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Effect Of Aerobic Versus Resistive Exercise On Restless Leg Syndrome In Hemodialysis Patients

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Abstract

Background: *Hemodialysis (HD) patients typically have a variety of negative consequences, including restless leg syndrome (RLS), which can be caused by the medical procedure or the end stage of renal failure. Exercises like resisted exercise and stationary aerobic cycling can help relieve HD-associated symptoms.*

Aim: *The effectiveness of aerobic versus resisted exercise on RLS severity in HD is unknown, so this study aimed to assess this aim.*

Methods: *Sixty non-obese HD patients (from both sexes) patients with RLS were allocated from the Hemodialysis Unit of a Local General Hospital in El-Behirah Governorate. All patients were a regular HD therapy more than one year. The International Restless Leg Syndrome Study Group (IRLSSG) questionnaire was used to diagnose RLS in the affected HD patients. Ages of patients ranged from 35-45 years old. Patients were randomly and equally assigned into 2 groups: group A and group B, n = 30 patients for each group. Both groups received stretching exercise, massage program, and usual medical care for 12 weeks. Additionally, group A (n=30) received moderate-intensity intradialytic 30-miunte aerobic exercise (cycling of lower limbs) using horizontal cycle ergometer during the first two hours of dialysis, three times weekly. Group B (n=30) received 30-minute resistance exercises for lower limbs using ankle free weights for 30 minutes, during the first two hours of dialysis session, three times weekly.*

Outcome: *RLS severity was assessed via IRLSSG questionnaire before and after 12 weeks.*

Results: *Both forms of exercise significantly improved RLS severity in the two groups but the improvement was greater in group A.*

Conclusion: *It could be concluded that both forms of exercise, aerobic or resisted exercise, improve RLS complaints in HD patients, but aerobic exercise recorded the highest improvement in RLS severity.*

Keywords: *Exercise, restless leg syndrome, hemodialysis*

1. INTRODUCTION

Hemodialysis (HD) is the process of passing blood through dialysis venous catheters using a dialysis fluid solution in an HD apparatus. The patient receives their blood back after external filtration. As chronic renal failure sets in, HD aims to eliminate waste materials including urea from the patient's blood as well as to free water [1].

The end stage of renal failure or the administered therapy sometimes results in a variety of problems for HD patients, including restless leg syndrome (RLS) [2].

RLS, a sleep-related sensory-motor problem, is identified by pins and needles, burning in the deep calf area between the knee and ankle joints, and insect crawling, which are among the unbearable discomforts associated with it. Physical exercise relieves or eradicates RLS, which has uncommon circadian rhythms [3].

Physical activity in general is prescribed to improve different physical and mental aspects in patients in chronic diseases [4-13]. The effects of altering lifestyles, such as engaging in aerobics or resistance training, have been examined in some recent studies. Mobility may help in relieving syndrome's

symptoms, which tend to manifest or aggravate during periods of immobility and rest. As a result, moderate exercise may be beneficial. Symptom-relieving exercises include swimming, walking, massage, stretching, resistive exercise, and stationary aerobic cycling [14]. The impacts of aerobic versus resisted exercise on RLS symptoms in HD are indefinite, so this study aimed to assess this aim.

2. MATERIALS AND METHODS

Approved ethics

This study is authorized by the Cairo university ethical committee. Medical Helsinki ethics were followed in this comparative trial.

Inclusion criteria

Sixty non-obese HD patients (from both sexes) patients with RLS were allocated from the Hemodialysis Unit of a Local General Hospital in El-Behirah Governorate. All patients were a regular HD therapy more than one year. The International Restless Leg Syndrome Study Group (IRLSSG) questionnaire was utilized to diagnose RLS in the affected HD patients. Ages of patients ranged from 35-45 years old.

Exclusion criteria

Exclusion criteria involve: cancer patients, cardiac disease patients, chronic inflammatory autoimmune disease, Infectious illness (HIV/AIDS, hepatitis B or C, etc), patients undergoing complementary managements/therapies (herbs, yoga, massage, vibration therapy, pneumatic compression, aerobic/resisted exercise, stretching exercises, aromatherapy, hot application, acupuncture, acupressure, etc..) for RLS within the last 6 months, patients with neurological disorders, patients with bad habits (smoking, alcohol and drug abuse), patients with diagnosed psychogenic diseases, patients with diabetes, cardiovascular/respiratory diseases, or other hepatic disorders (hepatic cancer, hepatitis, etc.), and patients with musculoskeletal disorders of lower limb (osteoarthritis) that may be present with RLS.

