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EFFECTIVENESS OF IMPLEMENTING MODIFIED MINDFULNESS BASED STRESS REDUCTION (MBSR) ON STRESS AND FATIGUE IN HEMODIALYSIS PATIENTS

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Abstract

Stress and fatigue are common complaints among hemodialysis patients, significantly affecting their quality of life during long-term therapy. This study aimed to evaluate the effectiveness of a modified Mindfulness-Based Stress Reduction (MBSR) intervention on stress and fatigue in patients undergoing hemodialysis. The study adopted a quasi-experimental pretest-posttest control group design and employed simple random sampling. A total of 32 respondents participated, with 16 in each group. Stress was measured using the Perceived Stress Scale (PSS-10) and fatigue using the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F 40). The modified MBSR intervention was conducted for 30 minutes per session. Data were analyzed using paired t-tests and independent t-tests. The results showed significant differences in stress (MD = -13.12, t = -4.748, p < 0.001) and fatigue levels (MD = 7.34, t = -3.865, p = 0.001) between the intervention and control groups. These findings indicate that the modified MBSR therapy was effective in reducing stress and fatigue, with a p-value < 0.05 indicating statistical significance. Therefore, this modified MBSR therapy is a promising non-pharmacological nursing intervention that can be integrated into nursing care for chronic kidney failure patients experiencing stress and fatigue during hemodialysis.

Keywords: *Fatigue, Hemodialysis, Mindfulness-Based Stress Reduction, Stress*

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INTRODUCTION

Chronic Kidney Disease (CKD) affected approximately 10% of the global population in 2020 (WHO, 2020). The number of CKD patients undergoing hemodialysis has been increasing by 8% annually, reaching about 1.5 million people worldwide. According to WHO, CKD-related mortality is projected to rise by 14% by 2030, leading to 11.5 million deaths globally (WHO, 2019). In the United States, about 35.5 million people, or 14% of the population, were estimated to have CKD in 2023 (CDC, 2023). Meanwhile, the Saudi Centre for Organ Transplantation reported a significant annual increase of 7.7% in the number of patients starting renal replacement therapy in Saudi Arabia in 2019 (SCOT, 2019). In Indonesia, the 2018 Riskesdas report revealed that 19.3% of adults had CKD, with the highest prevalence in Jakarta at 38.7% (Ministry of Health, 2018).

The Provincial Health Research and Development Agency of Banten reported in 2018 that the prevalence of chronic kidney failure reached 0.25%, with 28.47% of these patients undergoing hemodialysis. Progressive CKD requires renal replacement therapy through hemodialysis (HD) to preserve remaining kidney function for a longer duration (Vaidya et al., 2022; Kalantar-Zadeh et al., 2021). Hemodialysis effectively filters blood to eliminate waste products and maintain electrolyte balance (Murdeshwar et al., 2023; Zazzeroni, 2017). However, patients undergoing hemodialysis often experience various complaints, including fatigue and high levels of stress (Razzera et al., 2021; Sakkas et al., 2012).

Fatigue is characterized by a feeling of exhaustion, both physically and psychologically (Davey et al., 2019; Flythe et al., 2019). It has a significant impact on patients' quality of life (Natashia et al., 2020). Stress is also a common complaint among patients with chronic kidney failure (Kahn et al., 2015). According to Dhungana (2023), approximately 69.49% of patients experienced moderate stress during hemodialysis. If left unmanaged, prolonged stress and fatigue can adversely affect the quality of life (Joshi et al., 2017; Yonata et al., 2022; Cecen et al., 2022; Diyanto et al., 2023).

Non-pharmacological nursing interventions, particularly cognitive behavioral therapy based on mindfulness, are currently evolving (Razzera et al., 2021). One of these therapies is Mindfulness-Based Stress Reduction (MBSR). Research by Fisher et al. (2023) demonstrated that MBSR is effective in reducing symptoms of mental health disorders. This finding is also supported by Arsy (2023), who reported that MBSR is an effective nursing intervention to alleviate psychological stress in patients with chronic diseases.

This study introduces a modification of MBSR by incorporating breathing exercises using the box breathing technique (BBT) with a timed counting system. According to Balban et al. (2023), box breathing practice has shown effective results in managing stress, well-being, and fatigue. Preliminary data from a study on CKD patients undergoing hemodialysis revealed frequent complaints of stress and fatigue, especially before therapy sessions, with no non-pharmacological therapy applied at the research site. Therefore, a strong rationale exists for developing nursing interventions using MBSR therapy to address stress and fatigue in CKD patients.

