# Depression among Patients Undergoing Maintenance Hemodialysis at a Nephrology Department in Benghazi Medical Center, Libya.

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## Abstract

Background: The number of End Stage Kidney Disease (ESKD) patients living on Kidney Replacement Therapy (KRT) is increasing globally. Hemodialysis is the most prevalent KRT worldwide. Patients with ESKD in general, and especially those on hemodialysis, are affected by an increased incidence of mental, cognitive, and psychological dysfunction-related issues, of these issues, depression has the highest burden, with its detrimental impact on the general health of patients, aggravating malnutrition, decreasing compliance to treatment, adding increased stress on their caregivers, and increasing morbidity and mortality. This study analyzed the occurrence of depression in patients with chronic kidney disease (CKD) undergoing hemodialysis (HD) at Benghazi Medical Center (BMC) in Benghazi, Libya. Methods: A cross-sectional study investigating the prevalence of depression among hemodialysis patients attending the nephrology department at Benghazi Medical Center, Benghazi, Libya, and its relation to some common socio-demographic factors, using Beck's Depression Inventory scale for depression conducted in September. Results: Forty-six (46) patients were included, the mean age of the patients was 48±14.3 years, with 28 (60.9%) male patients and 18 (39.1%) female patients; depression was observed in 22 (47.8%) patients, mean BDI score was 11.7±9.39; ranging from 0 to 43, female patients had a higher median score of 13 ranging from 1 to 43, male patients median score was 8 ranging from 0 to 25, illiterate patients had a median score of 25; ranging from 12 to 35, educated patients median was 8 ranging from 0 to 43. Conclusions: Depression was common in patients undergoing HD, and the rate of depression was significantly higher in female and illiterate patients.

Keywords: End-Stage Kidney Disease, Depression, Hemodialysis, Benghazi, Libya

Abbreviations:
ESKD: End Stage Kidney Disease, KRT: Kidney Replacement Therapy, HD: Hemodialysis, CKD: Chronic kidney disease, WHO: World Health Organization, BDI: Beck Depression Inventory, BMC: Benghazi Medical Center, SPSS: Statistical Package for the Social Sciences.

**Introduction**

End Stage Kidney Disease (ESKD) is a common worldwide morbidity, with an increasing incidence rate of patients undergoing Kidney Replacement Therapy (KRT) [1]. Globally, the number of patients who underwent KRT in 2010 is estimated to be about three million patients, and this number is expected to increase to reach a prevalence of about 5 to 10 million in 2030 [2]. Hemodialysis (HD) is the most common type of KRT used worldwide [3]. ESKD can lead to many physical and psychological burdens once it develops, and patients on HD are at a significantly increased risk of mental disabilities, including depression, anxiety, fatigue, and decreased quality of life compared to other treatment modalities [4]. The World Health Organization (WHO) defines depression as "a common mental disorder characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feeling of tiredness, and poor concentration" [5]. Unfortunately, depression frequently goes undiagnosed among patients undergoing hemodialysis (HD), contributing to suboptimal compliance with dialysis therapy. Consequently, inadequate adherence to the prescribed treatment regimen can result in insufficient dialysis, leading to heightened uremia, exacerbation of the underlying condition, and an escalation in the severity of depression. These cascading effects can further manifest as impaired nutritional balance, reduced self-esteem, and an augmented propensity for suicidal ideation [6]. There are several tools for screening depression, but few of these tools have been validated in chronic kidney disease (CKD) and dialysis patients, one of these validated tools is the Beck Depression Inventory (BDI) scale, which is a self-rated tool which is used to identify depression symptoms and measure the intensity of depression, manifested through the person's behavior and perspectives, consisting of 21 questions, surveying both mental and somatic symptoms of depression, graded from 0 to 3 for each question, the total score is ranging from 0 to 63 [7]. The usefulness of the BDI scale tool for screening depression is due to its relatively easy administration, and patients with ESKD on HD had a significantly high BDI score [8], which was shown to be associated with aggravated morbidity and mortality in HD patients [9]. Unlike high-income and well-developed countries, the problem of depression has not been well studied in less developed countries like Libya, and there is scarce data regarding the prevalence of depression and its risk factors both in the general population and in special high-risk groups, such as patients with ESKD. This study aimed to estimate the prevalence of depression in patients with CKD undergoing HD at the Benghazi Medical Center (BMC) in Benghazi, Libya, to assess the sociodemographic and clinical characteristics associated with depression among HD patients, and to help identify modifiable factors associated with depression among Libyan hemodialysis patients.

