

Efficacy of Psychological Interventions in Reducing the Prevalence and Intensity of Depression in Patients with Long-Term Hemodialysis

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Abstract

Background: People with end-stage renal disease treated with long-term hemodialysis is frequently affected by major depression, which results in poor patients' outcomes; therefore, psychological interventions are crucial. **Aim of the study:** This study aimed to investigate the efficacy of psychological interventions in reducing the prevalence and intensity of depression in patients with long-term hemodialysis. **Design:** A one group quasi-experimental design that measures change in depression pre and post psychological interventions. **Setting:** This study was conducted at the hemodialysis unit (HD) in Dyarb Negm Central Hospital in Dyarb Negm City, in the Sharkia Governorate. **Subjects:** A purposive sample of 100 adult patients with End Stage Renal Disease (ESRD) who are on regular hemodialysis therapy in the study setting and have agreed to participate in the study. **Tools:** Patients' baseline demographic and medical data structured interview questionnaire and Beck Depression Inventory. **Results:** The current study findings revealed that all of the studied patients had depression, and the majority suffered from severe depression pre-intervention phase, while the intensity of depression for the majority reduced to a mild level post-intervention phase. **Conclusion:** There were statistically significant differences in depression and its intensity pre-and post-psychological interventions. **Recommendation:** The study recommends that all ESRD patients on regular hemodialysis undergo periodic psychological evaluations in order to detect any disturbances early. Further research is proposed to examine the efficacy of such psychological interventions on the quality of life of patients on regular hemodialysis.

Key words: Long-term hemodialysis, Depression, Psychological interventions

Introduction

Chronic kidney disease (CKD) affects 10–15% of the adult world population. It refers to kidney damage or reduced kidney function that has persisted for a minimum period of 3 months (Vart et al., 2020). Its prevalence is estimated to increase further due to the universal diabetes epidemic (Goh and Griva, 2018). In its early stages, treatment is focused on slowing the progression of kidney disease and preventing or treating complications and comorbid diseases. In end-stage renal disease (ESRD), renal replacement therapy, which includes hemodialysis (HD) treatment, is essential to maintain life (Wen et al., 2020).

HD is a treatment in which a machine filters waste and water from the blood as the kidneys did when they were healthy, but it has limitations and does not totally replace the function of normal kidneys. HD sessions usually last several hours each, on multiple days each week (National Institute of Diabetes and Digestive and Kidney Diseases (NIH), 2019), which can make individuals experience different emotions, such as stress, anxiety, and depression, as well as hopes and gratitude (Davison, 2010; Cohen et al., 2003). According to Goyal et al. (2018), 45% of adults undergoing HD have some degree of psychological issues (Goyal et al., 2018). Within the same context; patients undergoing hemodialysis feel at times like they are between life and death. Occupational,

nutritional, and financial problems, concerns about marriage and sexual life, and the fear of death and readmission are the major problems that may cause depression and despair among them (Nikkhah et al., 2020).

Depression is the most common psychological problem in patients undergoing dialysis (Finkelstien et al., 2000; Kimmel et al., 1993; Levenson et al., 1991), with a morbidity rate that can reach 25%, 4 times the rate among normal populations (Palmer et al., 2013).

Depression is a serious mood disorder characterized by severe symptoms that interfere with a person's patterns of thinking, feeling, and coping with daily activities (NIH, 2019). In this regard, approximately one-quarter of dialysis patients meet diagnostic criteria for major depression (Palmer et al., 2013; Szeifert et al., 2012). The prevalence of depression and anxiety symptoms in the dialysis population is high, ranging between 19 and 60% (Mehrabi et al., 2017), and is associated with increased mortality (Bossola et al., 2010; Chen et al., 2010; Kurella et al., 2005). The main factors that contribute to the development of depressive symptoms are medications, reduction of physical function, and dietary restrictions (Farrokhi et al., 2014). Depression in dialysis patients is associated with lower adherence to dialysis prescriptions (Kaveh et al., 2001; Kimmel et al., 1995; Afsar et al., 2009) and recommended dietary and fluid restrictions (Everett et al., 1993).