Interventions

Patients were randomly and equally assigned into two groups: group A and group B, n = 30 patients for each group. Both groups received stretching exercise, massage program, and usual medical care for 12 weeks. Additionally, group A (n=30) received moderate-intensity intradialytic 30-miunte aerobic exercise (cycling of lower limbs) using horizontal cycle ergometer during the first two hours of dialysis, three times weekly. Group B (n=30) received 30-minute resistance exercises for lower limbs using ankle free weights at 60% of three repetition maximum (RM) for 30 minutes, during the initial two hours of dialysis session, three times weekly

Assessment of RLS as main outcome of this study

International Restless Legs Syndrome Study Group Rating Scale (questionnaire): The IRLSSG questionnaire is a valid tool used to diagnose RLS. It comprises ten items with a rating from 0 (no effect) to 4 (extremely severe effect). It categorizes the severity of RLS into mild (0-10 points), moderate (11-20 points), severe (21-30 points), or extremely severe (31-40 points) [15].

Statistical analysis

All data were analyzed by the SPSS version 23. Chi squared test was employed for comparing sex distribution. All data were normally distributed (Based on Smirnov's test). Quantitative data were displayed as mean ± SD. The paired T test was utilized for comparing within-group RLS, while the unpaired T test was conducted for comparing both groups. A significant P-value was defined as ≤ 0.05.

3. RESULTS

Basic data

For group A, thirty HD patients with RLS were included in this group. Their mean ± SD age, weight, and height were 39.7±3.32 years, 63.12±7.84 kg, and 159.3±5.34 cm, respectively.

For group B, thirty HD patients with RLS were included in this group. Their mean ± SD age, weight, and height were 39.6±3.15 years, 64.66±6.34 kg, and 158.63±6.01 cm, respectively.

Comparing the basic data of patients of both groups before starting treatments revealed no significant

variation across groups in age, weight, and height ($p > 0.05$). Sex distribution was not significantly different across groups before starting two forms of exercise training ($p > 0.05$)

Within-group comparison of IRLSSG questionnaire before and after 12 weeks

The mean± SD value of IRLSSG questionnaire before treatment of group A was 22.47±2.36, and that after treatment was 11.23±2.98. The mean difference between before and after intervention was 11.23 and the percentage of change was 50%. There was a significant decrease in the IRLSSG questionnaire after treatment in comparison with before treatment ($p<0.05$) (Figure1).

The mean±SD value of pre-treatment of IRLSSG questionnaire of group B was 21.23±3.1 and that post-treatment was 15.2±4.54. The mean difference between pre- and post-treatment was 6.03 and the percentage of change was 28.4%. There was a significant decrease in IRLSSG questionnaire after treatment in comparison with before treatment ($p<0.05$) (Figure1).

Between-group comparison of IRLSSG questionnaire before and after 12 weeks

Comparing pre-treatment mean difference (1.23) of IRLSSG questionnaire across groups indicated no significant difference ($p > 0.05$). Also, comparing after treatment mean difference (-3.97) of IRLSSG questionnaire across groups indicated a significant change ($p < 0.05$).

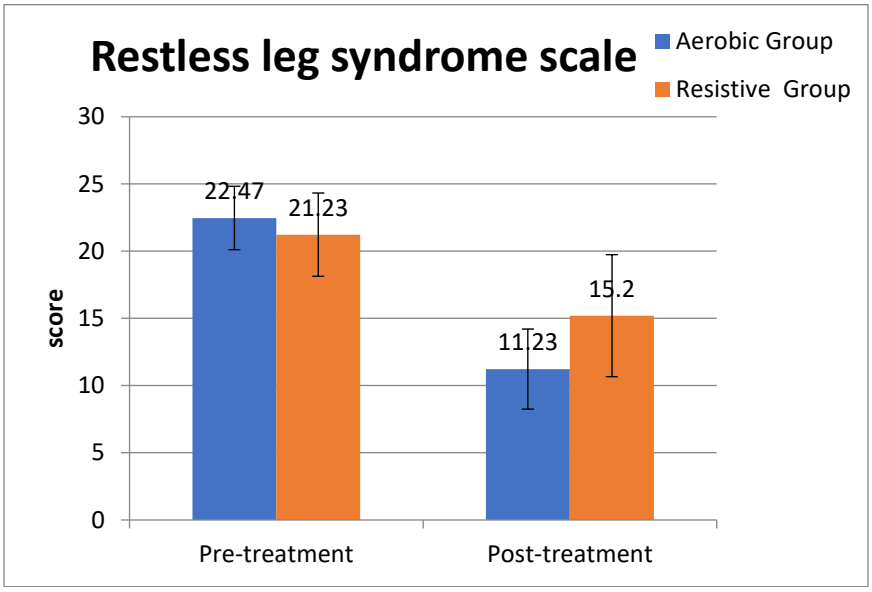

Figure (1). Mean of IRLSSG questionnaire before and after treatment of both groups