**Methods**

This was an observational cross-sectional descriptive study of patients on maintenance HD at the Nephrology Department in Benghazi Medical Center (BMC), conducted over 30 days in September 2019, after ethical clearance from the Research Ethics Committee of Benghazi Medical Center. The STROBE cross-sectional reporting guideline checklist was used to validate the consistency of the study. Patients who had received at least three months of maintenance HD, aged eighteen (18) years and above, of both sexes were asked to provide informed consent for inclusion in the study. Fifty HD patients were recruited in the study period, patients who had previous documentation of clinical dementia or cognitive impairment, acutely ill patients, and patients who declined or were unable to provide informed consent; were excluded, the final sample size was forty-six (46) patients. The total number of HD patients was 50 HD patients recruited for participation, of whom four patients were excluded due to non-illegibility; thus, the final number of enrolled patients was 46. Data were collected by trained investigators, and it consisted of multiple parts:

- Patient demographic characteristics included questions about age, gender, level of education, employment status, and marital status.
- Clinical data obtained from the patients' records, about history and their disease and comorbidities, which include frequency and duration of dialysis per week, duration of renal failure, years of undergoing HD, smoking status, exercise, and present comorbidities (such as hypertension, diabetes mellitus, ischemic heart diseases).
- The Beck Depression Inventory (BDI) scale score, obtained through a self-administered validated Arabic translation of the BDI-II questionnaire [10], was filled directly by patients or through a helper who reads aloud and explains the questions to the patient who would choose his answer; we used the score cutoffs of: (a) no depression for a score from zero to 9, (b) mild depression for a score from 10 to 15, (c) moderate depression for a score from 16 to 23, and a score of 24 or more indicates (d) severe depression [7].
- The choice of cutoff score in the BDI scale has implications for identifying individuals with depressive symptoms. Using slightly higher cutoffs, such as those recommended in the revised version of the BDI scale (BDI-II), or considering the variability observed in different studies can help address inconsistencies and improve comparability across research [7].

**Ethical statement**

This research study was approved by the Benghazi Medical Center Research EthicsBoard (ID: 2019.45.44.1, date of approval: 08/06/2019). All participants provided informed consent before participating in the study. The study was conducted in accordance with all applicable ethical standards.

**Statistical analysis**

Statistical analysis was done by Statistical Package for the Social Sciences (SPSS) v23 (IBM Corp 2015, Armonk, NY: IBM), quantitative data was expressed as the mean ± SD & median, qualitative data was expressed as absolute frequencies & relative frequencies, and Continuous data had been checked for normality by using the Shapiro Walk test, Mann Whitney U test was used to compare two groups of non-normally distributed variables, Spearman's rank correlation coefficient was calculated to assess the relationship between different study variables, (+) sign point out direct correlation & (-) sign point out inverse correlation, additionally, values near to 1 point out strong correlation & values near zero point out weak correlation, All tests had been two-sided, p-value < 0.05 was regarded statistically significant (S) and p-value ≥ 0.05 was regarded statistically insignificant.