with 14.4% to 67% rate of nonadherence (Griva et al., 2014). In addition to significantly affect social interactions and leisure activities (Sugisawa et al., 2018) which may lead to poorer clinical outcomes (Chilcot et al., 2018). Moreover, depression has been associated with an increased rate of hospitalization, reduced quality of life, and increased mortality for dialysis patients (Farrokhi et al., 2014; Edmondson et al., 2013; Rosenthal et al., 2012; Palmer et al., 2013; Weisbord et al., 2014; Flythe et al., 2017). Therefore, it is essential to take effective and timely measures to reduce depression in hemodialysis patients. Indeed, as a complementary therapy, psychosocial interventions are recommended to improve both the clinical and psychosocial outcomes of kidney disease care (Mascha et al., 2009; Mollahadi et al., 2010) and are easier for patients to accept. In this regard; the National Institute for Health and Clinical Excellence recommends psychological intervention in managing depression for hemodialysis patients (Mollahadi et al., 2010). However, the efficacy of psychosocial interventions is still debated by some scholars. Therefore, whether psychological interventions are effective to treat depression in hemodialysis patients remains to be confirmed (Barello et al., 2022). Therefore, this study aims to investigate the efficacy of psychological interventions in reducing the prevalence and intensity of depression in patients with long-term hemodialysis.

Significance of the study

By 2020, the number of ESRD (end-stage renal disease) patients in the world will have increased by nearly 60% compared to 2005 (Bayoumi et al., 2013) and most of them will receive dialysis. Hemodialysis patients are prone to a variety of psychological problems; however, depression is frequently experienced by them and results in poor patient outcomes. Dialysis patients consider treatments that help with depression to be a high priority. Despite the fact that psychosocial interventions have been shown to decrease depression in various chronic diseases, we are very uncertain about whether treatments prevent or treat depression in dialysis patients, as studies are rare (Natale et al., 2019).

Aim of the study

The aim of this study was to investigate the efficacy of psychological interventions in reducing the prevalence and intensity of depression in patients with long-term hemodialysis.

Research Hypothesis

To fulfill the aim of the study, the following research hypothesis was formulated:

Psychological interventions for patients with long-term hemodialysis will reduce the prevalence and intensity of depression among them.

Methods

Research design: A one group quasi-experimental design that measures changes in depression pre and post psychological interventions.

Setting: The study was carried out in the hemodialysis (HD) unit in Dyarb Negm Central Hospital in Dyarb Negm City, at Sharkia Governorate. The unit consists of four rooms with twenty-seven HD machines and beds. Three of these rooms are allocated to patients negative for hepatitis C virus and one for positive patients.

Subject: A purposive sample of 100 adult patients with End-Stage Renal Disease (ESRD) who had been on regular hemodialysis therapy for 1 to more than 10 years and were experiencing depressive symptoms as a result of HD agreed to participate in the current study. While patients with other severe illnesses, malignant tumors, or mental illnesses were excluded.

Sampling:

The sample size was calculated to demonstrate an improvement in patients' depression symptoms with a moderate effect size (0.45), at 95% level of confidence and 80% study power (Chow et al., 2008; Hulley et al., 2013), taking into account a dropout rate of about 20%.

Tools of the study:

Two tools were used in this study to achieve the study's aims.

Tool 1: Baseline Demographic and Medical Data Structured Interview Questionnaire: It was developed by the researchers based on a literature review and comprised baseline demographic and medical data related to the studied patients' age, gender, marital status, children, education, job, income, and residence; and another part for medical data such as the cause and duration of the renal disease, family history of similar illness, duration of hemodialysis, and any associated complications.

Tool 2: Beck Depression Inventory (BDI), developed by Beck et al. (1996), was used to assess the level and intensity of depression. It has 21 self-reported items inquiring about depressive symptoms over the preceding 2 weeks. For each item, the respondent is asked to rate how he or she has been feeling about it during the past two weeks. The response to each item consists of four choices, indicating its severity. The response to each item is scored from 0 to 3, with a higher score indicating more severity. The scores of the 21 statements are summed-up for a maximum score of 63. The level of depression is categorized as: none (<10), mild (10-20), moderate (21-30), and severe (31+).