4. DISCUSSION

More research is necessary to determine the fundamental mechanisms via which exercise helps hemodialysis (HD) patients with RLS symptoms. This impact can be explained by a number of theories. First, by increasing blood flow, exercise is known to enhance circulation, which may help with peripheral hypoxia, which is believed to be an underlying contributor to symptoms of RLS [16]. Second, it is believed that exercise alters neurotransmitter systems, specifically the opioid and dopamine circuits [17], which are both linked to the pathogenesis of RLS.

Furthermore, uremic toxins, which are prevalent in HD patients and may contribute to the development of RLS, may be reduced with exercise [18].

Exercise's psychological benefits could be another process, since increases in depression ratings imply that physical activity's positive impacts on mental health could potentially help with symptom relief [19].

Lastly, muscle training through stretching and strengthening exercises may help ease some of the physical manifestations of RLS by reducing muscle tension and pain. Alongside, these processes

demonstrate the complex role that exercise plays in helping this population treat RLS. [20].
One possible explanation for the decrease in RLS and periodic limb motion brought on by resistance exercise is the known exercise effect on the beta-endorphin pathway. Beta-endorphins are opioids that reduce pain and enhance feelings of wellbeing. It is well recognized that the pathophysiology of RLS involves the opioid system in the brain, and that RLS was successfully decreased by opioid medication. The thalamus of individuals with idiopathic RLS was shown to have lower levels of beta endorphins, which is crucial since it confirms the theory that the endogenous opioid system plays a role in the pathophysiology of the condition. Thus, it appears probable that the discharge of beta-endorphins brought on by exercise may be the cause of the decrease in RLS following periods of resistive exercise [21].
The symptoms of RLS and depression scores in uremic patients were reduced by a 6-month exercise training program that was just as successful as a 6-month low-dose dopamine agonist therapy [22].
Supporting the presented results, aerobic exercise or stretching program was indicated to be efficient in decreasing RLS manifestations in patients with primary RLS [23].
Supporting the findings, in adults on maintenance HD, regular performance of aerobic exercise improved RLS [24]. Supporting the results, 24-session supervised aerobic exercise training in five cases with severe RLS produced clinically meaningful changes in their RLS severity in all individuals [25].
Aerobic and lower body resistive training can help manage RLS symptoms, as demonstrated by Aukerman et al. [26]. After six weeks, they discovered that RLS symptoms were improved, and they persisted throughout the entire twelve weeks of the intervention.
In accordance with the findings, RLS severity at baseline and the completion of 16 weeks of aerobic exercise in seven HD patients with RLS significantly improved [27].

5. CONCLUSION

Both aerobic and resistive exercise were proven to alleviate RLS complaints in HD patients; however, aerobic exercise showed the greatest reduction in RLS severity.

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REFERENCES

1. Ismail AMA, Abdelhay MI, Draz RS. Response of salivary flow rate to transcutaneous electrical nerve stimulation in haemodialysis patients. Physiother Quart. 2023;31(1):23–27; doi: https://doi.org/10.5114/pq.2023.123524.
2. Ragab, A. A., El-Nahas, N. G., Qotb, S. S., & Ali Ismail, A. M. (2025). Effect of Acupuncture-Like TENS on Restless Leg Syndrome in Haemodialysis Patients. Egyptian Journal of Hospital Medicine, 99(1): 1633-1637. doi: https://dx.doi.org/10.21608/ejhm.2025.422606.
3. Anupama, A. V., Mehta, A., Javali, M., Eswarappa, M., Rangaiah, P., & Acharya, P. Prevalence, Risk Factors, and Psychosocial Impact of Restless Legs Syndrome in End-Stage Renal Disease Patients Undergoing Hemodialysis - A Cross-Sectional Study. Annals of Indian Academy of Neurology 2025; 28(3), 387–391. https://doi.org/10.4103/aian.aian_1038_24
4. Ismail, A. M. A., El-Azeim, A. S. A., & Saif, H. F. A. E. A. Effect of aerobic exercise alone or combined with Mediterranean diet on dry eye in obese hypertensive elderly. Irish Journal of Medical Science (1971-). 2023; 192(6), 3151-3161. doi: https://doi.org/10.1007/s11845-023-03387-6
5. Ismail, A., Mousa, N. M. A., Elgendy, S. K. M., Al-Emrany, A. M., Saber, O. S. A., Elhakk, S. M. A., ... & Ghaleb, H. A. M. Effect of lifestyle changes on liver enzymes, triglycerides, sex hormones, and daytime sleepiness in polycystic ovarian syndrome women with obstructive sleep apnea and fatty liver–a randomized controlled trial. Menopause Review/Przegląd Menopauzalny 2025, 24(2), 94-101. doi: https://doi.org/10.5114/pm.2025.152991
6. Mohamed AME, Ismail AMA, Ali RR, Ali EA, Ali AA, Draz RS, Elgendy SKM, Zaid AAAA, Abd Allah WA, Roshdy SHA, Said MSS, Marouf AYM, El Gressy NSSA, Elmasry DM. Efficacy of Baduanjin Exercise in Patients with Idiopathic Chronic Fatigue