METHODS

Study Design

This study employed a quantitative research approach using a quasi-experimental design with a two-group pretest-posttest control group approach. Participants were divided into two groups: the intervention group, which received a modified Mindfulness-Based Stress Reduction (MBSR) intervention, and the control group, which received standard care in the hemodialysis unit. Data were collected at two time points: before the intervention and two weeks after the intervention. This design allows for the evaluation of the stability of the patient's condition.

Sampling and Participants

The study population consisted of CKD patients undergoing hemodialysis at An Nisa Hospital Tangerang from 2023 to December 2024, totaling 45 individuals. The sample size was determined using G Power 3.1.9.4 software, with a t-test for mean differences between two groups, an effect size of 1.01 (Alisaleh & Shahrbanoo, 2016), an alpha error probability of 0.05, and a power of 0.80, resulting in a minimum required sample of 26 respondents. To account for a 20% risk of missing data, the final minimum sample size was set at 32 respondents, evenly divided into two groups of 16 participants each. This sample size was considered sufficient to analyze the statistically significant effects of the modified MBSR intervention.

The sample was selected using simple random sampling, totaling 32 respondents divided equally into two groups. The inclusion criteria were as follows: (1) willingness to participate as a respondent, (2) aged over 18 years, (3) undergoing hemodialysis (HD) for at least 3 months, and (4) no hearing impairments. The exclusion criteria included: (1) cognitive dysfunction or intellectual disability, (2) unstable hemodynamics, (3) uncooperative behavior in following the program, (4) use of psychopharmacological medications or undergoing psychotherapy, and (5) failure to attend the intervention more than twice.

Data Collection and Measurement

Demographic data collected in this study included age, gender, education level, and employment status. Additionally, patient medical history data were gathered, such as the duration of hemodialysis (HD) in years, the duration of each HD session in hours, comorbid diseases, and hemoglobin levels (g/dL) obtained from medical records during treatment. The level of stress was measured using the Perceived Stress Scale (PSS-10), which ranges from a score of 0 (never) to 4 (very often) (Facit.org). A higher score indicates a greater level of stress. The reliability test resulted in a Cronbach's Alpha value of 0.761. Meanwhile, the level of fatigue was assessed using the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F 40) instrument, with scores ranging from 0 (not at all) to 4 (very much) (Facit.org). For the fatigue scale, a higher total score indicates a lower level of fatigue. The reliability test resulted in a Cronbach's Alpha value of 0.957.

Ethical Approval

Ethical approval was obtained from the Ethics Committee of the Faculty of Nursing, Universitas Muhammadiyah Jakarta (Approval No. 1496/F.9-UMJ/X/2024). Participants were informed that their data would remain confidential, used solely for research purposes, and coded for anonymity. They were provided with a clear explanation of the study's procedures, objectives, and benefits, ensuring no harm during participation. Participants were also informed of their right to withdraw at any time or decline to answer questions without consequences. Informed consent was obtained before participation, and all respondents were treated equally throughout the study.

Intervention Descriptions

The intervention for the treatment group consisted of a modified Mindfulness-Based Stress Reduction (MBSR) program conducted twice a week at the hospital. Participants were also encouraged to practice independently at home once daily for five consecutive days, with each session lasting 30 minutes. The intervention included four sessions: body scan, sitting meditation, mindful movement, and mindful breathing using the box breathing technique. Meanwhile, the control group received standard hospital care, including verbal education provided by HD room nurses. At the end of the intervention, both groups underwent a post-test assessment using the same instruments.

Data Analysis

Data were analyzed using IBM SPSS Statistics 22 software. Descriptive statistical data analysis was used to obtain an overview of the frequency distribution and mean value of each variable. The analysis that has been done is the normality and homogeneity test by analyzing each variable. Homogeneity analysis on numerical measurement variables such as age, duration of HD, duration of HD, hemoglobin value and CCI is seen from the results of the Levene test while categories such as gender, education and occupation with the chi square test. Data were analyzed using a paired t-test to see the difference in pre-test and post-test data for each group and an independent t-test to see the difference in the intervention and control groups..

RESULTS AND DISCUSSION

Demographic and Characteristics of Respondents

The demographic and clinical characteristics of the respondents are summarized in Table 1 and Table 2, covering aspects such as age, education level, employment status, duration of haemodialysis, duration per session, comorbid conditions, and haemoglobin levels for both the intervention group (N = 16) and the control group (N = 16).

