Original Article

The Effect of Physical Exercise on Quality of Life in Chronic Kidney Disease Patients Undergoing Hemodialysis

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ABSTRACT

Background: Chronic kidney disease leads to a progressive and irreversible decline in kidney function, necessitating lifelong treatments such as dialysis or kidney transplantation. Patients undergoing hemodialysis (HD) often encounter challenges such as muscle weakness, which can frequently precipitate feelings of hopelessness and premature aging. These challenges can lead to medical, social, economic, and psychological issues that profoundly affect their quality of life.
Objective: This study aimed to determine the effect of physical exercise on the quality of life of patients undergoing HD.
Methods: This research was a correlational study using a cross-sectional approach. The population comprised chronic kidney disease patients undergoing HD at Anna Medika Hospital, Bekasi. There were 38 respondents who met the inclusion criteria. The analysis of the research data was conducted using the Wilcoxon test.
Results: The study yielded quality of life results after physical exercise, with both the good and moderate categories showing the same result of 47.4%, while the bad category had 5.3%.
Conclusion: There is a significant improvement in quality of life after physical training compared to before.
Keywords: quality of life, hemodialysis, chronic kidney disease.

Introduction

Chronic Kidney Disease (CKD) poses a growing global health challenge, as evidenced by increasing rates of incidence, prevalence, morbidity, and mortality. CKD is characterized by kidney damage and a decrease in glomerular filtration rate (GFR) of less than 60 mL/min/1.73 m^2 for at least 3 months.[1] According to a survey by the Indonesian Nephrology Association, the prevalence of CKD in Indonesia is relatively high, at around 44.2%. This is often associated with various comorbidities, including diabetes mellitus and hypertension.[2]

Renal Replacement Therapy (RRT) can take the form of dialysis or kidney transplantation. There are two primary options for dialysis treatment: peritoneal dialysis (PD) and hemodialysis (HD). HD involves the removal of remaining metabolites from the body through diffusion to the dialysis fluid via a dialyzer tube. CKD patients undergoing HD often experience complications and problems, accompanied by changes in the form and function of body systems.[3] The problem that often occurs is muscle weakness. CKD patients experience weaker muscle strength due to reduced activity, muscle atrophy, myopathy, neuropathy, or a

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combination of these factors.[4] Weak muscles can be strengthened through physical exercise. Physical exercise entails planned, structured movements aimed at improving or maintaining one or more aspects of physical fitness. It is essential for preserving and enhancing overall body health.[5]

Physical exercise during HD increases muscle blood flow and capillary surface area, facilitating the transfer of urea and toxins from tissues to the vasculature, and subsequently to the dialyzer. It enhances body fitness, physiological function, skill, and increases lower extremity muscle strength.[6] The type of physical exercise performed is aerobic exercise, which stimulates the heart, blood circulation, and breathing. It is conducted over an extended period to yield improvements and benefits to the body.[7]

According to the WHO, quality of life is an individual's perception of their position in life within the cultural context and value system they live in, including their goals, hopes, standards, and concerns.[8] Quality of life refers to a state where an individual experiences satisfaction and enjoyment in daily activities related to physical and mental health, a sense of optimism, and the ability to actively engage in daily social activities such as work, home life, social interactions, and hobbies. Physical health is assessed based on physical function, limitations in physical roles, body pain, and perceptions of health. Mental health assessment involves evaluating social functioning and limitations in emotional roles.

The 4-5 hours HD process typically induces stress, leading some patients to experience fatigue and headaches, which can have psychological ramifications. Impaired cognitive function, lack of concentration, and disruptions in social relationships may ensue, collectively diminishing the quality of life for CKD patients undergoing HD.[6] The objective of this study was to assess how physical exercise influences the quality of life in individuals undergoing HD.

Methods

Design and participants

This research employed an observational analytical study with a cross-sectional approach, utilizing non-probability sampling. The study focused on CKD patients undergoing HD at the HD Unit of Bekasi Hospital from August to September 2019. Participants met specific criteria, including being aged over 25 years, having undergone HD for at least three months, absence of nervous system diseases or psychological disorders, stable hemodynamics, clear consciousness, doctor's approval for physical activity, good musculoskeletal health, effective communication skills, willingness to participate in the study, and readiness to engage in physical exercise—specifically, pedaling a stationary bicycle for 15 minutes twice a week during HD.

