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Original Research

Assessment of Cognitive Function and Psychological Resilience in Patients Undergoing Hemodialysis Treatment

Elçin Babaoğlu[1,*], Hale İrban[2]

[1]Uskudar University Health Sciences Faculty, 34100 Istanbul, Turkey
[2]Umraniye Training and Research Hospital-Kidney Service, 34173 Istanbul, Turkey
*Correspondence: elcin.babaoglu@uskudar.edu.tr (Elçin Babaoğlu)
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Abstract

Background: The characteristics of cognitive impairment in hemodialysis (HD) patients and its relationship with resilience remain incompletely understood. This study aimed to evaluate cognitive function, resilience, identity factors, as well as examine the relationship between cognitive functions and resilience. **Method**: Patients (n = 90) with chronic kidney disease (CKD) undergoing HD participated in the cross-sectional study. Data were collected using the Montreal Cognitive Assessment (MoCA) tool, the Resilience Scale for Adults (RSA), and a demographic questionnaire. **Results**: Participants had a mean age of 54.21 $\pm$ 14.39 years and had undergone HD for 1–3 years (53.3%). More than half (51.1%) scored below 21 on the MoCA. Abstract thinking (0.94 $\pm$ 0.85) was the MoCA domain with the lowest score. The mean RSA score was 119.54 $\pm$ 23.90, with the highest resilience detected in social resources (26.34 $\pm$ 6.17) and family cohesion (22.96 $\pm$ 5.80). A weak positive relationship was found between cognitive function and resilience (r = 0.286, $p < 0.05$). **Conclusions**: More than half of patients undergoing HD had cognitive impairment, and a correlation was observed between resilience and cognitive function. Therefore, it is recommended to evaluate both areas of care and plan interventions to strengthen them. These findings emphasize the importance of a comprehensive psychosocial assessment of cognitive function to support quality of life in patients undergoing HD.

Keywords: cognitive function; Montreal Cognitive Assessment; psychological resilience; hemodialysis; chronic kidney disease

1. Introduction

Cognitive function encompasses the mental processes that enable individuals to perceive, understand, and interact with their surroundings through abilities, such as language, memory, learning, perception, and reasoning (Drew et al., 2019; Du et al., 2025). Patients with chronic kidney disease (CKD) undergoing hemodialysis (HD) face a higher risk of cognitive impairment compared to those receiving other forms of kidney replacement therapy (KRT) (Chien et al., 2020; Karakizlis et al., 2022). The characteristics of cognitive impairment in these patients and their relationship with certain psychosocial factors have not yet been fully elucidated (Nicholas et al., 2022). Psychological resilience, one of these psychosocial factors, is defined in the literature as the ability to adapt to difficult life conditions and stressors (Cal et al., 2015; Parsons et al., 2016). Son et al. (2019) reported that individuals with high levels of resilience had an enhanced orbitofrontal network and higher cognitive function.

The prevalence of cognitive impairment in HD patients is estimated to be between 30%–60% and is higher than in other patient groups (Bogataj et al., 2022; Chien et al., 2020). This may be partly due to changes in cerebral blood flow during HD therapy (Drew et al., 2019). Although cognitive impairment was initially associated with cardiovascular or metabolic disorders, recent studies indicate that age is significantly related to cognitive decline, regardless of comorbidities prior to HD (Karakizlis et al., 2022; Nicholas et al., 2022). Furthermore, factors such as polypharmacy, sleep disorders, and higher rates of depression and anxiety in HD patients compared to the general population exacerbate cognitive impairment, particularly in executive functions. These findings highlight the need for preventive interventions (Diamond, 2013; Feng et al., 2022; Liston et al., 2009; Rodriguez et al., 2013). Cognitive brain training, a preventive intervention, is a drug-free intervention approach that involves a series of cognitive activities aimed at preserving or improving participants' mental abilities such as memory, attention, judgment, decision-making, learning, and reasoning (Aksoy et al., 2024). A recent study involving individuals undergoing HD who received cognitive training using a classic n-back memory task observed improvements in cognitive and attentional functions. The n-back task involves tracking a series of stimuli and identifying the moment when the current stimulus matches the stimulus n steps earlier in the sequence. This task is designed to assess and train working memory and cognitive control by requiring participants to update and maintain relevant information over varying intervals (Aksoy et al., 2024). Cognitive brain training programs also enhance psychological resilience by reducing cognitive difficulties such as memory impairments and depression. This highlights the clinical significance of our study, as it represents a type of intervention that supports the positive relationship between cognitive function and resilience and aims to improve both cognitive and psychosocial outcomes. Previous studies have shown that psychological resilience has a protective effect in preventing depression and also enhances cognitive functioning (González-Flores et al., 2021; Kim et al., 2019).