The average age of respondents was 47.2 (±10.2) years in the intervention group and 48.9 (±5.6) years in the control group. The mean duration of haemodialysis was similar between the groups, with 9.6 (±1.5) months for the intervention group and 9.4 (±1.6) months for the control group. Both groups also had an identical average duration per haemodialysis session of 4.9 (±0.2) hours. The mean comorbidity score (CCI) was equivalent between the groups, averaging 2.0 (±1.0).

Interestingly, the mean haemoglobin level was higher in the intervention group at 8.1 (±1.6) g/dL compared to 7.1 (±1.5) g/dL in the control group.

Based on Table 2, the majority of respondents were female, comprising 17 (53.1%) individuals. In terms of education, most respondents had completed elementary to junior high school, totalling 23 (71.8%). Regarding employment status, the majority were unemployed, with 28 (87.5%) respondents reporting no employment.

Overall, these results suggest that the demographic and clinical characteristics were well-balanced between the two groups, reducing potential confounding factors in the evaluation of intervention outcomes.

Table 1. Characteristics of Respondents Based on Age, Duration of Hemodialysis, Duration per Session, Comorbidities, and Hemoglobin Levels

Characteristics	Group	$\bar{x}$ (±SD)	min-max	t	df	p value	MD (95% CI)
Age	Intervention Control	47,2 (±10,2) 48,9 (±5,6)	26-58 39-61	-0,577	23,20	0,044	-1,67 (-7,73;4,35)
Duration of HD (months)	Intervention Control	9,6 (±1,5) 9,4 (±1,6)	6-12 6-11	0,225	30	0,929	0,13 (-1,00;1,25)
Duration of HD Session (hours)	Intervention Control	4,9 (±0,2) 4,9 (±0,2)	4-5 4-5	0,591	30	0,237	0,10 (-0,15;0,27)
Comorbid (CCI)	Intervention Control	2,0 (±1,0) 2,0 (±0,8)	1-4 1-4	0,000	30	0,592	0,00 (-0,69;0,69)
Hb (g/dl)	Intervention Control	8,1 (±1,6) 7,1 (±1,5)	4,0-10,2 4,8-10,0	1,955	30	0,855	1,08 (-0,04;2,21)

Table 2. Characteristics of Respondents Based on Gender, Enducation, and Work Status

Characteristics	Intervention n (%)	Control n (%)	Total n (%)	X^2	p value
Gender					
Man	7 (46,7)	8 (53,3)	15 (100%)	0,723	1,000
Woman	9 (52,9)	8 (47,1)	17 (100%)		
Education					
Elementary and Junior High School	12 (52,2)	11 (47,8)	23 (100%)	0,694	1,000
Senior High School dan College	4 (44,4)	5 (55,6)	9 (100%)		
Work Status					
Work	3 (75,0)	1 (25,0)	4 (100%)	0,285	0,600
Don't Work	13 (46,4)	15 (53,6)	28 (100%)		

Effectiveness of MBSR on Stress and Fatigue Levels

Table 3 presents the results of the Paired T-Test analysis comparing pre-test and post-test scores for stress and fatigue within the intervention and control groups. In terms of stress levels, the intervention group showed a significant reduction in stress scores from a pre-test mean of 85.46 (±8.95) to a post-test mean of 47.34 (±5.94), with a mean difference (MD) of 38.12 (95% CI: 32.58–43.66, p-value = 0.000). This indicates that the MBSR intervention was highly effective in reducing stress levels among participants. In the control group, stress scores also decreased from a pre-test mean of 69.06 (±10.83) to a post-test mean of 60.46 (±9.31), with a mean difference of 8.59 (95% CI: 1.88–15.29, p-value = 0.015), suggesting a modest reduction in stress even without the intervention, though less substantial than the intervention group.

For fatigue levels, the intervention group demonstrated a significant improvement, with scores increasing from a pre-test mean of 47.92 (±2.84) to a post-test mean of 59.49 (±6.60), indicating a reduction in perceived fatigue (MD: -11.56, 95% CI: -15.15 to -7.97, p-value = 0.000). In contrast, the control group did not show a significant change in fatigue scores between pre-test (49.76 ± 4.39) and post-test (52.14 ± 3.76) measurements (MD: -2.38, 95% CI: -6.44 to 1.68, p-value = 0.231).