Who Additionally Survived from COVID-19 Contraction: A Randomized Controlled Trial. International Journal of Human Movement and Sports Sciences. 2025;13(4):708-718. doi https://doi.org/10.13189/saj.2025.130406.

7. Ismail AMA, Morsy MM, Saber OSA, Elfahl AMA, Ahmed AM, Elgendy SKM, Zaid AAAA, Yousef ASA, Al-Emrany AM. Comparative Response of Oxidative Stress to Baduanjin Exercise Versus Electro-Acupuncture in Patients with Type 2 Diabetes Mellitus. Universal Journal of Public Health. 2025;13(3):599-606. doi: https://doi.org/10.13189/ujph.2025.130308
8. Ismail, A. M. A., El Gressy, N. S. S. A., Hegazy, M. D., Ahmed, O. S. M., & Elfahl, A. M. A. H. Effects of diaphragmatic breathing exercise on sleeping quality, cortisol, cardiovascular autonomic functions, depression, and fatigue: a randomized-controlled trial in women with systemic sclerosis. Reumatologia,.2025;63(2), 89-96. doi: https://doi.org/10.5114/reum/200193
9. Ismail, A. M. A., & Tolba, A. M. N. Effectiveness of lifestyle-modification approach (a randomized-controlled program of diet restriction and treadmill walking exercise) on elderly's metabolic syndrome-associated subjective tinnitus. European Archives of Oto-Rhino-Laryngology, 2025; 1-9. doi: https://doi.org/10.1007/s00405-025-09494-7
10. Ismail, A. M. A., & Morsy, M. M. Effect of Baduanjin exercise on lipid profile, blood pressure, and thyroid-stimulating hormone in elderly with subclinical hypothyroidism and mild cognitive impairment: a randomized-controlled trial in women. Geriatric Nursing, 2025;64, 103434. doi: https://doi.org/10.1016/j.gerinurse.2025.103434.
11. Ismail, A. M. Is there an effect of lifestyle changes (exercise and diet control) on the suggested connection between dry eye syndrome and psoriasis? Health Problems of Civilization, 2024. doi: https://doi.org/10.5114/hpc.2024.140002
12. Ismail, A. M. CHATGPT-assisted introduction of exercise advice to patients with phenylketonuria: restrictions and advantages. Health Problems of Civilization, 2024. doi: https://doi.org/10.5114/hpc.2024.140504
13. Ismail AM, El Gressy N, Hegazy M, Abdel-Halim Elfahl A, Ahmed O. Randomized controlled effect of treadmill walking exercise on liver enzymes, psychological burden, and erectile dysfunction in men with hepatitis C. Gastroenterology Review/Przegląd Gastroenterologiczny. 2024;19(3):263-270. doi: https://doi.org/10.5114/pg.2023.130334.
14. Fauzi, A., Ahmedy, F., & Irawati, D. (2025). The effect of aerobic virtual-reality-based exercise on restless legs syndrome, sleep quality, and quality of life among patients undergoing hemodialysis. Indonesian Nursing Journal of Education and Clinic (INJEC), 19(2), 21-29. http://dx.doi.org/10.24990/injec.v19i2.629.
15. Tsai, L. H., Chen, C. M., Lin, L. M., Tsai, C. C., Han, Y., & See, L. C. Acupressure reduces the severity of restless legs syndrome in hemodialysis patients: A cluster-randomized crossover pilot study. Biomedical Journal. 2022;45(3), 533–541. doi: https://doi.org/10.1016/j.bj.2021.05.005
16. Altayb Ismail, M. A., Daffalla, I., Singh, T., Siddique, Q. R., Almadhoun, M. K. I. K., Irfan, R., Saqib, M., Haris, M., Khan, Z., Fernandes, J. G. F., Iqbal, A., & Bokhari, S. F. H. (2024). Efficacy of Aerobic and Stretching Exercises in Managing Willis-Ekbom Disease (restless leg syndrome) Among Hemodialysis Patients. Cureus 2024; 16(10), e71470. doi: https://doi.org/10.7759/cureus.71470