Statistical analysis

Univariate analysis was performed on the research data, involving scoring of the quality of life questionnaire before and after physical exercise. The results of this data analysis are presented using a scoring system. Bivariate analysis was conducted to assess the impact of physical exercise on the quality of life of CKD patients undergoing HD. The statistical test employed in this research was the Wilcoxon test method. Data analysis was performed using SPSS version 2.3.

Results

This research data are primary data observed and measured directly by researchers. There are 38 patients who met the criteria. The research was conducted twice weekly for 6 weeks, from 6 August to 14 September 2019. Kidney Disease Quality of Life SF-36 (KDQOL SF-36) questionnaire data was collected in the first and sixth weeks; then, physical exercise was carried out in the second to fifth weeks.

Table 1. Characteristics of Respondents

Characteristics	Amount (%)
Gender	
Man	25 (66)
Woman	13 (34)
Age	

≤40	5 (13)
41-50	11 (29)
51-60	11 (29)
61-70	8 (21)
≥70	3 (8)
Length of HD (years)	
≤1	2 (6)
1-2	18 (47)
≥2	18 (47)

Male participants accounted for 66%, while the remaining percentage consisted of females. The two largest age groups were 41-50 and 51-60, respectively, each 29%. The duration of undergoing HD, which was 1-2 years and more than two years, was also the same, at 47% (Table 1).

The quality of life level assessment was conducted using the KDQOL SF-36 questionnaire of 24 questions focused on the current quality of life. According to the total scoring results, there are three levels of quality, namely very good (331-361), moderate (301-330), and poor (269-300). Quality of life scoring before physical exercise was good at 18.4%, moderate at 41.2%, and poor at 39.5%. Meanwhile, after physical exercise, the same number of good and moderate criteria were found, namely 47.4% and 5.3% poor (Table 2).

Table 2. Quality of life scoring before and after physical exercise

Quality of life scoring	Before (n and %)	After (n and %)
Good (331-361)	7 (18.4)	18 (47.4)
Medium (301-330)	16 (41.2)	18 (47.4)
Poor (269-300)	15 (39.5)	2 (5.3)

The assessments measured when respondents physically exercise using a stationary bike are time, distance, calories, speed, and vital signs. The results of each assessment category are different for each respondent because the respondent's physical condition influences them at that time. After 4 weeks of physical training, there was an increase in time of 69%, distance of 87%, calories of 61%, and speed of 55% (Table 3).

Table 3. Distribution of assessment results on physical training for 4 weeks

Evaluation	Increase (n and %)	Stable (n and %)	Decrease (n and %)
Time	26 (69)	7 (18)	5 (13)
Distance	33 (87)	0	5 (13)
Calories	23 (61)	2 (5)	13 (34)
Speed	21 (55)	3 (8)	14 (37)

The difference was found between the questionnaires before and after physical exercise. When before is subtracted from after with a negative result (negative rank), the questionnaire after is lower than before; there are no respondents. A positive rank indicates that the questionnaire after was higher than before, totaling 37 respondents, while the number with the same value or no change was 1 respondent. The analysis revealed *the p-value* was 0.000 <0.01 ($\alpha + 1\%$), meaning there was a significant difference in quality of life observed between the periods before and after engaging in physical exercise.

Table 4. Measurement of vital signs

Vital Signs	Before	After
Pulse		
<60	5 (13.1)	8 (21)
61-99	32 (84.2)	28 (73.8)
>100	1 (2.7)	2 (5.2)
Systolic blood pressure (mmHg)		
<120	16 (42.1)	8 (21.1)
121-159	19 (50)	21 (71)
>160	3 (7.9)	3 (7.9)
Diastolic blood pressure (mmHg)		
<80	29 (76.3)	23 (60.5)
81-99	7 (18.4)	12 (31.5)
>100	2 (5.3)	3 (8)
Respiratory frequency		
<20	12 (31.5)	10 (26.4)
>20	26 (68.5)	28 (73.6)

Discussion

The number of respondents who participated in the research is 38, with the majority being male at 66%. The research is the same as other research and data from the 2018 Indonesian Renal Registry, which found more

male patients than female. Clinically, men have a risk of experiencing CKD 2 times greater.[2,4,10] This may be because women pay more attention to health and maintain a healthy lifestyle than men.[10]

The percentages for the 41-50 and 51-60 age categories are the same, at 29%. This research aligns with other researchers who found the most significant age category in the 18-45 years group (46%) and an age category of 45-60 years (74.1%).[11,12] Patients aged >60 years have a 2.2 times greater risk of experiencing CKD than those aged <60 years. Kidney function will decrease with increasing age. After 40 years, there will be a progressive decrease in GFR until 70 years, approximately 50% of normal.[13]

