

# Physical Exercise Intervention In Reducing The Severity Level Of Restless Leg Syndrome In Hemodialysis Patients: Literature Review

## Intervensi Physical Exercise Dalam Menurunkan Tingkat Keparahan Restless Leg Syndrome Pada Pasien Hemodialisa : Literature Review

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### ABSTRACT

*Restless Leg Syndrome (RLS) is a serious problem that is often experienced by Hemodialysis (HD) patients. Some nonpharmacological therapies can be done to reduce RLS symptoms such as stretching exercises, aerobics, cool dialysate therapy, Physical Activity Therapy (PAT), reflexology, and aromatherapy massage. This literature review aims to determine the effect of Physical Exercise Intervention (PEI) in reducing RLS symptoms in patients undergoing HD including the type of movement, exercise duration, and frequency. Data were collected from PUBMED, Science Direct, Proquest, Ebscohost, CNBI, and e-resources with a total of 522 articles. These articles were limited to the criteria of English language and experimental design within the last 10 years. Physical Exercise Intervention could be applied with RLS including stretching exercises and aerobic exercises based on seven selected articles. Meanwhile, the most appropriate PEI duration was 30-40 minutes and the most appropriate PEI frequency was three times per week. The most widely used instrument to assess the degree of RLS was the international Restless Legs Syndrome Severity Scale (IRLS). PEI is effective in reducing RLS of hemodialysis patients. The most factors contribute to the effectiveness of PEI are the type of movement, the duration of exercises, and the frequency of exercises performed.*

**Keywords:** physical exercises, restless leg syndrome (RLS), hemodialysis

## ABSTRAK

*Restless Leg Syndrome (RLS) merupakan masalah serius yang sering dialami oleh pasien Hemodialisis (HD). Beberapa terapi non farmakologi dapat dilakukan untuk mengurangi gejala RLS yaitu latihan peregangan, aerobic, terapi cool dialysate, Terapi Aktifitas Fisik (TAF), refleksiologi, dan pijat aromaterapi. Literature review ini bertujuan untuk mengetahui pengaruh Intervensi Physical Exercise(IPE) dalam mengurangi gejala RLS pada pasien yang menjalani HD meliputi jenis gerakan, durasi latihan serta frekuensi. Data dikumpulkan dari database elektronik PUBMED, Science Direct, Proquest, Ebscohost, CNBI dan e-resources dengan jumlah total 522 artikel. Artikel dibatasi pada kriteria berbahasa Inggris dan desain eksperimen dalam rentang waktu 10 tahun terakhir. Berdasarkan 7 artikel yang terpilih didapatkan bahwa IPE yang dapat diterapkan pada pasien dengan RLS antara lain latihan peregangan dan latihan aerobic. Sementara itu untuk durasi IPE yang paling tepat adalah selama 30-40 menit dan frekuensi IPE yang paling sesuai adalah 3.kali per minggu. Instrument yang paling banyak dipakai untuk menilai derajat RLS adalah International Restless Legs Syndrome Severity Scale (IRLS). TAK efektif untuk mengurangi RLS pada pasien Hemodialisis. Faktor yang paling berperan dalam efektifitas IPE meliputi jenis gerakan, durasi latihan dan frekuensi latihan yang dilakukan.*

**Kata kunci:** *Physical Exercise, Restless Leg Syndrome, hemodialysis*

## INTRODUCTION

Chronic kidney diseases are public health problems throughout the world including in Indonesia. The incidence of chronic kidney failure in Indonesia is 0.38% (713,783 people) of the total Indonesian population that is 252,124,458 people. They are in the age of  $\geq 15$  years (Risesdas Kemenkes RI, 2018). The chronic kidney disease progresses to kidney failure on patients that need kidney replacement therapy, one of which is hemodialysis (Alcalde-Bezhold et al., 2021). In Indonesia, the number of patients undergoing routine hemodialysis in 2018 increases double compared to that in 2017, which was 66,433 new patients and 132,142 active patients and was very at risk of various complication (Pernefri, 2018).