Field work:

The study was carried out in five phases:

I. The preparatory phase

Tools development:

The researchers developed the study tools after an extensive review of relevant literature for the current study, both local and international, using text books, articles, and scientific magazines. This phase ended with a pilot study.

Pilot study:

The data collection tool was presented to a jury of five experts in nursing and medicine for face and content validation. They reviewed it for clarity, relevance, and comprehensiveness. The BDI scale is a standard one with high validity and a reliability Cronbach alpha coefficient 0.92-0.93 (American Psychiatric Association [APA], 2000). Moreover, a pilot study was conducted on ten patients to check the clarity, applicability, and feasibility of the data collection tool. Since no changes were required, the patients from pilot study were included in the main study sample. The pilot also served to assess the reliability of the BDI scale, which showed a high level of reliability with a Cronbach's alpha coefficient of 0.958.

Administrative design:

The researchers obtained official permission from the Research Ethics Committee at the Faculty of Nursing, the Dean of the Faculty of Nursing, Zagazig University, and the directors of Dyarb Negm Central Hospital to collect the necessary data and explain the purpose of the study in order to obtain their cooperation.

II-Assessment phase:

During this phase, the researchers met with the eligible subjects under study in HD units two days a week, from 9:00 AM to 2:00 PM, where each interview took about 45 minutes. The data obtained were considered as pre-test results for later comparison with post-test results.

III: Planning phase:

This phase was for the preparation of the psychological intervention sessions based on pretest data and pertinent literature. Its general objective was that hemodialysis patients would acquire knowledge and coping skills to reduce the intensity of their depressive symptoms. It consisted of 15 sessions, including theoretical and practical aspects, where the theoretical sessions covered the background concerning an overview of chronic kidney disease, hemodialysis treatment, and depression as one of its psychological implications. The practical sessions involved training in relaxation techniques and practices to reduce the intensity of depression, such as deep breathing exercises, visualization, meditation, guided imagery, and yoga.

IV: Implementation phase:

This phase took about two months, two days weekly, to conduct 15 sessions for the subjects under study (5 theoretical and 10 practical). Each session lasted for

approximately 45 minutes. Suitable teaching aids prepared specially for the program were: booklets (handouts), videos, and pictures. At the end of every session, the participant's questions were discussed to clarify any misunderstandings that occurred during it, and the beginning of the next session started by summarizing the content of the previous session. The studied subject attended the planned sessions in small groups of ten people. The researchers used simple Arabic to ease their understanding of each program's sessions and gain their interaction and cooperation.

Method of teaching:

Interactive lectures, small group discussion, role play.

Media used:

In addition to the program handout, the teaching media included a data-show and a flipchart.

Evaluation method:

Feedback through oral questioning, redemonstration and positive participation and interaction.

V: - Evaluation phase:

This was done immediately after the implementation of the program. A line of contact for communication was established between the researchers and the subjects for feedback, monitoring, and evaluating their knowledge and practices using the previously mentioned data collection tools. Where; the efficacy of psychological interventions on frequency and intensity of patients' depressive symptoms was tested based on a comparison between the results of pre- and post-tests. The fieldwork was done two days per week, from 9:00 AM to 2:00 PM. It lasted for 5 months, from January to May 2022.

Statistical analysis:

Data entry and statistical analysis were done using the SPSS 20.0 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, , means and standard deviations, and medians for quantitative variables. Cronbach alpha coefficient was calculated to assess the reliability of the scales used by assessing their internal consistency. Quantitative continuous data were compared using the non-parametric Mann-Whitney or Kruskal-Wallis tests. Spearman rank correlation was used for assessment of the interrelationships among quantitative variables and ranked ones. In order to identify the independent predictors of depression scores, multiple linear regression analysis was used, and the analysis of variance for the full regression models was done. Statistical significance was considered at a p-value <0.05.