Resilience refers to the ability of the individual to respond positively to adversity despite difficulties by transforming them into opportunities for growth (González-Flores et al., 2021). In many previous studies, resilience has been associated with treatment compliance and well-being in chronic diseases. Resilience has also been reported to exert a protective effect against the development of psychiatric diseases occurring in individuals with chronic diseases (Cal et al., 2015; Kim et al., 2019; Li et al., 2018; Ma et al., 2013). In patients with kidney disease, negative emotional states have been reported to decrease as resilience domains such as self-confidence, family support, and social support improve (González-Flores et al., 2021).

Limited studies have investigated the relationship between cognitive function and resilience (Arola et al., 2021; McDaniel et al., 2022). In previous studies conducted with elderly patients with cerebrovascular risks, increased resilience was associated with better-preserved cognitive function,whereas individuals with lower resiliance exhibited stronger cognitive impairment (Wingo et al., 2010; Wolf et al., 2019; Yang et al., 2021). A prospective study of 276 older adults from a German population with lower educational levels, which was set as the proxy for cognitive reserve, showed that worse cognitive decline was associated with greater amyloid pathology (Wolf et al., 2019). However, cognitive reserve alone does not fully explain resilience, and further comprehensive assessment of psychological resilience is necessary. Moreover, another study reported that higher cognitive function was positively correlated with resilience in a relatively younger population (Wingo et al., 2010). However, evidence regarding the relationship between psychological resilience and cognitive function remains limited (Arola et al., 2021; McDaniel et al., 2022; Wingo et al., 2010; Wolf et al., 2019; Yang et al., 2021). Cognitive functioning and resilience have generally been investigated separately in patients receiving HD, and no studies have examined these two areas together. The theoretical basis for this relationship is that psychological resilience is a psychosocial resource that supports coping with chronic disease stressors and facilitates positive adaptation. High resilience may enable individuals to better preserve their cognitive functioning despite the physiological and psychosocial challenges associated with HD therapy. This can be explained by the protective role of increased cognitive reserve or resilience. In this context, the joint assessment of cognitive functioning and psychological resilience is important for the development of comprehensive care strategies to improve therapy adherence and quality of life. Moreover, another study reported a positive correlation between cognitive function and resilience in a relatively younger population. Although recent studies provide longitudinal evidence of a relationship between psychological resilience and cognitive function (Du et al., 2025), evidence for this relationship is increasing across different chronic patient groups. However, there is still insufficient evidence regarding the relationship between cognitive functioning and psychological resilience in specific populations, such as HD patients. To address this gap, the aim of this study is to examine the relationship between cognitive functioning and psychological resilience in HD patients. Patients undergoing HD therapy should possess healthy decision-making skills and good adaptability to reduce physical and psychosocial risks and cope more effectively with the challenges associated with this treatment (Mok and Tam, 2001). Assessing cognitive functioning and psychological resilience together may benefit both the literature and clinical practice in this context. This study addresses an important gap, as it is among the first to examine cognitive functioning and psychological resilience together in HD patients. From a practical standpoint, the findings will help identify at-risk patient groups and lay the foundation for cognitive and psychosocial interventions in nursing care and multidisciplinary approaches.