Table 4 further supports these findings by comparing post-test scores between the intervention and control groups using the Independent T-Test. The post-test stress score was significantly lower in the intervention group (47.34 ± 5.94) compared to the control group (60.46 ± 9.31), with a mean difference of -13.12 (95% CI: -18.76 to -7.48, p-value = 0.000), indicating that the MBSR intervention had a substantial impact on reducing stress. Similarly, the post-test fatigue score was significantly higher in the intervention group (59.49 ± 6.60) compared to the control group (52.14 ± 3.76), with a mean difference of 7.34 (95% CI: 3.46 to 11.22, p-value = 0.001), suggesting that the intervention effectively alleviated fatigue symptoms. In summary, the results indicate that the MBSR intervention was significantly effective in reducing stress and alleviating fatigue among hemodialysis patients compared to the control group.

Tabel 3. Statistic Analysis Paired T-Test of Stress and Fatigue on Pre-Test and Post-Test value Implementing Modified MBSR to Intervention and Control Group (N=16, N= 16)

Variabel	Group	Mean (±SD)	95% CI (Lower; Upper)	MD	Df	t	p-Value
Stress	Intervention Pre-test Post-test	 85,46 (±8,95) 47,34 (±5,94)	32,58;43,66	38,12	15	14,680	0,000
	Control Pre-test Post-test	 69,06 (±10,83) 60,46 (±9,31)	1,88-15,29	8,59	15	2,732	0,015
Fatigue	Intervention Pre-test Post-test	 47,92 (±2,84) 59,49 (±6,60)	-15,15; -7,97	-11,56	15	-6,863	0,000
	Control Pre-test Post-test	 49,76 (±4,39) 52,14 (±3,76)	-6,44; 1,68	-2,38	15	-1,249	0,231

Tabel 4 Statistic Analysis Independent T-Test on Stress and Fatigue to Post-Test of Implementing Modified MBSR to Intervention and Control Group (N=16, N= 16)

Variabel	Group	*Mean* (±SD)	95% CI (*Lower; Upper*)	*Mean Difference*	*df*	*t*	*p-Value*
Stress	Intervention	47,34 (±5,94)	-18,76; -7,48	-13,12	30	-4,748	0,000
	Control	60,46 (±9,31)					
Fatigue	Intervention	59,49 (±6,60)	3,46;11,22	7,34	30	3,865	0,001
	Control	52,14 (±3,76)					

DISCUSSION

Demographic and Disease Characteristics

The average age of respondents in this study falls into the adult and pre-elderly categories, where stress levels can significantly influence health, productivity, and quality of life (Gonzales et al., 2021). As age increases, organ function, including the kidneys, tends to decline, potentially leading to chronic kidney disease (CKD) (Kumar et al., 2020). The majority of respondents were female, aligning with the National Kidney Foundation's findings that women have a higher risk of developing CKD, partly due to urinary tract infections and pregnancy-related complications (NKF, 2019). However, men are more prone to faster progression of kidney failure due to hormonal differences, with testosterone potentially accelerating renal decline (Carrero et al., 2018).

Most respondents had a primary to junior high school education level, which can influence their knowledge and management of their condition (Smith & Nguyen, 2020). Lower education levels may limit access to information about managing CKD effectively. The majority were also unemployed, with those employed working under shift systems that can increase stress and impact health (Lee & Kim, 2019). Occupational stress, including heavy workloads and shift work, is a recognized risk factor for CKD progression (Hsu et al., 2016).

Respondents had been undergoing haemodialysis for varying durations. Haemodialysis is a lifelong necessity unless a kidney transplant is performed, and its prolonged nature can significantly impact patients' lifestyles, causing fatigue and stress (Murtagh et al., 2019). Comorbidities were common, with diabetes being a predominant condition, consistent with data from the Indonesia Renal Registry, which identifies diabetes as a leading cause of CKD (IRR, 2020). Anaemia was also prevalent, which is a typical complication in CKD due to impaired erythropoietin production by the kidneys (Stauffer & Fan, 2014).

Effectiveness of MBSR on Stress

The findings indicated that modified Mindfulness-Based Stress Reduction (MBSR) therapy was effective in reducing stress among respondents. MBSR works by modifying cognitive functions and affect, which can positively influence emotions and self-esteem (Kabat-Zinn, 1990). It helps patients develop awareness and acceptance of their experiences, enabling them to manage stress-inducing events more effectively (Grossman et al., 2004). By focusing on present-moment awareness, MBSR reduces the impact of negative thoughts and emotions that contribute to stress (Baer, 2003).

