

CHANGES IN FATIGUE LEVELS AFTER APPLYING DEEP BREATHING EXERCISES TO HEMODIALYSIS PATIENTS

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ABSTRACT

Fatigue is a condition of physical and mental exhaustion that persists for a long time and does not improve with rest. This condition can disrupt concentration, thought processes, social interactions, and reduce patients' quality of life. This study aimed to analyze the effect of Deep Breathing Exercise on fatigue in patients undergoing hemodialysis. A pre-experimental design with a one-group pre-test–post-test approach was used. The sample consisted of 32 respondents selected through consecutive sampling. Data were collected using questionnaires and analyzed using the Marginal Homogeneity test. The results showed that before the intervention, most respondents experienced moderate fatigue. After Deep Breathing Exercise, most respondents experienced reduced fatigue levels to the mild category. Statistical analysis showed a p-value of 0.000 (<0.05), indicating a significant effect of the intervention on fatigue reduction. Deep Breathing Exercise effectively reduces fatigue by promoting relaxation, improving oxygen supply, and supporting energy production.

Keywords: *Deep Breathing Exercise, Fatigue, Hemodialysis.*

INTRODUCTION

One health problem known as chronic kidney failure occurs when kidney function gradually and irreversibly declines. This condition causes the kidneys to no longer be able to maintain metabolic balance and fluid levels in the body (Hasanuddin, 2022). Patients with chronic kidney failure require kidney replacement therapy, which can be done through dialysis and kidney transplantation (Patimah et al., 2024). The most common complaint experienced by chronic kidney failure patients is fatigue or tiredness (Dadi Santoso, Sawiji, 2022). In hemodialysis patients, fatigue includes physical and mental disorders that occur over a long period of time and do not improve even after rest (Luh et al., 2024).

If fatigue is not addressed immediately, it can worsen the patient's quality of life and potentially reduce patient compliance with therapy, and the role of nurses as care givers is very influential in identifying, managing, and helping to resolve fatigue problems in chronic kidney failure patients undergoing hemodialysis.

According to (WHO, 2024), Chronic kidney disease is now among the top 10 causes of global death in 2021, ranking 9th among the world's total causes of death. This indicates that CKD is not only a national health problem but also a significant global burden. According to the 2023 Indonesian Health Survey (SKI), 0.18% of Indonesians aged 15 and over suffer from chronic kidney disease (CKD) as diagnosed by a doctor. Prevalence of CKD Based on Characteristics (SKI, 2023). By age group (SKI, 2023), The prevalence of CKD tends to increase with age, with the highest prevalence in the ≥ 75 age group at 0.57%, while the lowest prevalence was in the 15–24 age group at 0.02%. Referring to gender, the prevalence of CKD in men was 0.22%, more dominant than women at 0.14%. Based on residence, urban areas were 0.19%, while rural areas were 0.15%. Proportion of Hemodialysis in CKD Patients (SKI, 2023) The proportion of people aged 15 years and older

with chronic kidney disease (CKD) who have or are currently undergoing hemodialysis in Indonesia is 21.1%. This means that approximately one in five CKD sufferers requires renal replacement therapy in the form of hemodialysis. Prevalence of PGK in East Java Province (SKI, 2023) At the provincial level, East Java has a prevalence of CKD of 0.12%. This figure indicates that CKD also has the potential to create a high burden on healthcare services, particularly at dialysis facilities. According to the 2024 Indonesian Health Profile, chronic kidney failure is listed as a catastrophic disease with 1,448,406 cases in the BPJS JKN program in 2024, with total financing costs reaching Rp2,760,968,219,728 (Kemenkes RI, 2024). Meanwhile, from the 2024 Mojokerto Regency health statistics publication, Chronic Kidney Disease was recorded as one of the non-communicable diseases in the region, with 1,964 cases or around 6.28% of all diseases reported during the survey period (DP2KBP2 Mojokerto, 2025).

Based on the data obtained from the medical records of RSI Sakinah Mojokerto, there were 215 patients in the Hemodialysis unit in 2025, and in the last 3 months from the beginning of 2026 there were 225 patients. From a preliminary study in the hemodialysis room of RSI Sakinah Mojokerto, it was obtained from the results of interviews with 5 patients undergoing hemodialysis that all patients stated that they experienced fatigue during therapy.