**Results**

The study enrolled a total of 46 patients, with an average age of 48 years (±14.3). The age range of the patients varied from 21 to 90 years. Among the enrolled patients, 28 (60.9%) were male, and 18 (39.1%) were female. In terms of marital status, the majority of patients, 25 (54.3%), were married, while 21 (45.7%) were single. Regarding education level, 4 patients (8.7%) were illiterate, 3 patients (6.5%) had completed primary education, 12 (26.2%) had finished preparatory and secondary education, and 15 (23.6%) were college graduates. In terms of employment status, 31 (67.4%) were unemployed, while 15 (32.6%) were employed. Additionally, 15.2% of the patients were smokers, 63% had hypertension, and 15.2% had diabetes mellitus (Table 1), The median duration of Hemodialysis among the studied patients was six years (ranged from 1 to 27 years). Depression was present in 22 (47.8%) of the patients to some degree, while it was not observed in 24 (52.2%) patients, as shown in Table 2 and Figure 1. The average score on the Beck Depression Inventory (BDI) was 11.7 (±9.39), ranging

from zero to 43. Female patients had higher depression scores, with a median score of 13 (ranging from one to 43), compared to male patients who had a median score of eight (ranging from zero to 25). This difference was statistically significant (p<0.05). Additionally, illiterate patients had higher depression scores, with a median score of 25 (ranging from 12 to 35), compared to educated patients who had a median score of eight (ranging from zero to 43). This difference was also statistically significant (p<0.05) (Table 3). Nevertheless, there was no statistically significant difference among other socio-demographic parameters, smoking, and comorbidities (diabetes, hypertension) and laboratory data (Hb, Blood glucose, Urea, Creatinine, S-Albumin, calcium, phosphate) and hemodialysis-related parameters of the studied patients, and their depression score; p>0.05. Figure 1: Flow chart on enrollment of studied population.

Table (1) Distribution of the studied patients according to demographic characteristics (n=46):

|  | no | % |
|---|---|---|
| Age per year |  |  |
| 20 - ≤ 40 | 15 | (32.6) |
| 41-60 | 23 | (50.0) |
| 61-90 | 8 | (17.4) |
| Mean± SD | 48±14.3 |  |
| Range | (21-90) |  |
| Gender |  |  |
| Female | 18 | 39.1 |
| Male | 28 | 60.9 |
| Education |  |  |
| illiterate | 4 | 8.7 |
| Primary | 3 | 6.5 |
| Preparatory | 12 | 26.1 |
| Secondary | 12 | 26.1 |
| Collage | 15 | 32.6 |
| Job |  |  |
| employed | 15 | 32.6 |
| Not employed | 31 | 67.4 |
| Marital status |  |  |
| Married | 25 | 54.3 |
| single | 21 | 45.7 |
| Smoking Habit |  |  |
| Non-smokers | 39 | 84.8 |
| Smokers | 7 | 15.2 |
| Diabetes mellitus |  |  |
| No | 39 | 84.8 |
| Yes | 7 | 15.2 |
| Hypertension |  |  |
| No | 17 | 37.0 |
| Yes | 29 | 63.0 |
| Other co-morbidities |  |  |
| No | 38 | 82.6 |
| Limb -amputation | 1 | 2.2 |
| CMP | 1 | 2.2 |
| Hiatus hernia | 1 | 2.2 |
| IHD | 3 | 6.5 |
| MR | 1 | 2.2 |
| SLE | 1 | 2.2 |

CMP: Cardiomyopathy, IHD: Ischemic Heart Disease., MR: mitral regurgitation, SLE: systemic lupus erythematosus.