The psychological burden of CKD, particularly in dialysis patients, can lead to various mental health challenges, including stress (Cukor et al., 2007). MBSR addresses these challenges by helping patients regulate their emotional responses and improve their coping mechanisms. This approach has been supported by previous studies demonstrating that mindfulness-based therapies significantly reduce stress levels and enhance psychological well-being in patients with chronic illnesses (Carlson & Garland, 2005).

Effectiveness of MBSR on Fatigue

The results also showed that MBSR was effective in managing fatigue among respondents. This effect can be attributed to MBSR's ability to influence the endocrine system and autonomic nervous system, particularly by activating the parasympathetic nervous system, which promotes relaxation and recovery (Zeidan et al., 2010). By reducing physiological responses such as elevated heart rate and blood pressure, MBSR enhances comfort and reduces feelings of fatigue (Chiesa & Serretti, 2009).

The ability of respondents to manage fatigue more effectively through MBSR may also be influenced by internal factors, such as hormonal balance, and external factors, including social support and environmental conditions (Garland et al., 2017). This suggests that MBSR not only addresses physical symptoms but also enhances coping strategies through improved self-regulation and adaptation to the environment (Shapiro et al., 2006)

Overall Effectiveness of Modified MBSR on Stress and Fatigue

The findings of this study indicate that modified Mindfulness-Based Stress Reduction (MBSR) therapy effectively reduces stress and fatigue among haemodialysis patients. The chronic nature of haemodialysis significantly affects patients' physical, social, and psychological well-being, making it crucial to incorporate independent interventions that patients can adopt to enhance their quality of life (Griva et al., 2018). Modified MBSR teaches patients to observe their experiences without judgment, accept their conditions, and respond appropriately to physical and emotional sensations (Bishop et al., 2004).

The positive impact of MBSR extends beyond psychological relief, influencing various biological systems. MBSR can modulate bidirectional communication between the brain and immune system, including the neuroendocrine system, autonomic nervous system, immune response, and even gene expression. This modulation leads to reduced stress and fatigue while enhancing cognitive function (Fox et al., 2014; Willekens et al., 2018).

One notable effect of mindfulness practice is the increase in neurotrophic factors such as Brain-Derived Neurotrophic Factor (BDNF), which supports neuronal growth and brain plasticity. MBSR has been shown to enhance the synchronization between brain areas responsible for emotional regulation, stress perception, and self-control, which in turn helps mitigate fatigue (Willekens et al., 2018). By activating the parasympathetic nervous system, MBSR promotes relaxation and recovery, reducing physiological stress responses such as elevated heart rate and blood pressure (Zeidan et al., 2010).

Furthermore, the effectiveness of MBSR in addressing stress and fatigue has been supported by previous studies, suggesting its potential as an adjunct therapy for CKD patients undergoing haemodialysis (Grossman et al., 2004). The integration of MBSR into nursing interventions could significantly enhance patients' ability to manage the physical and emotional demands of their condition, thereby improving treatment outcomes and overall well-being (Carlson et al., 2014).

In conclusion, the implementation of modified MBSR appears to be a promising approach for managing stress and fatigue in haemodialysis patients. Its ability to influence both psychological and biological responses highlights its potential role in comprehensive care strategies aimed at improving the quality of life for CKD patients.

CONCLUSION

This study demonstrates the effectiveness of modified Mindfulness-Based Stress Reduction (MBSR) therapy in reducing stress and fatigue among haemodialysis patients. As a non-pharmacological nursing intervention, MBSR can be integrated into nursing care for haemodialysis patients. Hospitals could consider using these findings to establish standard operating procedures (SOPs) for MBSR therapy as part of a structured program, which can be implemented both in-hospital and at home.

However, this study has several limitations. The use of subjective measurement tools may introduce bias, potentially affecting the accuracy of the results. Additionally, the absence of long-term follow-up limits the ability to assess the sustained effects of MBSR. The sample was also limited to a specific geographic area, which may affect the generalizability of the findings.

Future research could address these limitations by incorporating both subjective and objective measurement tools, conducting long-term follow-ups, and expanding the sample size and demographic diversity. Comparative studies could also explore the effectiveness of MBSR relative to other interventions, such as Mindfulness-Based Cognitive Therapy (MBCT) or other relaxation therapies. Additionally, modifying MBSR content into video formats could enhance accessibility and adherence among patients.

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