Patients with chronic kidney disease (CKD) experience a gradual and irreversible decline in kidney function, making them unable to maintain fluid and electrolyte balance and carry out metabolic processes. In this case, hemodialysis is the treatment of choice for patients with CKD. This condition can lead to uremia, a buildup of urea and nitrogenous metabolic waste in the blood, and azotemia, characterized by increased creatinine and urea levels (Hasanuddin, 2022). In addition, people with chronic kidney failure can experience various manifestations of uremia, including increased blood pressure, impaired phosphorus and calcium balance, nausea, vomiting, and anemia. Anemia occurs due to decreased kidney function which causes reduced erythropoietin production, even though this hormone plays a role in stimulating red blood cell formation, resulting in a decrease in hemoglobin which can reduce the blood's ability to carry oxygen, and can worsen tissue hypoxia and can reduce cell work capacity, so this can directly contribute to the sensation of tiredness and fatigue felt by patients related to physiological factors (Nugrahandari, 2024). Uremia can also cause various symptoms such as decreased appetite, nausea, and reduced energy and protein intake. This condition also causes decreased creatinine production, which impacts energy production in skeletal muscles, ultimately triggering fatigue or prolonged tiredness (Djunizar Djamaludin1, 2022).

Patients with chronic kidney failure require complex treatment in the form of kidney replacement therapy, such as undergoing hemodialysis (blood dialysis) or kidney transplantation (Listiana et al., 2023). The purpose of this procedure is to eliminate waste products of protein metabolism such as urea, creatinine, and uric acid, as well as reduce the accumulation of excess fluid in the body, maintain or restore the balance of the body's buffer system, maintain stable electrolyte levels, and help maintain the patient's survival and well-being until kidney function improves (Silaen, 2023). However, during hemodialysis, rapid fluid ultrafiltration occurs, triggering fluctuations in intravascular volume and can lead to intradialytic hypotension. This condition reduces tissue perfusion and worsens oxygen distribution, further increasing the risk of fatigue (Sajidah et al., 2021). Patients may experience fatigue accompanied by cold sweats due to decreased blood pressure, a side effect

of hemodialysis. Hemodialysis treatment takes 1-15 hours per week, with 4-5 hours per treatment (Silaen, 2023). In general, physical stress occurs and can trigger fatigue due to situational factors. Fatigue is related to the length of time undergoing hemodialysis (Djunizar Djamaludin1, 2022).

Fatigue, if left untreated, can lead to low blood pressure, weakness, dizziness, muscle cramps, and nausea. This condition also affects the patient's ability to concentrate, think, and interact with their social environment, resulting in a decreased quality of life (Luh et al., 2024). Fatigue treatment can use pharmacological and non-pharmacological therapy (Rinaldi & Sukraeny, 2023). Pharmacological therapy can include L-carnitine, vitamin C, erythropoietin, and medications aimed at controlling anemia. Meanwhile, non-pharmacological management that can reduce fatigue includes breathing exercises, such as Deep Breathing Exercises (Djunizar Djamaludin1, 2022).

Deep breathing exercises are a form of nursing intervention where the nurse guides the client through slow, deep breathing techniques, maximally holding inspiration and then gradually exhaling. In addition to helping reduce pain intensity, this deep breathing relaxation technique can also increase lung ventilation and improve blood oxygenation (Faisol, SKM, S.Kep, 2022). Physiologically, deep breathing exercises can stimulate the activity of the parasympathetic nervous system which plays a role in increasing endorphin production, reducing heart rate, increasing lung expansion so that the lungs can expand optimally, and helping the body's muscles to become more relaxed (Djunizar Djamaludin1, 2022). Deep breathing exercises help the body obtain adequate oxygen, which plays a vital role in the respiratory and circulatory systems. When breathing exercises are performed, oxygen enters the bloodstream and is distributed throughout the body's tissues, helping to remove toxins and unnecessary metabolic waste and enhancing the metabolic process for energy production. Deep breathing exercises also play a role in improving tissue oxygenation by increasing oxygen intake and distribution throughout the body. This results in more effective energy production and reduced fatigue (Djunizar Djamaludin1, 2022).

Based on research results (Listiana et al., 2023) With 17 respondents, before being given breathing exercises, the majority of hemodialysis patients experienced severe fatigue, consisting of 12 people (70.6%), and 5 people (29.4%) with mild fatigue. After the breathing exercise intervention, the proportion of patients with severe fatigue decreased to 4 people (23.5%), while mild fatigue increased to 13 people (76.5%). These data indicate that fatigue is a dominant problem in hemodialysis patients and requires effective nursing intervention. These data strengthen the evidence that fatigue can be reduced with deep breathing exercises.