2. Materials and Methods

2.1 Design

This was a cross-sectional study and adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2.2 Setting and Study Participants

The present study was conducted at the HD center of a state hospital in Turkey between February and May 2021. Patients who were ≥18 years old who had a diagnosis of CKD, were receiving HD, and were willing to participate were included in the study. Individuals who had neurological, mental, or psychiatric diagnoses, those with traumatic brain injury or lesions, and those with severe visual or hearing impairments that would prevent them to fill in the scales were not included in the study.

2.3 Data Collection

Data were collected using a demographic questionnaire, a clinical record review, and two self-reported instruments used to screen for cognitive function and psychological resilience. Data collection was conducted under the supervision of two researchers, with patients in the HD unit, usually during the first hour of the dialysis session or during outpatient appointments, using face-to-face interviews. Self-reported demographic characteristics included age, gender, education, marital, employment status, perceived socioeconomic level, physical activity, and duration of sleep. Information on the duration of HD treatment, HD session, and comorbid chronic diseases was extracted from the hospital records.

2.4 Montreal Cognitive Assessment (MoCA)

The Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005), an extensively validated screening and clinical assessment tool for CKD (Drew et al., 2019), was used to assess participants for cognitive impairment.

The MoCA is one page, 30-point test that assesses several cognitive domains, including executive function, visuospatial function, complex attention, language, memory recall, and abstract thinking. Total score range from 0 to 30, with a test result of $\leq$24 points indicating cognitive impairment and $>$24 points indicating normal cognitive function. The MoCA demonstrated good reliability (Cronbach alpha 0.73–0.85) (Carson et al., 2018). The Turkish version was validated and its reliability assessed by Selekler et al. (2010), who determined a cut-off point of 21 in this population.

The second investigator was certified to administer cognitive assessment using the MoCA. Drew et al. (2019) found no differences in cognitive performance based on the time of testing, suggesting that tests performed during the first hour of dialysis provide valid measures of cognitive performance (Drew et al., 2019). Therefore, the test was conducted either during outpatient clinic appointments or during the first hour of an HD session.

2.5 Resilience Scale for Adults (RSA)

The RSA was developed by Friborg et al. (2005) and its Turkish validity and reliability study was conducted by Basım and Çetin (2011). The Cronbach Alpha value of the scale was 0.75–0.84 (Basım and Çetin, 2011). The scale used a 5-point Likert style and consists of 33 items across 6 domains: personal strength, structured style, social competence, family cohesion, and social resources. Total scores range between 0 and 161. The increase in the scores that can be obtained from the scale without any cut-off point shows increased psychological resilience levels.

2.6 Sample Size

According to 2019 data, the study population consisted of 205 patients with CKD who received HD at the HD center. Of these, 90 patients who had undergone HD therapy for at least one year and consented to participate comprised the study sample. The required sample size was calculated as 88 using a non-random, judgement-based sampling method. To ensure adequacy, 90 patients were contacted. A post-hoc power analysis was conducted to investigate whether the sample size was sufficient. The correlation coefficient (r = 0.286; $p < 0.05$) between MoCA and RSA scores was used in the analyses, and the power of the sample was calculated to be 90% with an error of 5%. Despite the small sample size (n = 90), the resulting 90% post-hoc power analysis supports the reliability of the main findings.

2.7 Data Analysis

Data analysis was conducted in the Statistical Package for Social Science (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to analyze the demographic characteristics and the mean scores of MoCA and RSA. The normality of continuous variables was analyzed with the One-Sample Kolmogorov-Smirnov Test and was also visually investigated with histograms. Nonparametric tests were used since the assumption of normality assumption was not met. The median was preferred over the mean because the data were not normally distributed, as determined by the Kolmogorov-Smirnov Test and visual inspection of histograms. Differences between the groups were determined with the Mann-Whitney U and Kruskal Wallis H Tests. When significant differences were observed, pairwise comparison tests were performed to determine specific group differences. The Spearman correlation test, with a 95% CI, was used to examine the relationship between MoCA and RSA scores. Effect sizes were calculated and reported alongside p-values for group comparisons (e.g., $r = Z/\sqrt{N}$ for Mann-Whitney U test) to enhance the interpretation of practical significance.