Table 1: Base line Demographic Characteristics of the Studied Patients (n=100)

Demographic Characteristics	Frequency	Percent
Age:		
<60	63	63.0
60+	37	37.0
Range	21.0-76.0	
Mean±SD	52.8±14.2	
Median	55.0	
Gender:		
Male	56	56.0
Female	44	44.0
Marital status:		
Unmarried	27	27.0
Married	73	73.0
Have children:		
No	16	16.0
Yes	84	84.0
Education:		
Primary	56	56.0
Intermediate	30	30.0
University	14	14.0
Job:		
Working	57	57.0
Not working	43	43.0
Income:		
Insufficient	38	38.0
Sufficient	62	62.0
Residence:		
Urban	15	15.0
Rural	85	85.0

Table 2: Medical Data of the Studied Patients (n=100)

Medical Data	Frequency	Percent
Cause of renal failure:		
Other chronic diseases	73	73.0
Renal disease	25	25.0
Post-surgery	2	2.0
Family history of renal failure:		
No	96	96.0
Yes	4	4.0
Duration on hemodialysis (per years):		
<5	50	50.0
5-	30	30.0
10+	20	20.0
Range	<1.0-19.0	
Mean±SD	5.9±4.5	
Median	4.50	
Session hours:		
3	4	4.0
4	96	96.0
Had complications:		
No	60	60.0
Yes	40	40.0

Table 3: Frequency & Intensity, and Scores of Depression Among the Studied Patients Pre and Post the Psychological Interventions.

Depression	Time				X ² test	p-value
	Pre		Post			
	No.	%	No.	%		
Depression:						
No	0	0.0	16	16.0	17.39	<0.001*
Yes	100	100.0	84	84.0		
Depression level:					158.62	<0.001*
None	0	0.0	16	16.0		
Mild	2	2.0	70	70.0		
Moderate	21	21.0	14	14.0		
Severe	77	77.0	0	0.0		
Depression score (max=63):					20.93	<0.001*
Range	13-63		0-29			
Mean±SD	37.5±9.1		15.0±5.9			
Median	37.0		15.0			

(*) Statistically significant at p<0.05

Table 4: Relations Between the Studied Patients' Depression and Their Demographic Characteristics Pre and Post Psychological Interventions.

Demographic characteristics	Depression score (pre)		p-value	Depression score (post)		p-value
	Mean±SD	Median		Mean±SD	Median	
Age:						
<60	38.6±9.4	39.00	0.04*	16.1±4.6	15.00	0.02*
60+	35.7±8.0	35.00		13.1±7.3	14.00	
Gender:						
Male	37.1±10.1	37.00	0.53	14.6±6.1	14.00	0.32
Female	38.0±7.5	37.50		15.5±5.7	15.00	
Marital status:						
Unmarried	40.6±11.0	40.00	0.08	18.6±6.5	20.00	<0.001*
Married	36.4±7.9	37.00		13.7±5.1	14.00	
Have children:						
No	44.7±12.9	48.00	<0.001*	20.7±4.3	21.00	<0.001*
Yes	36.2±7.4	36.50		13.9±5.5	14.00	
Education:						
Primary	37.0±8.0	37.00	0.44	14.4±5.8	15.00	0.61
Intermediate	39.6±9.3	39.00		15.9±6.5	15.50	
University	35.5±11.7	35.50		15.3±4.9	14.50	
Job:						
Working	38.2±9.5	37.00	0.41	15.7±6.5	15.00	0.14
Not working	36.7±8.3	37.00		14.1±4.9	14.00	
Income:						
Insufficient	42.1±8.4	41.50	<0.001*	16.1±6.3	16.00	0.06
Sufficient	34.7±8.2	34.50		14.3±5.6	14.00	
Residence:						
Rural	37.4±9.5	37.00	0.62	14.8±6.0	15.00	0.84
Urban	38.1±6.1	37.00		16.2±5.3	14.00	

(*) Statistically significant at p<0.05

(H) Kruskal Wallis test

Table 5: Relations Between the Studied Patients' Depression and Their Medical Characteristics Pre and Post Psychological Interventions.