Patients on routine hemodialysis are at a risk for various complications such as restless legs syndrome (RLS), depression, itching, insomnia, and fatigue (Matar et al., 2022). RLS is characterized by discomfort felt by patients, mostly in the leg area with symptoms of strong and irresistible urge to move their legs, burning or heat in the leg area, sleep disturbance and discomfort in the form of pain or tingling (Menezes et al., 2018). Renal failure patients with HD are at an increased risk of iron deficiency due to a chronic inflammation, poor erythropoiesis, and blood loss during HD. In addition, HD patients are at a risk of dopaminergic abnormalities that are directly related in the pathophysiology of RLS occurrence (C.-W. Huang et al., 2020). The prevalence of RLS in hemodialysis patients reaches 6.6% - 8%, which is higher than in the general population which is only 3-9% (Gopaluni et al., 2016). The prevalence of RLS in patients undergoing hemodialysis is 28-62%. The high prevalence of RLS in hemodialysis patients should be an important concern for health workers so that appropriate interventions can be made (M. Huang et al., 2019).

Some non-pharmacological therapies that can be done to reduce RLS symptoms in hemodialysis patients are cool dialysate therapy, physical exercises, reflexology, and aromatherapy massage (Buchfuhrer, 2016). Progressive exercise training has an influence on RLS symptoms experienced by hemodialysis

patients. This study showed that intradialytic progressive exercise training for six months was safe (no side effects report), effective in reducing RLS symptoms and beneficial in improving sleep quality and depression scores (Krase et al., 2020). According to this research, a light physical exercise or combined exercise in a structured and sustainable manner will be beneficial for the physical condition of renal failure patients undergoing HD (M. Huang et al., 2019).

## **MATERIALS AND METHODS**

The study design is a literature review with references to the Preferred Reporting Items for Literature Reviews and Meta-Analyses (PRISMA). The author formulated PICO to direct the clinical search for articles. Those article search sources used electronic database such as ProQuest, Science Direct, Pubmed, Ebscohost, and e-resources. The search for articles was adjusted to the inclusion and exclusion criteria that have been determined with the framework and keywords used so that the desired article was obtained. The keywords in the search for evidence-based research in this literature review were “Physical exercise” and ‘restless leg syndrome” and “hemodialysis”. The synthesized data were physical exercise interventions to reduce the severity of RLS in hemodialysis patients. The inclusion criteria in this literature review were published in 2012-2022, using English, hemodialysis patients experiencing RLS symptoms, research articles n physical exercise for hemodialysis patients with RLS symptoms and experimental research designs. While the exclusion criteria are publications before 2012, no using English, patients with RLS but not undergoing hemodialysis, the type of the article review article and on-experimental research design. The search for primary using electronic databases aimed to obtain relevant articles. Databases used included ProQuest, Science Direct, e-resources, EBSCOhost, and PubMed.

## **RESULTS AND DISCUSSION**

The search was conducted using electronic databases such as ProQuest, Science Direct, e-resources, EBSCOhost, and PubMed which were further adjusted to the keywords, inclusion and exclusion criteria that had been compiled including publications from the past 10 years, and were research articles. The filtered articles at this stage will undergo a full-text screening, where articles that truly meet the inclusion criteria and research methods will undergo articles assessment (critical appraisal). The detailed flow of article search based on the PRISMA method can be seen in the following figure :