Although previous research has shown that deep breathing exercises are effective in reducing fatigue levels, several limitations remain. These studies generally used relatively small sample sizes, making the results less generalizable. Based on these limitations, a better, more structured design is needed to generate strong evidence regarding the effectiveness of deep breathing exercises. Therefore, researchers are interested in conducting research on the effect of deep breathing exercises on fatigue in patients undergoing hemodialysis.

Based on the above description, it is necessary to determine whether Deep Breathing Exercise affects fatigue levels in hemodialysis patients. This study aims to determine fatigue levels before and after Deep Breathing Exercise, and analyze the effect of Deep Breathing Exercise on fatigue levels in hemodialysis patients. The results of this study are expected to provide information to hemodialysis patients, their families, and the community about the

benefits of Deep Breathing Exercise as a non-pharmacological therapy to help reduce fatigue. In addition, this study is expected to increase insight in the health sector related to non-pharmacological interventions, serve as a reference for the development of more comprehensive health services, and encourage further researchers to develop research on various effective methods for addressing fatigue in hemodialysis patients.

METHOD

This study used a quantitative research type with a pre-experimental method, using a one-group pre-test and post-test design. Based on the scope and depth of this study, the aim was to determine the Effect of Deep Breathing Exercise on Fatigue Incidence in Patients Undergoing Hemodialysis at RSI Sakinah Mojokerto. The location of this research was carried out according to the title and objectives, namely at RSI Sakinah Mojokerto. The subjects who became the population in this study were kidney failure patients who received hemodialysis therapy at the Islamic Hospital Sakinah Mojokerto. The sample in this study were patients who met the inclusion and exclusion criteria consisting of 32 respondents, where the inclusion criteria were Patients undergoing hemodialysis Patients were ready to be respondents after signing the informed consent form, Patients were fully conscious (composmentis), able to communicate verbally, and were cooperative, Time was more than 3 hours / 4-5 hours per therapy, Patients who had a regular HD schedule and for the exclusion criteria were Patients who underwent unscheduled hemodialysis (Cito) or in emergency conditions, Patients who underwent hemodialysis with a duration of less than 4-5 hours per therapy. This study applied a non-probability sampling technique using a consecutive sampling approach,

In this study, data collection used an Informed Consent Questionnaire, a Self-Identity Questionnaire, a Deep Breathing Exercise SOP Questionnaire, and a FACIT FATIGUE (Functional Assessment Chronic Illness Therapy Fatigue Scale) questionnaire to measure the level of fatigue in patients undergoing HD, consisting of 13 questions. This study was conducted during the research preparation stage, administration and licensing, data collection, and data processing and analysis. Research data collection was carried out on May 20, 2026, to May 25, 2026, so that the entire data collection process lasted for six days. The steps for analyzing this research data were through the stages of editing, coding, scoring, tabulating, and analysis techniques in this study using univariate analysis. Reporting this analysis is in the form of frequency distribution and percentages and bivariate Bivariate analysis is a type of analysis that involves two variables to determine the relationship or correlation between the independent variable and the dependent variable.

(Widodo, 2023). The statistical analysis used was the Marginal Homogeneity Test to determine the differences in the distribution of categories before and after giving Deep Breathing Exercise.

FINDING AND DISCUSSION

RESEARCH RESULT

1. General Data

a. Respondent Characteristics Based on Age, Gender, Length of Hemodialysis and Frequency of Hemodialysis

Table 1 Frequency Distribution, Based on Respondent Characteristics Age, Gender, Duration of Hemodialysis, and Frequency of Hemodialysis

No	Variable	Category	Frekuensi (n)	Presentase (%)
1	Age	Adults (18-59 Years)	28	87,5
		Elderly (60 - >60 Years)	4	12,5
2	Gender	Male	19	59,4
		Female	13	40,6
3	Hemodialysis Duration	< 1 Years	5	15,6
		≥ 1 Years	27	84,4
4	Hemodialysis Frequency	2x/week	32	100
Total			32	100

Source: Primary Data, 2026

The table above shows that most of the respondents are in the adult age category with a total of 28 respondents (87.5%), with male gender with a total of 19 respondents (59.4), duration of hemodialysis more than 1 year with a total of 27 (84.4%), and frequency of hemodialysis 2x/week with a total of 32 respondents (100%).