Medical characteristics	Depression score (pre)		p-value	Depression score (post)		p-value
	Mean±SD	Median		Mean±SD	Median	
Cause of renal failure:						
Other chronic diseases	36.0±7.8	36.00	0.03*	14.6±5.2	14.00	0.23
Renal disease	41.5±9.7	40.00		16.5±6.8	17.00	
Post-surgery	44.5±26.2	44.50		12.0±17.0	12.00	
Family history of renal failure:						
No	37.3±9.1	37.00	0.17	15.0±5.8	15.00	0.56
Yes	42.0±2.9	42.00		15.3±8.8	17.00	
Duration on hemodialysis (Per years):						
<5	37.3±9.1	37.00	0.87	16.0±6.3	16.00	0.03*
5-	38.6±8.6	37.00		15.3±4.7	15.00	
10+	36.5±9.6	39.00		12.1±5.7	13.00	
Session hours:						
3	40.0±3.7	40.50	0.41	15.5±3.0	14.00	0.93
4	37.4±9.2	37.00		15.0±6.0	15.00	
Had complications:						
No	36.0±8.8	36.00	0.07	15.0±5.9	15.00	0.53
Yes	39.8±9.0	39.00		15.0±6.0	15.00	

(*) Statistically significant at p<0.05

Table 6: Correlation Between the Studied Patients' Depression Scores and Their Characteristics Pre and Post Psychological Interventions.

Characteristics	Spearman's rank correlation coefficient	
	Pre-intervention	Post-intervention
Age	-.368**	-.385**
Education level	.049	.059
Income	-.426**	-.190
Years on hemodialysis	-.067	-.227*
Session hours	-.083	-.009

(*) Statistically significant at $p < 0.05$ (**) Statistically significant at $p < 0.01$ **Table 7: Best Fitting Multiple Linear Regression Model for Depression Scores Pre and Post Psychological Interventions.**

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B		
	B	Std. Error				Lower	Upper	
Pre-intervention depression score								
Constant	46.10	2.15		21.419	<0.001		41.83	50.37
Having children	-7.26	2.14	-0.30	3.388	0.001		-11.51	-3.01
Income	-6.37	1.62	-0.35	3.937	<0.001		-9.58	-3.16
Complications	3.67	1.58	0.20	2.318	0.023		0.53	6.81
r-square=0.26 Model ANOVA: F=12.64, $p < 0.001$ Variables entered and excluded: age, gender, education, marital status, residence, job, family history, years on hemodialysis								
Post-intervention depression score								
Constant	65.91	2.53		26.048	<0.001		60.92	70.90
Having children	-7.17	1.32	-0.19	5.433	<0.001		-9.78	-4.57
Income	-3.72	1.01	-0.13	3.683	<0.001		-5.72	-1.73
Intervention	-22.52	0.95	-0.83	23.681	<0.001		-24.40	-20.64
r-square=0.76 Model ANOVA: F=103.53, $p < 0.001$ Variables entered and excluded: age, gender, education, marital status, job, residence, family history, years on hemodialysis, complications								

Results

The current study was conducted on 100 hemodialysis patients whose ages ranged from 21 to 76 years, with a median age of 55.0 years as shown in **Table 1**. 56% were males. 73% were married, and 84% have children. 56% had a primary education, 57% were working, 62% had sufficient income, and 85% were residing in rural areas.

Regarding patients' renal disease and hemodialysis characteristics, **Table 2** reveals that 73% of them reported renal disease due to other chronic illnesses. Only 4% were having a family history of renal disease. 20% on regular hemodialysis for more than 10 years. All of them were having three sessions per week, and these were 4-hour sessions for the great majority of them (96%). Two-fifths of them reported having complications.