Table (2) Prevalence of depression among the studied patients and their grades and scores (n=46):

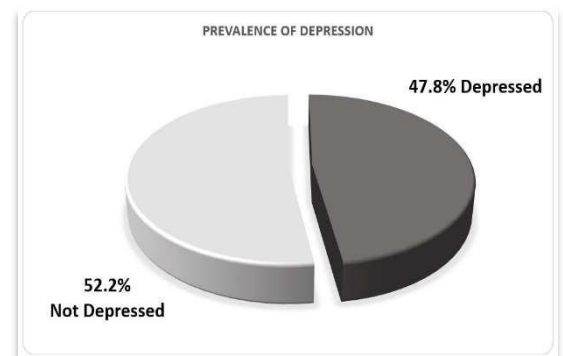| | | No. | % |
|---|---|---|---|
| Depression grade Studied patients (n=46) | | | |
| No Depression | | 24 | 52.2 |
| With depression | Mild | 11 | 23.9 |
| | Moderate | 5 | 10.9 |
| | Severe | 6 | 13.0 |
| Total: | | 46 | 100% |



Figure 1: Prevalence of depression among the studied patients

Table (3) Relationship between sociodemographic, smoking, and comorbidities of the studied patients and their depression score:

| Variables | Mean BDI ± SD | Median(range) | U-test | p-value |
|---|---|---|---|---|
| SEX | | | | |
| Female | 15.72±11.89 | 13(1-43) | 1.93 | 0.049(S) |
| Male | 9.11±6.35 | 8(0-25) | | |
| Education | | | | |
| Illiterate | 24.5±9.5 | 25(12-35) | 2.5 | 0.012(S) |
| Educated | 10.48±8.5 | 8(0-43) | | |
| Job | | | | |
| Un- employed | 13.39±10.5 | 11(1-43) | 1.41 | 0.16 |
| Employed | 8.2±5 | 7(0-18) | | |
| Marital status | | | | |
| Single | 12.19±8.8 | 9(3-35) | 0.64 | 0.52 |
| Married | 11.28±10 | 8(0-43) | | |
| Smoking | | | | |
| Yes | 7.71±3 | 8(4-12) | 0.96 | 0.33 |
| No | 12.4±9.97 | 10(0-43) | | |
| Diabetes mellitus | | | | |
| Yes | 15.29±8 | 13(4-25) | 1.59 | 0.11 |
| No | 11±9.6 | 8(0-43) | | |
| Hypertension | | | | |
| Yes | 11.59±7.86 | 11(0-30) | 0.78 | 0.44 |
| No | 11.88±11.83 | 7(1-43) | | |

U-Test= Mann-Whittney U test        S=significant p<0.05.

## Discussion

In this study, it was found that 47.8% of the patients experienced some level of depression. This finding is consistent with the results of several international studies that utilized self-administered or clinician-administered scoring tools, such as the BDI score. For instance, rates of depression in dialyzed patients were reported as 51.8%, 49%, 56.5%, and 42.7% in Nepal, the USA, Korea, and Brazil, respectively [11-14]. Moreover, In a meta-analysis conducted by Palmer et al, which included 87 studies using the BDI as a screening tool, depression was observed in 41.3% (CI, 37.9–44.7) of the surveyed population, consisting of 9384 subjects [15].