17. Mahindru, A., Patil, P., & Agrawal, V. Role of Physical Activity on Mental Health and Well-Being: A Review. Cureus, 2024;15(1), e33475. doi: https://doi.org/10.7759/cureus.33475
18. Lee, C. L., Wang, P. C., Chen, Y. L., Chen, Z. Y., Uen, C. C., Lai, H. Y., & Shiao, C. C. Comparisons of Intradialytic Exercise Versus Home-Based Exercise in Hemodialysis Patients: A Narrative Review. Biomedicines 2024; 12(10), 2364. https://doi.org/10.3390/biomedicines12102364
19. Fauzi, A., & Triaswati, R. The effect of intradialytic stretching training on restless legs syndrome and sleep quality in hemodialysis patients. Korean Journal of Adult Nursing 2021;33(1), 37-43. https://doi.org/10.7475/kjan.2021.33.1.37
20. Borhan, W. H., Abouelkhair, R., Elkeblawy, M. M., E Gouda, Z., & Ali, K. M. The effect of aerobic exercise on physical functional performance among hemodialysis patients. The Egyptian Journal of Hospital Medicine 2023; 90(2), 3075-3080. doi: https://dx.doi.org/10.21608/ejhm.2023.288396
21. Giannaki, C. D., Sakkas, G. K., Hadjigeorgiou, G. M., Karatzaferi, C., Patramani, G., Lavdas, E., Liakopoulos, V., Koutedakis, Y., & Stefanidis, I. Non-pharmacological management of periodic limb movements during hemodialysis session in patients with uremic restless legs syndrome. ASAIO journal (American Society for Artificial Internal Organs: 1992), 2010;56(6), 538–542. doi: https://doi.org/10.1097/MAT.0b013e3181f1cc04
22. Giannaki, C. D., Sakkas, G. K., Karatzaferi, C., Hadjigeorgiou, G. M., Lavdas, E., Kyriakides, T., Koutedakis, Y., & Stefanidis, I. Effect of exercise training and dopamine agonists in patients with uremic restless legs syndrome: a six-month randomized, partially double-blind, placebo-controlled comparative study. BMC nephrology 2013;14, 194. doi: https://doi.org/10.1186/1471-2369-14-194
23. Çoban, Ö., Ün Yıldırım, N., Yaşa, M. E., & Sonkaya, A. R. Effects of Different Exercise Programs on Symptoms, Sleep, and Quality of Life in Patients with Primary Restless Legs Syndrome. Movement disorders clinical practice 2023; 10(9), 1349–1359. doi: https://doi.org/10.1002/mdc3.13833
24. Hargrove, N., El Tobgy, N., Zhou, O., Pinder, M., Plant, B., Askin, N., Bieber, L., Collister, D., Whitlock, R., Tangri, N., & Bohm, C. Effect of Aerobic Exercise on Dialysis-Related Symptoms in Individuals Undergoing Maintenance Hemodialysis: A Systematic Review and Meta-Analysis of Clinical Trials. Clinical journal of the American Society of Nephrology: CJASN 2021;16(4), 560–574. doi: https://doi.org/10.2215/CJN.15080920
25. Aktar B, Balcı B, Buran S, Aslantas B, Mermi D, Öztura İ, Baklan B. Aerobic Exercise in Individuals with Restless Legs Syndrome: A Case Series Study. JBACHS 2024;8(2):511-515. doi: https://doi.org/10.30621/jbachs.127773

26. Aukerman, M. M., Aukerman, D., Bayard, M., Tudiver, F., Thorp, L., & Bailey, B. Exercise and restless legs syndrome: a randomized controlled trial. Journal of the American Board of Family Medicine: JABFM 2006;19(5), 487–493. doi: https://doi.org/10.3122/jabfm.19.5.487
27. Sakkas, G. K., Hadjigeorgiou, G. M., Karatzaferi, C., Maridaki, M. D., Giannaki, C. D., Mertens, P. R., Rountas, C., Vlychou, M., Liakopoulos, V., & Stefanidis, I. Intradialytic aerobic exercise training ameliorates symptoms of restless legs syndrome and improves functional capacity in patients on hemodialysis: a pilot study. ASAIO journal (American Society for Artificial Internal Organs: 1992). 2008; 54(2), 185–190. doi: https://doi.org/10.1097/MAT.0b013e3181641b07