Scale. Clinical and physiological parameters, including serum albumin, serum creatinine, and interdialytic weight gain, were extracted from the participants' medical records and dialysis documentation[7].

Data Collection Procedure

After obtaining approval from the Institutional Ethics Committee and permission from the participating dialysis centers, eligible patients were approached during their routine hemodialysis sessions. Written informed consent was obtained from all participants before enrollment. Psychological questionnaires were administered individually in a quiet and confidential setting during dialysis sessions. Clinical and biochemical data were extracted

from patients' most recent laboratory reports and dialysis records. Participant confidentiality and anonymity were maintained throughout the study[8].

Statistical Analysis

Data were entered and analyzed using IBM SPSS Statistics software. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participants' demographic and clinical characteristics. Pearson's product-moment correlation analysis was performed to examine the relationships between psychological and physiological variables. Variables showing significant correlations were subsequently subjected to simple linear regression analysis to identify potential predictors. A p-value of less than 0.05 was considered statistically significant for all analyses.

Results

Participant Characteristics

Initially, 155 patients diagnosed with End-Stage Renal Disease (ESRD) and receiving maintenance hemodialysis were enrolled in the study. During the course of data collection, 28 participants were excluded from the final analysis due to physical discomfort that prevented completion of the assessment (n = 14), voluntary withdrawal from the study (n = 8), or failure to complete the required study procedures (n = 6). As a result, the final analysis was performed using data obtained from 127 participants.

The mean age of the participants was 45.59 ± 9.51 years. Males constituted 54.3% of the study population, while 45.7% were females. Most participants were married (95.3%) and had completed graduate-level education (68.5%). The mean duration of maintenance hemodialysis was 2.76 ± 1.37 years, with an average dialysis frequency of 2.01 ± 0.21 sessions per week. The mean General Health Questionnaire (GHQ-12) score was 8.50 ± 1.61 , indicating psychological distress among the study participants (Table 1).

Table 1. Demographic and Clinical Characteristics of the Participants

Variable	Value
Sample size	127
Age (years), Mean $\pm$ SD	45.59 ± 9.51
Male, n (%)	69 (54.3%)
Female, n (%)	58 (45.7%)
Married, n (%)	121 (95.3%)
Single, n (%)	6 (4.7%)
Secondary education	7.1%
Higher secondary	24.4%
Graduate	68.5%
Dialysis frequency (sessions/week), Mean $\pm$ SD	2.01 ± 0.21
Duration of dialysis (years), Mean $\pm$ SD	2.76 ± 1.37

GHQ-12 score, Mean $\pm$ SD	8.50 $\pm$ 1.61
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(N = 127)

Correlation Between Psychological and Physiological Variables

Pearson's correlation analysis demonstrated significant associations between several psychological and physiological variables (Table 2).

Serum albumin showed a significant negative correlation with anxiety ($r = -0.222$, $p < 0.01$), indicating that lower anxiety levels were associated with higher serum albumin concentrations. Serum creatinine exhibited significant positive correlations with illness intrusiveness ($r = 0.253$, $p < 0.01$) and depression ($r = 0.204$, $p < 0.05$). Higher creatinine levels were therefore associated with greater illness intrusiveness and depressive symptoms.

Interdialytic weight gain (IWG) was positively correlated with illness intrusiveness ($r = 0.247$, $p < 0.01$) and anxiety ($r = 0.203$, $p < 0.05$).

Physical activity, assessed using the Karnofsky Performance Status scale, demonstrated a significant negative correlation with depression ($r = -0.209$, $p < 0.05$), suggesting that patients with better physical functioning experienced fewer depressive symptoms (Table 2).

Table 2. Correlation Between Psychological and Physiological Variables

Psychological Variable	Serum Albumin	Creatinine	IWG	Physical Activity (KPS)
Depression	0.094	0.204*	-0.055	-0.209*
Anxiety	-0.222	0.162	0.203*	-0.040
Illness Intrusiveness	0.003	0.253	0.247	-0.065
QOL-Physical	0.030	0.078	0.040	0.040
QOL-Health	-0.066	-0.123	-0.170	-0.170

* $p < 0.05$, ** $p < 0.01$

Correlation Among Psychological Variables

A significant positive correlation was observed between depression and anxiety ($r = 0.348$, $p < 0.01$). Anxiety was also positively associated with the physical component of quality of life ($r = 0.226$, $p < 0.05$). No statistically significant relationships were identified between illness intrusiveness and the remaining psychological variables (Table 3).