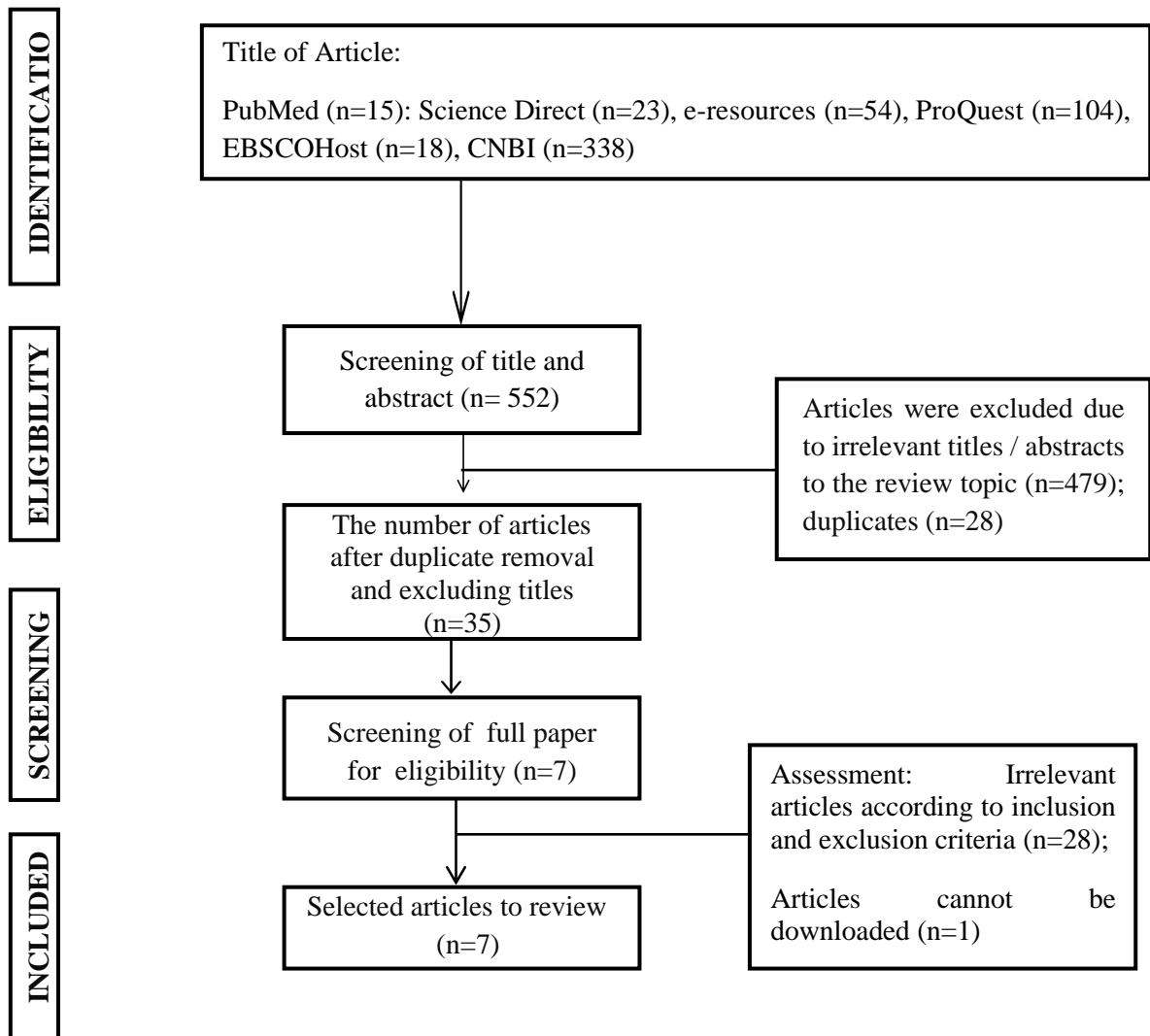


Figure 1. Flow of article search PRISMA method

Researcher & Title	Desain, Instrument & Respondents	Intervention Model	Key Finding
Shahgholian et al., 2016 (The effects of two methods of reflexology and stretching exercises on the severity of restless leg syndrome among hemodialysis patients)	RCT (ANOVA), paired t-test, <i>post hoc</i> LSD (RLS standardized questionnaire), 90 HD patients	Foot reflexology and stretching exercises were performed three times a week for 30-40 minutes within four consecutive weeks	<i>Paired t-test</i> showed a significant difference in the mean scores of restless leg syndrome severity before and immediately after the intervention in the reflexology and stretching exercise groups, respectively (P <0,001) LSD <i>post hoc</i> test showed a significant difference in the mean scores of restless legs syndrome severity immediately after the intervention in the reflexology and control and in the stretching exercises and control groups (P<0,05)