3. Results

The mean age of the overall group was 54.21 $\pm$ 14.39 years, and 53 (58.9%) were males. 66 of the participants were married (73.3%), and 68.9% had completed primary school. Most participants, 75 participants (83.3%) were unemployed, and 59 (65.6%) reported a perceived middle socioeconomic status. Regarding HD treatment, 53.3% of participants had been receiving HD for 1 and 3 years, while 46.7% had been on HD for 4 or more years. HD was performed 3 times a week by 76 participants (84.4%), with session durations of 4 h for 82.2% of participants. Most participants (72.2%) had a comorbid chronic disease, such as cardiovascular or metabolic disease (Table 1). Individuals who had neurological diagnoses, such as dementia, were excluded. All participants attended HD sessions alone, without the use of wearable devices or assistive technology.

MoCA scores ranged between 2–30, with a mean of 18.79 $\pm$ 6.74, 51.1% scored below 21 points. The highest MoCA domain score was in orientation (5.67 $\pm$ 1.67), with a range of 2 to 6. The lowest MoCA domain score was found in abstract thinking (0.94 $\pm$ 0.85), which ranges from 0 to 2 (Selekler et al., 2010) (Table 2).

The RSA total score ranges from 0 to 161, with higher scores indicating greater psychological resilience; the scale does not have a cut-off point (Basım and Çetin, 2011). As shown in Table 2, the mean total RSA score was 119.54 $\pm$

Table 1. Demographic characteristics (n = 90).

Variables			n	%
Age (years)	(m ± SD: 54.21 ± 14.39)	<54	45	50.0
	(min: 23, max: 84)	≥54	45	50.0
Gender		Women	37	41.1
		Men	53	58.9
Education status		Primary school graduate	62	68.9
		High school graduate	16	17.8
		University graduate	12	13.3
Marital status		Married	66	73.3
		Unmarried	24	26.7
Employment status		Employed	15	16.7
		Not employed	75	83.3
Perceived socioeconomic status		Low socioeconomic status	31	34.4
		Middle socioeconomic status	59	65.6
Physical activity		Yes	28	31.1
		No	62	68.9
Duration of sleep		<8 hours	41	45.6
		≥8 hours	49	54.4
Duration of HD treatment (years)		1–3 years	48	53.3
		≥4 years	42	46.7
Weekly HD treatment frequency		2 times a week	14	15.6
		3 times a week	76	84.4
Duration of HD sessions (hours)		3 hours	16	17.8
		4 hours	74	82.2
Comorbid chronic disease		Yes	65	72.2
		No	25	27.8

M, mean; HD, hemodialysis; n, number of samples.

Table 2. Assessment of cognitive function and psychological resilience (RSA Scores).

MoCA and Domains Scores	Min	Max	m ± SD
Visuospatial function	0	5	2.39 ± 1.86
Naming	0	3	2.38 ± 0.77
Attention	0	6	4.11 ± 1.94
Language	0	3	1.80 ± 1.10
Abstract thinking	0	2	0.94 ± 0.85
Delayed memory	0	5	1.50 ± 1.67
Orientation	2	6	5.67 ± 1.67
Total MoCA Scores	2	30	18.79 ± 6.74
RSA and Domains	Min	Max	m ± SD
Perception of self	7	30	22.14 ± 5.97
Planned future	4	20	11.53 ± 5.07
Structured style	4	20	13.95 ± 4.19
Social competence	10	30	22.60 ± 5.63
Family cohesion	9	25	22.96 ± 5.80
Social resources	9	35	26.34 ± 6.17
Total RSA scores	43	155	119.54 ± 23.90

MoCA, Montreal Cognitive Assessment; RSA, Resilience Scale for Adults; m, mean.

23.90. The highest domain score was in social resources (26.34 ± 6.17), while the lowest two scores were in structured style (13.95 ± 4.19) and perception of the future (11.53 ± 5.07).