2. Specific Data

a. Respondent Characteristics Based on Fatigue Level Before Intervention

Table 2 Frequency Distribution of Respondents Based on Fatigue Before Intervention in Patients Undergoing Treatment at Sakinah Mojokerto Hospital

Variable	Category	Frekuensi (n)	Presentase (%)
Fatigue Before Intervention	No Fatigue	0	0
	Mild Fatigue	5	15,6
	Moderate Fatigue	25	78,1
	Severe Fatigue	2	6,3
Total		32	100

Source: Primary Data, 2026

Based on the table above, it shows that of the total 32 respondents, the majority experienced moderate fatigue, namely 25 respondents with a percentage (78.1%). Furthermore, respondents who experienced mild fatigue were 5 respondents with a percentage (15.6%), and those who experienced severe fatigue were 2 respondents with a percentage (6.3%). Meanwhile, there were no respondents who did not experience fatigue (0%).

b. Respondent Characteristics Based on Fatigue Level After Intervention
Table 3 Frequency Distribution of Respondents Based on Fatigue After Intervention Given to Patients Undergoing Treatment at Sakinah Mojokerto Hospital

Variable	Category	Frekuensi (n)	Presentase (%)
Fatigue After Intervention	No Fatigue	0	0
	Mild Fatigue	27	84,4
	Moderate Fatigue	5	15,6
	Severe Fatigue	0	0
Total		32	100

Source: Primary Data, 2026

The table above shows that of the 32 respondents, the majority experienced mild fatigue, namely 27 respondents (84.4%). Furthermore, 5 respondents experienced moderate fatigue (15.6%). Meanwhile, there were no respondents who experienced severe fatigue or who did not experience fatigue (0%).

3. Analysis of the Effect of Deep Breathing Exercise on Fatigue Levels in Patients Undergoing Hemodialysis

Table 4 The Effect of Deep Breathing Exercise on the Incidence of Fatigue in Patients Undergoing Hemodialysis at RSI Sakinah Mojokerto

Fatigue Level	Pre Intervensi		Post Intervensi	
	Frekuensi (n)	Presentase %	Frekuensi (n)	Presentase %
No Fatigue	0	0	0	0
Mild Fatigue	5	15,6	27	84,4
Moderate Fatigue	25	78,1	5	15,6
Severe Fatigue	2	6,3	0	0
Total	32	100	32	100
MARGINAL HOMOGENEITY	P-Value		0,000	

Source: Primary Data, 2026

Based on the above, it shows that before the intervention (pre-test), the majority of respondents experienced moderate fatigue (25 people) (78.1%), followed by mild fatigue (5 people) (15.6%), and severe fatigue (2 people) (6.3%).

After the Deep Breathing Exercise intervention (post-test), a significant change occurred, with the majority of respondents (27 people) in the mild fatigue category (84.4%), and the remainder (5 people) experiencing moderate fatigue. At the post-test stage, no respondents experienced severe fatigue (0%).

The results of the statistical test using Marginal Homogeneity showed a p-value of 0.000. Since the p-value <0.05, it can be concluded that H_a is accepted, indicating a significant effect of Deep Breathing Exercise on reducing fatigue levels in patients undergoing hemodialysis.

4. Table of Fatigue Category Change Patterns

No	Category	Amount	Respondent Number
1	Severe Fatigue → Moderate Fatigue	2	2,14
2	Moderate Fatigue → Mild Fatigue	22	1,3,4,5,6,7,9,10,11,13,17,18,19,20,21,23,25,26,27,29,31,32
3	Mild Fatigue → Mild Fatigue	5	8,12,16,22,30
4	Moderate Fatigue → Moderate Fatigue	3	15,24,28
Total		32	

Source: Primary Data, 2026

Based on the table above, the most common pattern of fatigue category changes was a change from moderate to mild fatigue, with 22 respondents. Furthermore, two respondents experienced a change from severe to moderate fatigue. Respondents who did not experience a change in fatigue category consisted of five respondents who remained in the mild fatigue category and three respondents who remained in the moderate fatigue category. These results indicate that the majority of respondents experienced improvements in their fatigue category after receiving the Deep Breathing Exercise intervention.