Table 3. Correlation Among Psychological Variables

Variable	Depression	Anxiety	Illness Intrusiveness	QOL-Physical	QOL-Health
Depression	—	0.348	NS	NS	NS
Anxiety	0.348	—	NS	0.226*	NS
Illness Intrusiveness	NS	NS	—	NS	NS

Association Between Physiological Variables and Quality of Life

Analysis of the Kidney Disease Quality of Life (KDQOL) domains demonstrated several significant associations.

Serum albumin was negatively associated with the social support domain of the physical component of quality of life ($r = -0.195, p < 0.05$). Physical activity was negatively associated with symptom burden ($r = -0.199, p < 0.05$), indicating that patients with better physical performance reported fewer symptoms.

Within the health survey component of quality of life, serum albumin was significantly associated with physical functioning ($r = -0.252, p < 0.01$), whereas interdialytic weight gain showed a significant negative association with role-physical functioning ($r = -0.287, p < 0.01$) (Table 4).

Table 4. Significant Associations Between Physiological Variables and Quality of Life Domain

Physiological Variable	Quality of Life Domain	r	p-value
Serum Albumin	Social Support	-0.195	<0.05
Serum Albumin	Physical Functioning	-0.252	<0.01
Physical Activity	Symptoms	-0.199	<0.05
IWG	Role Physical	-0.287	<0.01

Linear Regression Analysis

Linear regression analysis was performed for variables demonstrating statistically significant correlations. The analysis identified serum albumin as a significant predictor of anxiety. Serum creatinine significantly predicted depression and illness intrusiveness, while interdialytic weight gain significantly predicted anxiety and illness intrusiveness. Furthermore, depression significantly predicted anxiety. These findings indicate that both physiological and psychological variables independently contributed to the observed clinical outcomes among patients undergoing maintenance hemodialysis (Table 5 & 6).

Table 5. Summary of Linear Regression Analysis

Dependent Variable	Predictor Variable	Significant
Anxiety	Serum Albumin	Yes
Physical Activity	Creatinine	Yes
Illness Intrusiveness	Creatinine	Yes
Depression	Creatinine	Yes
Illness Intrusiveness	IWG	Yes
Anxiety	IWG	Yes
QOL-Physical	Anxiety	Yes
Anxiety	Depression	Yes

Table 6. Summary of Significant Findings

Predictor	Outcome	Direction	Significance
Serum Albumin	Anxiety	Negative	$p < 0.01$
Creatinine	Depression	Positive	$p < 0.05$
Creatinine	Illness Intrusiveness	Positive	$p < 0.01$
IWG	Anxiety	Positive	$p < 0.05$
IWG	Illness Intrusiveness	Positive	$p < 0.01$
Physical Activity	Depression	Negative	$p < 0.05$
Depression	Anxiety	Positive	$p < 0.01$
Anxiety	QOL-Physical	Positive	$p < 0.05$

Discussion

The present study investigated the relationship between psychological factors and physiological indicators among patients with End-Stage Renal Disease (ESRD) undergoing maintenance hemodialysis. The findings demonstrated significant associations between depression, anxiety, illness intrusiveness, physiological biomarkers, and quality of life, emphasizing the multidimensional nature of ESRD management. These results support the growing evidence that psychological well-being is closely linked to physiological health and should be considered an integral component of routine dialysis care[9].

One of the principal findings of this study was the significant negative association between serum albumin and anxiety. Serum albumin is widely recognized as an indicator of nutritional status and an important predictor of morbidity and mortality in patients receiving hemodialysis. The observed relationship suggests that patients experiencing greater anxiety may have poorer nutritional status, potentially due to reduced appetite, altered dietary behaviors, or increased physiological stress. Similar findings have been reported by Friend et al. and Zamojska et al., who demonstrated that psychological distress adversely influences nutritional indicators in dialysis populations. These findings reinforce the importance of addressing psychological distress as part of nutritional management in ESRD[10].