Mortazavi et al., 2013 ( <i>Aerobic Exercise Improves Signs of Restless Leg Syndrome in End Stage Renal Disease Patients Suffering Chronic Hemodialysis</i> )	<i>Quasi Experiment (RLSQ Questionnaire)</i> , 26 patients	Aerobic exercise (pedaling a bicycle) for 30 minutes 3 times a week for 16 weeks	The mean difference in RLS markings at the first week of the study and the last week was $5.5 \pm 4.96$ in the exercise group $0.53 \pm 2.3$ in the control group
Fauzi & Triaswati, 2021 ( <i>The Effect of Intradialytic Stretching Training on Restless Legs Syndrome and Sleep Quality in Hemodialysis Patients</i> )	<i>Quasi Experiment, International Restless Legs Syndrome Study Group (IRSSG)</i> , 38 patients	Intradialytic stretching exercises for 8 weeks were performed during the third and fourth hours of hemodialysis.	The mean RLS before intervention was 1.74 (Standard Deviation [SD]=0.23) and after intervention, there was a significant decrease in RLS score to a mean of 0.42 (SD=0.17) ( $p<.001$ )
Manal, 2019 ( <i>Efficacy of neuromuscular electric stimulation versus aerobic exercise on uraemic restless legs syndrome</i> )	<i>Quasi Experiment, sit-to-stand (STS)</i> , 60 patients	Participants were randomized to receive neuromuscular electrical stimulation or aerobic exercise.	Neuromuscular electronic stimulation was more significant on the STS-5 test than aerobic exercise while it was more significant than neuromuscular electrical stimulation on the STS-60 test. There was a greater increase in the muscle strength, as measured by the STS-5 test, after treatment in the neuromuscular electrical stimulation group (4.6%) when compared to the aerobic exercise group (2.1%)
Giannaki et al., 2015 ( <i>Combination of Exercise Training and Dopamine Agonists in Patients with RLS on Dialysis: A Randomized, Double-Blind Placebo-Controlled Study</i> )	<i>RCT, International Restless Legs Syndrome Severity Scale (IRLS)</i> , 14 patients	Exercise plus DA (EX + DA) and exercise plus placebo (EX + PL) in a 6-month intradialytic exercise training program	International Restless Legs Syndrome Severity Scale (IRLS) scores were found to be significantly reduced after the intervention period with EX + DA ( $p = 0.026$ ) and EX + PL ( $p = 0.038$ ) agonists.
Cederberg & Motl, 2021 ( <i>Feasibility and Efficacy of a Physical Activity Intervention for Managing Restless Legs Syndrome in Multiple Sclerosis: Results of a Pilot Randomized Controlled Trial</i> )	<i>RCT, International Restless Legs Syndrome Study Group Scale (IRLS)</i> , 15 patients	The physical activity intervention was delivered over a 16-week period and outcomes were assessed at baseline and immediately after the 16-week period in both conditions	There was a significant positive effect of the intervention on overall RLS severity ( $p=.01$ ; $\eta^2=.43$ ), and nighttime severity ( $p=.03$ , $\eta^2=.35$ ), daytime severity at rest ( $p=.01$ , $\eta^2$ daytime active ( $p<.01$ , $\eta^2=.61$ ), and a non-significant increase in RLS severity while asleep 2 ( $p=.33$ , $\eta^2=.09$ ).
Aliasgharpour et al., 2016 ( <i>The Effect of Stretching Exercises on Severity of Restless Legs Syndrome in Patients on Hemodialysis</i> ).	<i>RCT, International Restless Legs Syndrome Severity Scale (IRLS)</i> , 33 patients	Stretching exercises were performed on the legs during dialysis for half an hour, three times a week for 8 weeks in the intervention group.	The results showed that most participants suffered from moderate RLS Symptom severity. This syndrome changed significantly eight weeks after the intervention in the intervention group compared to the control group ( $P<0.001$ ).