Table 3 provides the relationship between total MoCA and RSA scores and demographic characteristics. Total MoCA scores were lower among participants over 54 years of age, primary school graduates, unemployed, those with low socioeconomic status, those who did not participate in physical activity, and those receiving 4-hour HD sessions compared with other groups ($p < 0.05$; Table 3). Total RSA scores were lower in women and those with lower socioeconomic status than in other groups ($p < 0.05$; Table 3). No significant associations were detected between total RSA scores and other demographic characteristics ($p > 0.05$; Table 3).

The correlation between total RSA and MoCA scores was statistically significant ($p < 0.05$), with a weak positive relationship (r = 0.286). This finding suggests that higher RSA scores are related to the increase in MoCA scores. However, this statistically significant correlation is weak (see Fig. 1).

4. Discussion

The results of this study indicated that more than half of the patients receiving HD had low cognitive functioning. As a cross-sectional study, these findings describe the cog-

Table 3. Assessment of total MoCA and RSA scores according to demographic characteristics of patients.

Demographic characteristics	Variables	Total MoCA Scores	Total RSA scores
		m (95% CI)	m (95% CI)
Age	<54	22 (21–24)	123 (115–132)
	≥54	14 (12–19)	121 (111–130)
	Z	–4.683	–0.307
	p	<0.001	0.759
	Effect size r	–0.495	–0.032
Gender	Women	18 (14–21)	115 (110–123)
	Men	21 (19–24)	130 (119–141)
	Z	–1.708	–2.711
	p	0.088	0.007
	Effect size r	–0.180	–0.286
Education status	Primary school graduate	16 (14–19)	120.5 (112–129)
	High school graduate	24.5 (23–26)	117.5 (104–133)
	University graduate	27.5 (24–29)	129 (97–140)
	χ^2	45.496	0.356
	p	<0.001	0.837
	Effect size r	–0.495	0.837
Marital status	Married	19 (17–21)	124 (115–130)
	Unmarried	22.5 (18–25)	116 (105–130)
	Z	–1.773	–0.821
	Effect size r	–0.187	–0.087
	p	0.076	0.411
Employment status	Employed	26 (24–29)	134 (116–150)
	Not employed	19 (16–21)	119 (112–127)
	Z	–4.153	–1.700
	p	<0.001	0.089
	Effect size r	–0.438	–0.179
Perceived socioeconomic status	Low socioeconomic status	18 (12–21)	115 (105–127)
	Middle socioeconomic. status	21 (19–24)	128 (116–137)
	Z	–2.19	–2.370
	p	0.029	0.018
	Effect size r	–0.231	–0.250
Physical activity	Yes	22 (21–26)	123.5 (109–137)
	No	17.5 (14–21)	121.5 (113–129)
	Z	–3.474	–0.641
	p	0.001	0.522
	Effect size r	–0.366	–0.068
Duration of sleep	<8 hours	19 (16–22)	117 (109–129)
	≥8 hours	21 (20–24)	122 (116–132)
	Z	–1.051	–0.215
	p	0.293	0.830
Duration of HD treatment (years)	1–3 years	21 (20–24)	125 (112–131)
	≥4 years	19 (15–22)	120 (111–128)
	Z	–1.912	–0.712
	p	0.056	0.477
Weekly HD treatment frequency	2 times in a week	21.5 (14–24)	114 (92–130)
	3 times in a week	20 (18–22)	123 (116–131)
	Z	–0.390	–1.771
	p	0.696	0.077
Duration of HD sessions (hours)	3 hours	24 (21–29)	116 (97–134)
	4 hours	19.5 (17–21)	122.5 (115–129)
	Z	–2.320	–0.333
	p	0.020	0.740
	Effect size r	–0.245	–0.187
Comorbid chronic disease	Yes	19 (17–22)	120 (112–129)
	No	21 (20–24)	127 (116–140)
	Z	–1.511	–0.815
	p	0.131	0.415