The study also found that serum creatinine was positively associated with depression and illness intrusiveness. Elevated creatinine levels reflect impaired renal function and reduced physiological reserve, which may increase the perceived burden of illness and contribute to depressive symptoms. Patients with severe disease often experience greater physical limitations, dependence on dialysis, and disruption of daily activities, all of which may contribute to emotional distress. These findings are consistent with previous studies by Cukor et al. and Kimmel et al., who reported that depression is associated with poorer clinical outcomes and reduced adherence among patients receiving maintenance hemodialysis[11].

Interdialytic weight gain (IWG) showed significant positive correlations with anxiety and illness intrusiveness. Excessive fluid accumulation between dialysis sessions is commonly regarded as an indicator of poor adherence to fluid restrictions and dietary recommendations. Psychological distress may reduce patients' ability to comply with treatment recommendations, resulting in greater interdialytic weight gain. Similar observations have been reported by Taskapan et al., who identified psychiatric disorders as important contributors to poor fluid management and treatment non-adherence in dialysis patients. These findings highlight the importance of integrating behavioral counseling and psychological support into routine dialysis care to improve treatment adherence.

Physical activity demonstrated a significant negative association with depression, indicating that patients with better functional performance experienced fewer depressive symptoms. This

finding is in agreement with previous research demonstrating that regular physical activity improves both physical and psychological well-being among individuals undergoing hemodialysis. Exercise has been shown to reduce depressive symptoms, enhance functional capacity, and improve health-related quality of life. Encouraging appropriately supervised physical activity programs during or between dialysis sessions may therefore provide substantial clinical benefits[12].

A significant positive correlation was observed between depression and anxiety, confirming the close coexistence of these psychological disorders in patients with ESRD. Chronic illness, dependence on lifelong dialysis, uncertainty regarding prognosis, financial burden, and social limitations may collectively contribute to emotional distress. Routine psychological screening using validated instruments may facilitate early identification and management of these conditions, thereby improving patient outcomes[13].

Quality of life remains an important indicator of treatment success in ESRD. The present study identified significant associations between physiological variables and selected quality-of-life domains, particularly physical functioning, social support, and role limitations. These findings suggest that improvements in physiological health alone may not fully translate into better patient-reported outcomes unless psychological well-being is also addressed[7]. A multidisciplinary approach involving nephrologists, dialysis nurses, psychologists, dietitians, physiotherapists, and social workers may therefore provide more comprehensive patient care. The strengths of this study include the simultaneous evaluation of multiple psychological and physiological variables using standardized assessment instruments and the inclusion of clinically relevant biochemical parameters routinely monitored in dialysis practice. This integrated approach provides a broader understanding of the interaction between mental health and physiological status in patients undergoing maintenance hemodialysis. Overall, the findings indicate that psychological distress is significantly associated with key physiological parameters and health-related quality of life in patients receiving maintenance hemodialysis. These results highlight the importance of incorporating routine psychological screening and appropriate psychosocial interventions into comprehensive nephrology care to improve overall patient well-being and clinical outcomes[11].

Conclusion

The present study identified significant associations between psychological factors and physiological indicators in patients with End-Stage Renal Disease (ESRD) receiving maintenance hemodialysis. Anxiety was significantly associated with serum albumin and interdialytic weight gain, while depression was associated with serum creatinine and reduced physical activity. Illness intrusiveness was positively related to serum creatinine and interdialytic weight gain, indicating that greater disease burden is accompanied by poorer physiological outcomes. Depression and anxiety were also strongly correlated, highlighting the coexistence of psychological disorders in this population.

These findings emphasize that effective management of ESRD should extend beyond routine biochemical monitoring and dialysis adequacy to include regular assessment of psychological health. Incorporating psychological screening, counseling, patient education, and multidisciplinary supportive care into routine dialysis services may improve treatment adherence, nutritional status, quality of life, and overall clinical outcomes. Future longitudinal and multicenter studies are warranted to establish causal relationships and evaluate the long-term impact of integrated psychosocial interventions in patients receiving maintenance hemodialysis.

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