**Table 1. Review results of selected articles**

The database search resulted in 552 articles based on keywords. In the first screening, duplicates in the title were searched, and a total of 28 articles with the same title were found. Then, the compatibility of the article titles with the desired theme was checked, resulting in the exclusion of 479 articles. The

remaining 35 articles were then read in full so that seven articles were decided to be suitable for further discussion.

Based on the seven selected articles, there were a total of 276 samples with their age of more than 18 years and undergoing a hemodialysis program for at least three months. All journals randomly assigned control and intervention groups with respect to inclusion and exclusion criteria. Those journals were experimental studies on patients with RLS symptoms undergoing routine hemodialysis. The interventions in the form of physical activity were given to patients with various durations and methods, both before and after hemodialysis. The physical activities applied according to the articles that reviewed the reference materials such as stretching exercises and aerobic exercises.

The research results of Giannaki (2014) showed that intradialytic aerobic exercise with cycling method for 45 minutes per HD session can reduce symptoms by 42% to 58% compared to the control groups.

In addition, reflexology and stretching exercise methods can effectively reduce RLS in hemodialysis patients (Shahgholian et al., 2016). However, the effectiveness of the combined methods has not been identified yet. In a research article conducted by Aliasgharpour (2016) light aerobic exercise during HD can reduce RLS symptoms done in six weeks, and the light stretching exercise method is effective in reducing RLS symptoms by doing two sessions for eight weeks with a program three times a week in the last two hours for 30 minutes.

Fauzi's study (2021) describes stretching exercises performed two times a week for eight weeks with the duration for each session for 15 minutes with ankle plantar flexion movements, gastrocnemius stretches, soleus stretches, hamstring stretches, and quadriceps stretches. In the study of Manal (2019), the mild stretching methods used were range of motion exercises, hip flexion and extension, knee flexion and extension, ankle dorsi and plantar flexion.

Shahgholian, et al. conducted a study with reflexology intervention and stretching exercises administrated to two groups as three session a week (12 sessions), each session lasting for 30-40 minutes in the first two hours of dialysis session where there was no notable change in BP respectively. The control group received routine intervention (Shahgholian et al., 2016).

In Manal's study (2019), the participants in the aerobic exercise group were instructed to exercise for 30 minutes each session. The exercises were performed by each patient separately three days a week for three months in the internal medicine department. The training program included a 5-minute warm-up, stretching and lower limb strengthening exercises in the form of range of motion exercises, hip flexion and extension, knee flexion and extension and ankle dorsi and planter flexion, followed by a 5-minute cooling down.

Another exercise activity considered of continuous cycling for 45 minutes using a bedside cycle ergometer at 45-50 rpm between the second and third hour of a 4-hour HD session (three sessions per week) a 50-60% of their maximum exercise capacity (intensity ranged between 20 and 50 watts). Exercise training was set between 60% and 65% of assessed maximum power capacity (watts) (C. D. Giannaki et al., 2015).

Exercise requires the functioning of several vital organs. Low exercise capacity is a contributing factor to poor quality of life and a higher risk of mortality rate in cases of chronic diseases such as patients undergoing HD with RLS symptoms. Physical exercises or stretching can improve functional capacity and possibly improve the patient's life quality. Patients undergoing HD are at higher risk of experiencing significant weakness compared to those not undergoing HD, due to limitations in movement, weakness leading to poor physical function, and decreased muscle strength associated with the HD process (Barcellos et al., 2015).