Table 3 demonstrates that all the patients in the study sample were depressed at the pre-intervention phase, with a median score of 37 out of a maximum attainable score of 63. At the post-intervention phase, statistically significant improvements ($p < 0.001$) were revealed, with 16% of the patients having no depression. Regarding; the level of depression, at the pre-intervention phase, 77% of the patients had a severe level of depression compared with none (0%) at the post-intervention phase. On the other hand, 70% of them had mild levels of depression at the post-intervention phase, compared with only 2% at the pre-intervention phase. These differences were statistically significant ($p < 0.001$). Moreover, the mean score of depression decreased from 37.5 to 15.0 with $p < 0.001$. **Table 4** shows statistically significant relations between patients' pre-intervention depression and their

age ($p=0.04$), having children ($p<0.001$), and income ($p<0.001$). It is evident that the mean and median scores were higher among <60 years old, having no children, and having insufficient income. At post-intervention, statistically significant relations were found between patients' depression and their age ($p=0.02$), marital status ($p<0.001$), and having children ($p<0.001$). As the table describes, the mean and median scores were higher among those <60 years old, unmarried, and not having children.

In terms of the relationships between patients' pre-intervention depression and their medical characteristics, **Table 5** shows only a statistically significant relationship with the cause of renal failure ($p = 0.03$). It can be noticed that the score was highest among those patients who reported post-surgery causes of renal failure. Although the scores were higher among those who had complications, the difference could not reach statistical significance ($p=0.07$). At post-intervention, the only statistically significant relationship was with the duration of hemodialysis ($p=0.03$). It is noticed that the score had a decreasing trend with the increasing duration of hemodialysis.

Table 6 shows that patients' age and income had significant weak to moderate negative correlations with depression pre-intervention scores. At the post-intervention phase, the depression scores had significant but weak negative correlations with patients' age and duration of hemodialysis.

In multivariate analysis, **Table 7** indicates that the statistically significant independent positive predictor of patients' pre-intervention depression score was having complications. Conversely, their having children and sufficient income were negative predictors. The model explains 26% of the variation in the depression score. At the post-intervention phase, the study intervention was the main statistically significant independent negative predictor of patients' depression scores, in addition to having children and sufficient income. The model explains 76% of the variation in the depression score.

Discussion

Dialysis treatment causes a biographical break with multiple psychological implications such as depression that may interfere with patients' quality of life (**Alosaimi et al., 2020**) and feeling of wellbeing (**Marthoenis et al., 2021**). These symptoms, which are highly prevalent among patients on maintenance hemodialysis, can be alleviated by different approaches, including pharmacological therapies, psychological approaches, as well as other complementary techniques (**Gerogianni et al., 2018**). Therefore, the aim of this study was to investigate the efficacy of psychological interventions in reducing the prevalence and intensity of depression in patients with long-term hemodialysis.

Regarding the demographic and medical data of the study participants, the current study findings demonstrated that their ages ranged from 21 to 76 years, and the majority had renal failure due to other chronic diseases; in only one-fourth of them, it was attributed to renal diseases. This highlights the importance of the role of prevalent chronic diseases like diabetes and hypertension in ESRD and renal failure. In line with this, a study in China highlighted the effect of increasing rates of diabetes and obesity as risk factors for chronic renal diseases on the incidence of ESRD (**Yang et al., 2020**). The duration of hemodialysis varied widely among the study participants, ranging from less than one to 19 years, with a mean 5.9 years. This is not surprising given that hemodialysis is a lifelong treatment for patients with renal failure. It can thus extend for decades, especially with the advances in the technology of hemodialysis and the strict infection control precautions. In congruence with this, a study in Thailand reported a mean duration of hemodialysis of 5.93 years (**Yuenyongchaiwat et al., 2020**).

The current study findings indicated that all patients in the sample were experiencing depressive symptoms at the pre-intervention phase. Moreover, in more than three-fourths of them, the depression was a severe degree. This is expected in ESRD patients undergoing hemodialysis and might be explained by their awareness of the fact that this management modality is for life and is not intended or expected to cure their disease. Similarly high rates of depression were reported among hemodialysis patients in Brazil (**Alencar et al., 2020**) and Japan (**Iida et al., 2020**).

Concerning demographic characteristics significantly influencing the pre-intervention depression among the patients in the current study, the bivariate analyses showed significantly higher scores among younger patients, those no children, and those with insufficient income. Moreover, the depression scores had negative correlations with patients' age. In the multivariate analysis, having children and having sufficient income were negative predictors, meaning that they are alleviating factors for depression. This is in agreement with the study conducted by, **Gadia et al. (2020)** in India, which showed that a lower income is associated with higher levels of depression among hemodialysis patients. These current study results might be explained by the fact that the younger patients who suffer this life-long illness lose hope in life while they might have had high expectations for the future. Moreover, the lack of support from children and the lack of financial resources may increase their depression. In line with this finding, a study in Iran demonstrated the positive effect of psychosocial support on hemodialysis patients' depression scores as well as their hope (**Rambod et al., 2020**).