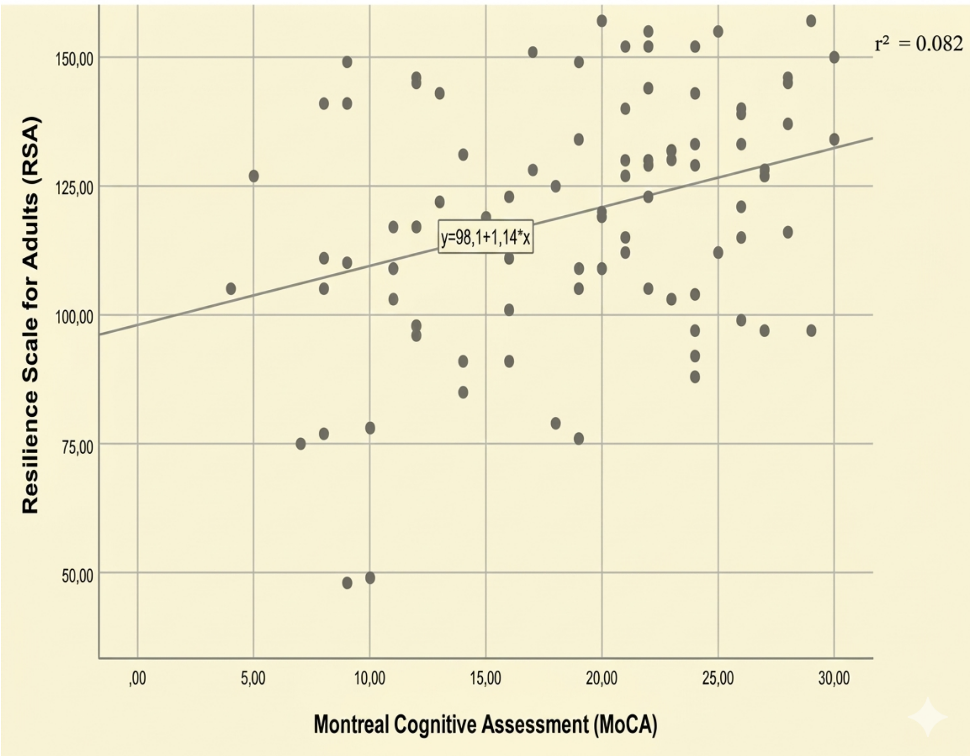

Fig. 1. Correlation between cognitive function and psychological resilience.

nitive function and psychological resilience levels of HD patients but does not establish causality. Advanced age, low educational level, unemployment, low socioeconomic status, and lack of physical activity were significantly associated with lower cognitive functioning. Similar results were obtained in other studies, indicating that cognitive impairment is common in patients receiving HD (Fazekas et al., 1995; Kurella Tamura et al., 2013; Pua and Yu, 2024). Karakizlis et al. (2022) reported that cognitive dysfunction in these patients was especially evident in delayed recall, executive functions, and language. In the present study, in the lowest MoCA domain scores were observed in abstract thinking (0.94 $\pm$ 0.85), delayed recall (1.50 $\pm$ 1.67), and language (1.80 $\pm$ 1.10) (see Table 2). Executive function is known to decrease in negative mood states, such as anxiety and depression (Diamond, 2013; Eysenck et al., 2007; Liston et al., 2009; Parsons et al., 2016). In the present study, a positive correlation was detected between cognitive functionality and resilience (r = 0.286, $p < 0.05$; Fig. 1). Considering the protective role of resilience against anxiety and depression, it can be argued that HD patients with high resilience maintain better cognitive function (González-Flores et al., 2021; Freire de Medeiros et al., 2017; Parsons et al., 2016).

In the present study, it was found that patients over 54 years of age had lower cognitive functionality in MoCA total and domains when compared to younger individuals. This finding is consistent with the results from numerous studies conducted in this field. Age was significantly associated with cognitive impairment in HD patients, independent of comorbidities (Chien et al., 2020; Drew et al., 2019; Feng et al., 2022; Nicholas et al., 2022). The study also found that patients with only a primary school education and those who were unemployed had lower cognitive functionality (see Table 3). Arola et al. (2021) reported that cognitive reserve, which is affected by educational and employment status, is a protective factor against cognitive impairment. The literature reported that participation in cognitively stimulating activities throughout life creates more cognitive reserve, reducing cognitive impairment despite significant brain pathology (Arola et al., 2021; Stern et al., 2019). These findings suggest that education and employment contribute to the maintenance of cognitive function by enhancing cognitive reserve. Regular participation in sports also provides cognitive reserve as a stimulant and protects functionality (Arola et al., 2021; Stern et al., 2019). In the current study, patients who engaged in sports had higher scores in all domains except delayed recall and orientation (see Table 3).