DISCUSSION

1. Fatigue level before being given Deep Breathing Exercise

The results of the study showed that of the 32 respondents, the majority experienced moderate levels of fatigue, namely 25 people (78.1%). Chronic kidney failure is a condition of progressive and irreversible decline in kidney function, resulting in the kidneys being unable to maintain metabolic processes and fluid and electrolyte balance in the body. This condition can cause uremia, which is the accumulation of urea and nitrogenous substances in the blood, and azotemia, which is characterized by increased levels of serum creatinine and urea in the blood (Hasanuddin, 2022). Patients with chronic kidney failure generally require hemodialysis therapy to help replace kidney function. However, this procedure can cause several side effects, including hypotension, muscle cramps, balance problems, and fatigue during dialysis (Anjum, 2023).

Fatigue can be caused by various factors, particularly physiological factors such as anemia, malnutrition, uremia, and hyperparathyroidism, as well as inflammatory processes associated with the course of chronic kidney disease. In patients undergoing hemodialysis, conditions such as uremia, anemia, malnutrition, depression, and lack of physical activity are known to influence fatigue levels. Uremia can cause decreased appetite, nausea, vomiting, reduced energy and protein intake, and decreased creatinine production, which impacts energy production in skeletal muscles, leading to fatigue. Furthermore, psychological factors such as stress, depression, and anxiety can also contribute to fatigue in patients (Djunizar Djamaludin, 2021).

On research (Danismaya, 2024), Age is a factor in increasing fatigue in hemodialysis patients. In this study, respondents were divided into adult and elderly age groups. This is in line with the theory (Rinaldi & Sukraeny, 2023), states that fatigue levels in hemodialysis patients are known to be closely related to age. Physiologically, aging causes a gradual decline in kidney function, particularly after age 50, due to a reduction in the number of nephrons by approximately 20%. Meanwhile, the incidence of chronic kidney failure in younger ages is generally influenced by unhealthy lifestyles, such as the habit of consuming nephrotoxic substances. Some examples of these nephrotoxic substances include coffee, energy drinks, and soda. In addition to lifestyle factors, degenerative diseases such as hypertension also play a significant role in increasing the risk of chronic kidney failure.

Based on the research results, some respondents underwent hemodialysis for more than 1 year with a total of 27 respondents (84.4%), where Fatigue experienced by patients undergoing hemodialysis can be influenced by the length of therapy and the duration of each hemodialysis session. In general, one hemodialysis session lasts for 4-5 hours with the aim of removing protein metabolic waste and restoring fluid and electrolyte imbalances in the body. However, during the dialysis process, the body has the potential to lose various important substances such as electrolytes and nutrients, which can ultimately cause weakness and fatigue in patients. This condition can also trigger physical stress that contributes to fatigue in hemodialysis patients (Amelia, 2021), The hemodialysis process must be carried out by patients routinely 1 to 3 times a week, which also triggers fatigue (Fransisco, 2024).

According to researchers, fatigue is a problem almost always experienced by chronic kidney failure patients undergoing regular hemodialysis. High levels of fatigue before deep breathing exercises are also caused by several factors, such as age, gender, duration of hemodialysis, and frequency. Untreated fatigue can lead to decreased concentration, malaise, sleep and emotional disturbances, and reduced ability to perform activities, ultimately leading to a decreased quality of life for hemodialysis patients.

2. Fatigue Level After Deep Breathing Exercise

The results showed that out of a total of 32 respondents, the majority experienced mild fatigue, namely 27 respondents with a percentage (84.4%). These results indicate that after being given the Deep Breathing Exercise intervention, there was a decrease in the level, marked by an increase in the number of respondents in the mild fatigue category and the absence of respondents with severe fatigue.

Reducing fatigue in hemodialysis patients can be influenced by various types of interventions, there are pharmacological and non-pharmacological, for pharmacological reduction using the method of adding L-carnitine, vitamin C and erythropoietin and treatment to control anemia, this can help increase hemoglobin levels, improve energy metabolism, increase oxygen supply to body tissues, and reduce physical weakness so that the level of fatigue in hemodialysis patients can decrease (Djunizar Djamaludin, 2021). For non-pharmacological therapy, several interventions such as physical exercise, lavender aromatherapy, and Benson relaxation therapy can be used to overcome fatigue. This study used non-pharmacological therapy, and one of the non-pharmacological

intervention therapies used in this study, which resulted in a decrease in fatigue scores and a change in category in patients undergoing hemodialysis, was Deep Breathing Exercise.