Furthermore, the present study's bivariate analyses revealed that depression scores had significant negative correlations with the duration of hemodialysis. This was noticed both at the pre-intervention and post-intervention phases. This could be attributed to the patient's adaptation to the process of hemodialysis, which could make him or her more accepting of the situation. In congruence with this, a study in Turkey revealed that the maintenance hemodialysis patients who are more able to adapt and cope with their illness experience fewer depressive symptoms (**Işık Ulusoy et al., 2020**).

Meanwhile, in the multivariate analysis, hemodialysis complications were identified as a positive predictor of the patient's depression score. The finding is quite plausible since the experience of any complications would certainly have a negative impact on the patient's mental wellbeing, and would accentuate his or her negative feelings towards the disease and its management. In line with this, a systematic review demonstrated that decreasing hemodialysis-related complications using aromatherapy can alleviate patients' depression symptoms (**Bouya et al., 2018**).

The present study found that psychological interventions led to significant improvements in patients' depressive symptoms. This was demonstrated in both the prevalence of depression symptoms among them, as well as the degree of severity of these symptoms, as implied by the grade and score of depression. This improvement was affected by the implementation of the psychological interventions, which have been identified as the main independent significant predictor of the improvement of the depression score. In agreement with this, a study in Iran demonstrated significant improvements in the depression scores of hemodialysis patients following the implementation of an intervention based on hope therapy (**Rahimipour et al., 2015**). Moreover, a systematic review provided strong evidence of the positive effect of mind-body interventions on depressive symptoms among patients undergoing maintenance hemodialysis (**Chu et al., 2020**).

The success of the psychological interventions could be attributed to both their content and process. Where its' content filled gaps identified in patients' knowledge and as well as provided practical training in behavioral strategies to cope with the psychological disturbances experienced by hemodialysis patients. In congruence with this finding, **Xing et al. (2016)** highlighted that psychological interventions for patients on maintenance hemodialysis can alleviate their depression symptoms through assisting them in the modulation of their perceptions to their disease and its management.

Concerning the factors influencing the present study patients' post-intervention depression scores, they

were similar to those of the pre-intervention score, in addition to being higher among the unmarried ones. This, however, was not identified as an independent predictor in the multivariate analysis, which again identified having children and having sufficient income as negative predictors of the post-intervention depression score. The same previously mentioned explanations for pre-intervention depression apply to the post-intervention score.

Conclusion: There were statistically significant differences in depression and its' intensity pre-and post-psychological interventions.

Recommendation: The study recommends that all ESRD patients on regular hemodialysis undergo periodic psychological evaluations in order to detect any disturbances early. Further research is proposed to examine the efficacy of such psychological interventions on the quality of life of patients on regular hemodialysis.

List of abbreviations:

CKD: Chronic kidney disease

ESRD: End stage renal disease

HD: Hemodialysis

BDI: Beck depression inventory

Ethics declarations:

Ethical approval and consent to participate

After obtaining an official permission to conduct the study, the researchers met with the eligible subjects to explain the purpose & nature of the study. Also, anonymity and confidentiality were assured through coding the data and the data were not reused in another research project without their consent. Consent was obtained, and the participants were assured that participation in this study was voluntary and they had the right to withdraw from it at any time without any penalty.

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Conflict of interest

The authors declare that they have no conflict of interest.

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Authors' contributions:

HE came up with the idea, devised the research methods, carried out the field research. FE conceived the title of the study, read the pertinent studies and wrote literature review, expressed viewpoints regarding the study findings and utilized relevant studies that agreed or disagreed with these findings, and edited the manuscript. All authors finalized the manuscript with the remaining sections like the

conclusion, recommendation, and references and approved the final version of the manuscript.

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