In the present study, it was found that the mean BDI score of the studied patients was 11.7 with a range of (0-43), In line with results from Western world countries, Wuerth et al. and Cukor et al. reported that the mean BDI score was 12.1±7.7 and 12.1±9.8 respectively in dialysis patients from USA [13,16], Ibrahim et al. from Egypt reported that the mean BDI score in Egyptian hemodialysis [17], However, in eastern world countries the average BDI score reported is seen to be higher; Manandhar et al. from Nepal reported mean BDI score of 19.2±10.2 [11], results from Pakistani and Turkish HD patients reported by Saeed Z. et al. and Bulut et al. showed a mean BDI score 25.4 ± 11.4 and 27.9+11.7 respectively [18,19], while KOO et al from Korea reported Mean BDI score of 22.7±11.4 [13], these differences in BDI scores between Western and Eastern world countries can be justified by the different perceptions of the BDI questionnaire between these different populations, and the influence of the diverse cultural, demographic, and socioeconomic factors that may interfere with symptoms of depression. It is worth noting that the BDI score is a self-rated tool in which the individual rates their own level of depressive symptoms. This means that it cannot be used as a standalone diagnostic tool for depression. To make an accurate diagnosis, more robust clinical tools like the Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria should be applied. These criteria involve qualified experts assessing the presence of depression while minimizing the influence of somatic symptoms on the survey. When using self-rated tools like the BDI, there is a concern regarding the overlap of somatic symptoms associated with ESKD, such as fatigue, impaired sleep, and anorexia, with symptoms attributed to depression in the BDI questionnaire. This can lead to an overestimation of depressive symptoms and, consequently, a higher observed rate of depression. In a meta-analysis of 41 studies conducted by Palmer S et al., it was found that depression was reported in 39% of dialysis patients when using both self-rated and clinician-administered survey tools. However, when utilizing diagnostic tools that employ structured clinical interviewing, like the DSM criteria, the observed prevalence rate of depression was nearly halved, with only approximately 22.8% (CI, 18.6–27.6) of subjects being diagnosed with depression. This difference does not appear to be related to demographic or general socioeconomic characteristics of the studied population [15]. Accordingly, expert guidelines state that patients who screen positive for depression using self-administered tools should be evaluated using structured interviewing tools to identify patients who may need active intervention to alleviate depression. Consequently, some expert authors have suggested a cutoff BDI score of 14 to 16 or above as the most reliable for selecting KRT patients who should be referred for further psychological evaluation and management [20]. Hence, in the literature, different BDI score cutoffs have been used to determine the degree of depression, while some authors use the standard BDI cutoff, as in this study, others adopt slightly higher cutoffs, such as those who use the revised version of the BDI scale (BDI-II), therefore, they report relatively lower rates of depression. This fact should be taken into consideration when comparing the results of different studies that use the BDI scale. The impact of socioeconomic factors on depression in hemodialysis patients is a complex and multifaceted issue. In our study, we did not find a statistically significant relationship betweendepression and socio-demographic characteristics such as age group, occupation, and marital status. This finding is consistent with previous research conducted in Egypt, Turkey, Sudan, and Iraq [21-24], which also reported no significant association between these factors and depression in hemodialysis patients. Similarly, we did not observe a significant relationship between depression and clinical data such as smoking, diabetes, hypertension, laboratory data, and hemodialysis-related parameters. These findings align with previous studies conducted inthe same regions, suggesting that these factors may not directly contribute to the development or severity of depression in hemodialysis patients. Interestingly, employment status did not have a significant influence on the rate of depression in our studied population. This contrastswith a report from Nepal by Manandhar et al., which indicated a positive relationship between unemployment and an increased rate of depression in Nepalese hemodialysis patients [11]. The difference in findings may be attributed to variations in socio-economic factors and the level

of governmental support in these populations. It is possible that the availability of social welfare programs, job opportunities, and financial support in different countries can influence the impact of employment status on depression in hemodialysis patients. Regarding gender, male sex was the most predominant in our study, with 60.9% of the included patients being males and 39.1% being females. This finding is consistent with the reported higher prevalence of ESKD among males in Libya [25]. However, despite the higher prevalence of ESKD among males, the depression score was higher among female patients. This finding is consistent with studies conducted in Iraq and other international settings, which have consistently reported higher rates of depression among female hemodialysis patients [24]. This observation may be attributed to gender differences in the willingness to express emotions. Females tend to be more open in expressing their emotions, while males may be more restrained in disclosing or expressing their emotional distress [26]. However, there are other studies in which no gender-specific difference in the rate of depression in HD patients was observed [14]. This contradiction can be attributed to the different perspectives and socio-economic factors within each population. In the present study, depression scores were higher among illiterate patients than among educated patients, which is consistent with another similar study conducted in Turkey by Oner N. This confirms the evidence for the negative impact of illiteracy on health by decreasing awareness of patients regarding their disease, poor communication with healthcare providers, and impaired compliance with treatments. This underscores the need for effective measures to eliminate health illiteracy to improve outcomes in HD patients. Furthermore, the current study showed that there was no significant relationship between higher depression scores and the marital status of patients (p = 0.119). However, according to Armaly et al., unmarried patients were two times more likely to be depressed than married ones. In contrast, a study in Saudi Arabia concluded that married patients were more depressed than single patients. This contradiction is difficult to resolve due to the complex socio-demographic, cultural, and behavioral differences between these different populations. Finally, it should be noted that this study had a relatively small sample size, which is a common characteristic of many international studies examining depression in CKD. For instance, Palmer et al., in a meta-analysis of 216 studies evaluating CKD-related depression, reported that the median sample size was 77 patients, ranging from 10 to 7475. Among the 216 studies, 155 had a sample size of less than 99 patients [15]. The authors hope that this study can contribute as a preliminary report on depression in this understudied group of patients.