According to researchers, reducing fatigue in hemodialysis patients can be influenced by various pharmacological and non-pharmacological interventions. Pharmacological interventions help improve patients' physical condition by increasing hemoglobin levels, energy metabolism, and oxygen supply to body tissues, thereby reducing fatigue. Furthermore, non-pharmacological therapies such as physical exercise, lavender aromatherapy, Benson relaxation, and deep breathing exercises can also help reduce fatigue through relaxation mechanisms, increased blood circulation, improved sleep quality, and increased oxygenation.

3. The Effect of Deep Breathing Exercise on Fatigue in Hemodialysis Patients

The research results indicate an effect of Deep Breathing Exercise on fatigue in hemodialysis patients, yielding a p-value of 0.000, which is less than the statistical significance threshold of 0.05.

The Marginal Homogeneity test results showed a p-value of 0.000 ($p < 0.05$) in the intervention group, thus concluding that Deep Breathing Exercise has an effect on fatigue in hemodialysis patients at RSI Sakinah Mojokerto. This result is based on differences in fatigue categories before and after the Deep Breathing Exercise intervention.

According to (Djunizar Djamaludin, 2021) Deep Breathing Exercise is a non-pharmacological intervention that utilizes natural healing techniques and is part of a holistic self-care approach to help reduce various complaints, such as fatigue, pain, sleep disorders, stress, and anxiety. Physiologically, deep breathing exercises can stimulate the activity of the parasympathetic nervous system, which contributes to increased endorphin production, decreased heart rate, expansion of lung volume so that the organ can expand optimally, and relaxation of the body's muscles. This technique allows the body to obtain an adequate supply of oxygen, which plays a vital role in the respiratory and circulatory systems. During breathing exercises, oxygen enters the bloodstream and is distributed throughout the body's tissues, thereby helping to remove toxins and unnecessary metabolic waste while also increasing the metabolic process for energy production. Furthermore, breathing exercises can also improve oxygen distribution throughout the body's tissues, thus optimizing energy production and reducing fatigue levels.

Although most respondents experienced a decrease in fatigue levels, eight respondents did not experience a change in their fatigue category, consisting of five respondents in the mild fatigue category and three respondents in the moderate fatigue category. In the mild fatigue group, the majority were under 50 years old and had been undergoing hemodialysis for less than three years. This condition is in line with the theory that age and duration of hemodialysis can affect fatigue levels. However, unchanged fatigue categories do not always indicate a lack of improvement. Some respondents continued to experience a decrease in fatigue scores, but not enough to reach a lower category. These differences in results may be due to varying individual responses to the intervention, as well as various other factors that influence fatigue, such as physical condition, health status, activity, psychological factors, family support, and the patient's clinical condition, which were not specifically studied. Therefore, although Deep

Breathing Exercise can help reduce fatigue, the magnitude of the changes that occur in each patient may vary.

The researchers concluded that the results showed a difference in fatigue levels among patients undergoing Deep Breathing Exercise. This change was marked by a shift in the fatigue category from moderate to mild in the majority of respondents. This indicates that the Deep Breathing Exercise intervention had a significant positive effect in reducing fatigue levels in patients.

CONCLUSION

Based on the results of research on the Effect of Deep Breathing Exercise on the Incidence of Fatigue in Patients Undergoing Hemodialysis at RSI Sakinah Mojokerto, the following conclusions can be drawn:

There is an Effect of Deep Breathing Exercise on Fatigue Incidence in Patients Undergoing Hemodialysis at RSI Sakinah Mojokerto, which is proven by the results of the Marginal Homogeneity test showing a significance value of $P = 0.000$, which means $p < 0.05$, so it can be concluded that the intervention given is effective in reducing fatigue levels. It is also proven that there is a change in category before the intervention was given, the majority of respondents experienced moderate fatigue and after the intervention was given, the majority of patients experienced mild fatigue, because Deep Breathing Exercise stimulates the parasympathetic nerves so that the body is more relaxed and oxygen supply increases, helping to increase energy production so that fatigue can decrease.

Hemodialysis patients are expected to regularly practice Deep Breathing Exercises as a self-help measure to help reduce fatigue. This technique is easy to perform, requires no special equipment, and can be applied both during hemodialysis and at home. Hospitals, particularly hemodialysis units, are expected to consider Deep Breathing Exercises as a non-pharmacological nursing intervention to address fatigue and develop simple standard operating procedures (SOPs) to support its implementation. Furthermore, future researchers are expected to develop research on other non-pharmacological therapies that have the potential to reduce fatigue in hemodialysis patients, thereby enriching the scientific evidence base for fatigue management.

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