Previous studies have found that receiving HD 6 days a week did not improve cognitive functioning compared with three times a week (Drew et al., 2019; Karakizlis et al., 2022; Kurella Tamura et al., 2013). In the current study, although the frequency of weekly HD sessions did not affect cognitive functioning, patients receiving HD 3 times a week had higher resilience scores in the domains of social competence, self-perception, and structured style when compared with those receiving HD twice a week (see Table 3). This

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suggests that receiving HD 3 times a week was sufficient to maintain the quality of life of the patients. These patients were able to maintain their social relations, recognize their strengths, and maintain positive beliefs in their ability to cope with difficult events (Basım and Çetin, 2011; Friborg et al., 2005). On the other hand, it was also found that resilience scores did not differ significantly with HD treatment and session duration (see Table 3).

The domain with the lowest resilience was detected in the perception of the future. Women, primary school graduates, unemployed participants, those with low income, and those who did not engaged in any sports scored lower in this field when compared with other groups (see Table 3). These results were similar to previous studies (González-Flores et al., 2021; McDaniel et al., 2022). Yang et al. (2021) reported that differences in biological mechanism between men and women lead to variations in how cognitive functions are affected, which in turn affects resilience. According to the same authors, economic status is also a variable with an effect on resilience (Yang et al., 2021). Additionally, women have neuroprotective hormones, such as estrogen, that provide cognitive protection during the premenopausal period. Estrogen can increase cognitive reserve by supporting neuronal health and cerebral blood flow. However, this protection decreases after menopause. In men, testosterone influences cognitive functions through different mechanisms. Studies indicate that female and male brains differ structurally and metabolically (e.g., different gray and white matter volumes, different glucose metabolism rates). These differences lead to activation of different neural networks in response to cognitive challenges. The mechanisms by which cognitive functions are protected directly affect an individual's resilience, defined as their ability to cope with challenges. Yang et al. (2021) argue that these different cognitive processes contribute to biologically distinct resilience capacities in men and women under conditions of chronic stress or illness. In this study, gender showed a moderate ($r = -0.286$) and significant effect on total RSA scores, reflecting autonomic nervous system activity, which is often associated with resilience and stress management. This supports the impact of biological and cognitive differences on resilience (see Table 3). Low income can cause stress by causing a survival-related crisis, which negatively affects resilience by reducing positive thinking in individuals (Cal et al., 2015; Parsons et al., 2016; Xie et al., 2019).

In this study, the limited sample size and the lack of data on characteristics such as depressive symptoms and polypharmacy prevented the establishment of a causal relationship between cognitive functioning and resilience. These characteristics could not be assessed because the patient records at the state hospital did not include this information. The study revealed an effect between cognitive functioning and resilience (see Fig. 1). Son et al. (2019) reported that individuals with higher resilience scores had more developed orbitofrontal network structures, which affect subjective well-being. Other studies on this topic have reported a relationship between resilience and cognitive functioning, with cognitive functioning increasing as resilience increases (Arola et al., 2021; McDaniel et al., 2022; Son et al., 2019; Yang et al., 2021). However, these studies focused on elderly individuals and patients with neurovascular problems, and no studies have examined the relationship between cognitive functioning and resilience in HD patients. While the present study found a relationship between cognitive functioning and resilience, it is unclear whether changes in cognitive functioning or resilience occur first. The current univariate analysis identified several related factors (e.g., age, education, employment status); however, it could not control for potential confounding factors, preventing the determination of independent predictors of MoCA and RSA scores. Multiple regression analysis could have addressed this limitation.