RLS is a disorder causing patients to experience unpleasant sensations in their limbs, especially the legs. These sensations create an urge to move the legs to alleviate the discomfort (Aliasgharpour et al., 2016). The sleep quality of life of individuals with RLS are negatively affected, leading to issues such as depression, anxiety, and increased stress levels (Akbaş & Yaman Sözbir, 2021). RLS is highly prevalent in the hemodialysis population, also known as uremic RLS. The high prevalence of RLS among end-stage renal disease patients highlights the need for doctors to increase awareness and recognition of RLS among these patients (Matar et al., 2022). Dialysis patients with diabetes mellitus are nearly 24% more susceptible to RLS in the Asian population. Additionally, decreased hemoglobin/iron levels are also a risk factor for the onset of RLS in dialysis patients (Mao et al., 2014).

Observations in uremic patients found a 15% reduction in muscle size in the thigh compared to patients who did not experience RLS without changes in muscle composition (C. D. Giannaki et al., 2014). This decrease in muscle mass was influenced by the state of uremia and the effects of hemodialysis treatment. The study showed the condition of patients undergoing hemodialysis with RLS symptoms showing muscle atrophy compared to patients without RLS. In this study mentioned that aerobic activities or exercises and resistance training can restore or stop the process of muscle shrinkage in hemodialysis patients (C. D. Giannaki et al., 2014). The muscle shrinkage occurs due to the limitations in routine activities that are mostly spent in hemodialysis sessions (Aliasgharpour et al., 2016). In HD patients it is associated with a high risk of mortality, due to changes in muscle structure with increased oxygen supply to tissues, greater vascular endothelial production factors, increased protein synthesis, inhibition of myostatin and decreased pro-inflammatory cytokines (Manal, 2019).

The results of a prospective study conducted by Salma et al., (2023) indicate that certain lifestyle factors, such as obesity, physical activity, and smoking, are associated with the risk of developing restless leg syndrome (RLS). These findings highlight the relationship between life style factors and the risk of RLS development, suggesting that lifestyle modifications may influence RLS risk (Batool-Anwar et al., 2016). Risk factors for RLS include hemodialysis duration, hypersensitive C-reactive protein, hyperparathyroidism, serum glycosylated protein, and erythropoietin treatment. RLS affects sleep quality and emotions while increasing the risk of cardiovascular disease in hemodialysis patients. RLS is more severe in patients with kidney transplant failure compared to those who have not undergone transplantation (Zhang et al., 2020).

RLS can be reduced with pharmacological and non-pharmacological therapies. Some non-pharmacological interventions may be beneficial to reduce the severity of RLS and improve sleep quality. Some therapies that can be given include repetitive transcranial magnetic stimulation, exercises, compression devices, counterstrain manipulation, infrared therapy, and standard acupuncture (Harrison et al., 2019). Massage therapy is an intervention that can also be used for the treatment of RLS that effectively reduces the symptoms of RLS, reduces the severity of RLS, and does not increase the risk of side effects (Xia et al., 2022). The use of progressive muscle relaxation techniques also reduces the severity of RLS in the hemodialysis patients (Soleimani, 2016). Non-pharmacological interventions aim to treat RLS by avoiding the side effects of drugs. Light exercise has been proposed to effectively treat RLS in patients with hemodialysis (C.-W. Huang et al., 2020).

Another form of non-pharmacological management is light physical exercise during the pre- or intra-dialysis period. A study involving 36 respondents with RLS symptoms in regular HD patients showed that 87.95% of patients with RLS symptoms did not engage in regular and routine exercise. Most participants experienced moderate to severe RLS symptoms. In the treatment group, participants underwent stretching exercises as an intervention, and there was a significant change in the severity level of RLS symptoms between the treatment and control groups at eighth week (24 sessions). However, the control group did not show significant changes in the severity of RLS symptoms (Aliasgharpour et al., 2016).