The duration of undergoing HD was 1-2 years and >2 years; the results were the same, respectively 47%. This study aligns with other studies, with results showing that the duration of HD is≥12 months (66%).[11] Several studies have found a relationship between the duration of HD and quality of life.[14] However, some state that there is no relationship between HD duration and the patient's quality of life.[15,16]

Research shows that the quality of life for patients undergoing HD >5 years is notably poorer in both physical and mental aspects compared to ≤5 years.[17] This finding is associated with being on HD for longer and older patient age, factors that indirectly influence patient quality of life.[18] As patients undergo hemodialysis for a more extended period, their adherence to the treatment tends to increase. Usually, the patient has reached the acceptance stage and received education about the disease from nurses and doctors.

The normality test for physical exercise on time, distance, and calories showed abnormal results, so the Wilcoxon test was used. While the speed of spread was normal, so the paired t-test was used. The Wilcoxon test results for the time, distance, and calorie components showed a Sig. (*2*-tailed) value <0.05, meaning a significant difference between the first and fourth weeks. The time, distance, and calories were higher in the fourth week than during the first week. Meanwhile, the paired t-test for the speed component showed a Sig. (*2*-tailed) value of >0.05, meaning there was no significant difference between the speed of the first and fourth weeks.

The Wilcoxon test tested the normality of vital sign components such as pulse rate, respiratory rate, TDS, and TDD, which are not distributed normally. It was found that the pulse and TDD had a Sig. value (*2*-tailed*)* <0.05. There is a significant difference between pulse and TDD at week 4 and week 1. The pulse and BBP in the first week were higher than in the fourth week, meaning there was a significant decrease in the pulse and BBP in the fourth week. Meanwhile, TDS and respiratory frequency did not significantly differ between the fourth and first weeks with Sig. values (*2*-tailed*)* ≥0.05.

The Spearman test shows no significant relationship between time, distance, calories, and speed in quality of life, as seen from the Sig. value (2-tailed) ≥0.05 (α=5%). Likewise, in the correlation test of vital signs with quality of life, there was no significant relationship between pulse rate, TDS, TDD, and respiratory frequency and quality of life with the Sig. value (*2*-tailed) ≥0.05 (α=5%).

The data collected for the first week using a questionnaire before physical exercise on 38 respondents was then analyzed using the Wilcoxon test due to the non-normal distribution of the data as determined by the normality test. The results revealed the quality of life was categorized as poor for 39.5% of participants, moderate for 41.2%, and good for 18.4%. The data collected in the sixth week using the same questionnaire after physical exercise showed that the quality of life was poor, 5.3%, moderate, and good, at the exact figures, 47.4% each.

Although HD can improve the quality of life for CKD patients, HD cannot stand alone in improving the patient's quality of life. Several studies show a decline in patient's quality of life after a long period of HD treatment. This is associated with the effect of HD on decreased muscle structure and function due to uremia, resulting in reduced physical activity, muscle atrophy, difficulty in walking, physical work ability, and impaired function.[19]

Strength training is one type of physical exercise required by regular HD patients.[19]

Researchers use stationary bicycles to carry out physical exercises. Patients were required to train their lower extremities, strengthening the muscles and working harder against resistance forces. Muscle strength is needed and is the basis for performing other physical abilities. Physical exercise can improve functional capacity, respiratory muscle strength, and quality of life among hemodialysis patients.[20] Johansen recommends incorporating physical exercise into the HD routine, which is essential for enhancing the quality of life of CKD patients. This can exert a significant effect on improving physical function, reducing physical pain, increasing vitality and general health, and improving the quality of life of HD patients.[21]

Conclusion

Before engaging in physical exercise, the quality of life for CKD patients undergoing HD is moderate. However, after physical exercise, the patient's quality of life improves. This shows the influence of physical exercise on the quality of life in CKD patients undergoing HD.

Limitations of the Study

This study is subject to several limitations, including a small number of respondents and the lack of literature discussing physical exercise in HD patients.

Declarations

Ethics approval

All respondents filled out a written willingness to participate in research. Passed research ethics eligibility is (No. 187/KEP-UY/BIA/X/2019).

Competing interests

None.

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Author's Contribution

Idea/concept: LA. Control/supervision: EP, HN. Data collection/processing: SHM. Extraction/Analysis/interpretation: SHM. Editor: MLU. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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