Finally, although the cut-off score in the original version of the MoCA scale used in this study was 26, it is remarkable the culture-specific adaptation established a cut-off of 21 (Nasreddine et al., 2005; Selekler et al., 2010). This difference is likely due to cultural factors, such as the level of education in the sample, limited engagement in lifelong learning, lack of reading habits and hobbies, and the delegation of daily activities to young family members in this population (Aluş, 2015; Selekler et al., 2010). These cultural habits are also thought to cause cognitive reserve deficiency, depriving individuals of a resource that maintains functionality (Arola et al., 2021).

4.1 Implications for Clinical Practice

The study had several limitations. Since it was conducted in a public hospital serving patients with lower education and socioeconomic status, the results may differ for patients attending private HD centers. Therefore, it is recommended that the study be replicated in private HD centers where patients generally have better socioeconomic status. It was not determined in the study which determinant preceded in the relationship between cognitive functionality and resilience. Future cohort studies are recommended to determine which factor precedes the other. The limited sample size and the absence of multiple regression analysis in the current study should be considered a limitation when interpreting the independent effects of demographic factors.

In the current study, women, individuals over 54 years of age, those with low education and income status, and patients who did not engage in sports were identified as at-risk groups for reduced cognitive functionality and resilience levels. It is recommended that these patients undergo evaluation of cognitive function and resilience at 6–12-month intervals from the onset of HD therapy.

Cognitive function and resilience are two key factors in protecting the physical and mental health of patients. Patients with higher levels of these abilities tend to demonstrate better treatment and self-care behaviors of patients (Yang et al., 2021). Therefore, it is recommended that nurses in the dialysis team evaluate cognitive function and resilience when collecting patient data and incorporate these assessments into care planning. Furthermore, the self-confidence and resilience of the patient can be increased by focusing not only on the weak areas but also on the strong areas.

4.2 Limitations

Despite its pioneering role in examining the relationship between cognitive functioning and psychological resilience in HD patients, this study has several methodological limitations that may affect the interpretation of its findings. Notably, this study employed a cross-sectional design, collecting data at a single point in time. Therefore, it is not possible to establish a cause-and-effect relationship between cognitive functioning and psychological resilience. The obtained correlation does not explain which variable has an impact on the other or whether both variables are affected by a third factor. Future research should use longitudinal designs to elucidate the nature of this relationship.

The study used a non-random, judgment-based sampling method, meaning the sample consisted only of patients from a single center who volunteered to participate in the study. Consequently, the findings have limited generalizability to the broader HD population or to patients across the country.

Although the post-hoc power analysis supports the strength of the main correlation finding (90%), the total sample size (n = 90) is relatively small. This may have reduced the statistical power of group comparisons and more detailed regression analyses, particularly in subgroups under demographic variables (such as education level and employment status).

Due to the limited scope of the study, several important clinical variables known to affect cognitive function and resilience (e.g., biochemical parameters such as anemia level, parathyroid hormone levels, inflammation biomarkers) were not measured. These excluded variables may have influenced the relationship between our main variables as confounding factors.

5. Conclusions

In the present study, more than half of the patients receiving HD exhibited cognitive impairment, and a correlation was observed between resilience and cognitive function. Accordingly, it is recommended to develop clinical interventions to strengthen both care areas. It is also recommended that the cognitive function and resilience levels of patients receiving HD be evaluated regularly to support treatment adherence and protect mental health. These assessments must inform clinical interventions, such as patient education and stress management strategies.

Availability of Data and Materials

The data that supports the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

EB: principal author, conceived study, participated in design and coordination, analyzed the data, helped to draft manuscript and approved the final manuscript. HI: participated in design and coordination, undertook interviews, assisted with design and data analysis, helped to draft manuscript, read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study conformed with Helsinki Good Clinical Practice Principles. Official permission letters were obtained from the Uskudar University Ethics Committee where the study was conducted to conduct the study (Approval Number: 67210991-383). All participants received verbal and written information and voluntarily provided consent before commencing the study.

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Conflicts of Interest

The authors declare no conflicts of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/BP45449.

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