Different types of physical exercise have different effects on measured parameters. However, exercise is beneficial for chronic hemodialysis patients and appears to improve their health. With 12 weeks of intradialytic resistance training, several parameters showed a tendency towards improved quality of life and reduced inflammation processes (Gallot et al., 2019). In the study of Aukerman et al., (2006) the results showed no significantly lower scores in total RLS severity and showed symptom improvement. The severity scores for the control group decreased by only 8% over six weeks, while the exercise group's severity scores decreased by 39% during the same period (Aukerman et al., 2006). Stretching dialysis, which has been proven to alleviate RLS symptoms, improve sleep quality and enhance overall quality of life (Song et al., 2017).

Other studies state that there is a possibility of high levels of RLS when the body is at rest. Stretching exercises are known to reduce the symptoms of the diseases. RLS cannot be cured immediately, but the treatment options such as stretching exercises are effective in reducing RLS symptoms (Kambampati et al., 2020). RLS sufferers can alleviate the symptoms by straightening their legs to release the burden on the hip adductor muscles (Harrison et al., 2018). The mechanism of physical activity therapy, such as exercises, in reducing RLS severity is by increasing the levels of  $\beta$ -endorphins in the brain and reducing oxidative stress (C.-W. Huang et al., 2020). Another study explain hat stretching exercises decrease RLS severity because they can increase local blood flow through vasodilation, thereby influencing RLS symptoms (Shohani et al., 2020).

Intradialytic exercise can significantly reduce the severity of RLS symptoms. Light physical exercise, such as aerobic activities or others, is a highly effective approach in treating uremic RLS. Theoretically,

various physiological mechanisms can explain the reduction of RLS symptoms caused by exercise, including the release of endorphins and increased blood flow to the brain. Beneficial effects of the exercises include neuroplasticity in the basal ganglia and increased antioxidant mechanisms (Sakkas et al., 2015). The combination of low-dose Dopamine Agonists with aerobic exercise can be considered as an alternative approach to high-dose DA regimens in reducing the severity of RLS symptoms (Rosa et al., 2020).

Stretching exercises during hemodialysis are programmed twice a week for 8 weeks, with each session lasting 15 minutes. The exercises include flexi plantar ankle exercises, gastrocnemius stretching, soleus stretching, back thigh stretching, and front thigh stretching. The exercises are performed during the third and fourth hour of hemodialysis (Fauzi & Triaswati, 2021). Aerobic exercises can reduce the burden of several difficult-to-treat symptoms, including RLS (Hargrove et al., 2021).

In addition, several studies report that stretching exercises are chosen over aerobic exercises because dialysis patients experience significant loss of strength and physical function during HD. Stretching exercises are considered a suitable choice to improve quality of life by enhancing physical strength and function. The exercise program during HD has some limitations, such as patients being connected to dialysis access needles, which requires exercises to be performed with patients in a seated position. The exercises are conducted during the first two hours, under the guidance and direction of a trained team, including physiotherapists or nurses (Bennett et al., 2015). Another study states that intradialytic aerobic exercises, depending on intensity, can reduce the frequency of RLS during hemodialysis sessions in patients with uremic RLS. Such exercise interventions, even at low intensity, can be considered as a safe non-pharmacological approach to improve motor symptoms of RLS during hemodialysis (C. Giannaki et al., 2010).

## CONCLUSION AND RECOMMENDATION

Light physical activity therapy is effective in reducing restless legs syndrome (RLS) in hemodialysis patients. There are various types of physical activity that can be given to the patients. The most factors contributing to the effectiveness of physical activity therapy are the type of movement, exercise duration, and exercise frequency. Exercise has no side effects, low cost, and can be done without assistance. Nurses can assist in alleviating RLS symptoms by training patients, thereby taking positive steps towards health goals. Another factor that influences the success of the intervention is the regularity of the action. However, there are still limitations in this journal review that there the absence of a comparative or control intervention.

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