**Conclusion**

Based on the results of this study, it can be concluded that depression is a common psychological disorder among patients undergoing hemodialysis, regardless of their demographic, socioeconomic, educational level, dialysis-related parameters, or comorbidities. However, it tends to be more prevalent and severe in female patients and those who are illiterate. It is important to screen hemodialysis patients for depression and implement effective preventive and therapeutic measures, with special attention given to the more vulnerable groups. This can be achieved through the implementation of a multidisciplinary program involving psychiatric experts, social support volunteers, and family members, aimed at prevention, identification, and treatment of depression. Additionally, increasing knowledge and awareness among both patients and healthcare providers regarding mental and mood disorders would improve patient-provider communication, treatment adherence, and promote a healthy lifestyle. These measures can enhance the quality of life for patients, reduce complications, minimize costs, medication errors, and even mortality.

**Limitations**

It is important to note that this study is cross-sectional in nature, and therefore, a causal relationship between hemodialysis and depression cannot be established unless compared to a control group of non-hemodialysis end-stage kidney disease (ESKD) patients with depression. Furthermore, the BDI scale, which was used in this study, was originally designed for screening depression in the general population and may not fully capture the complexity of depression in CKD patients. In this study, more accurate results could have been obtained if the findings were validated through a structured interview-based approach in patients with moderate or higher BDI scores, A structured interview allows for a more comprehensive assessment of depressive symptoms by providing an opportunity for clinicians or researchers to directly interact with patients. This approach enables the exploration of additional information, such as the context and severity of symptoms, as well as the presence of comorbid conditions that may influence the interpretation of BDI scores. Additionally, the study would have been strengthened by including a larger sample size. One potential strategy for increasing the sample size is to collaborate with multiple research sites or centers. By involving multiple sites, researchers can access a larger pool of potential participants, thereby increasing the overall sample size. This approach allows for a more diverse and representative sample, enhancing the generalizability of the study findings to a broader population of hemodialysis patients. It is important to mention that this study represents data from adult Libyan patients undergoing hemodialysis, and further research should consider screening for depression in the pediatric age group, However, pediatric patients undergoing hemodialysis also face unique challenges and may experience depression at different rates compared to adults. Furthermore, studying depression in pediatric hemodialysis patients can provide insights into specific risk factors and protective factors that may be unique to this population. Factors such as developmental stage, family dynamics, and social support systems can significantly impact the prevalence and manifestation of depression in pediatric patients. Finally, implementing a longitudinal design in future research investigating the relationship between depression and hemodialysis can provide valuable insights and enhance our understanding of this complex association. By studying participants over an extended period, a longitudinal design allows for the examination of changes and patterns in variables of interest over time, offering several potential benefits in exploring the relation between depression and hemodialysis in patients. Availability of data and materials: Some of the data that support the findings of this study are provided in the charts included in the manuscript. Additional data can be obtained upon request from the corresponding author. However, due to ethical considerations regarding participant privacy and consent, as well as legal restrictions, certain sensitive patient data cannot be publicly disclosed.

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