

# The Applicability of Rehabilitation Strategies in Individuals with Chronic Kidney Disease during Hemodialysis: a Literature Review

## A Aplicabilidade de Estratégias de Reabilitação em Indivíduos Portadores de Doença Renal Crônica Durante a Hemodiálise: ma Revisão Bibliográfica

Alex Oliveira\*<sup>ab</sup>; Julia Lumiati Bela Barreta<sup>c</sup>; Debora Walquiria da Silva<sup>b</sup>; Gabriel Salles<sup>b</sup>; Raissa Martins Guinossi<sup>c</sup>; Angelica Barboza<sup>c</sup>; Lais Santana Barone<sup>c</sup>; Jeniffer Regina dos Santos Jeremiah<sup>c</sup>;

<sup>a</sup>School of Medicine of Jundiaí, Stricto Sensu Graduate Program in Health Sciences. SP, Brazil.

<sup>b</sup>Universidade Paulista. SP, Brazil.

<sup>c</sup>Physiotherapist. SP, Brazil.

\*E-mail: [ftalexoliveira@gmail.com](mailto:ftalexoliveira@gmail.com)

---

### Abstract

Chronic kidney disease is manifested by an injury to the kidneys that can cause a consequent need to replace their function. This replacement is performed through an invasive therapy by catheterization and is called hemodialysis. This therapy aims to correct metabolic changes with the extracorporeal blood filtration process. Because it is a chronic process, such replacement occurs with a certain frequency and, depending on the clinical need of the individual, can be performed daily, thus causing significant damage to the functional capacity of these patients. In this context, the need for this literature review arises, aiming to evaluate the best type of physical therapy intervention to apply to the patient while undergoing hemodialysis, since it is an invasive therapy with predictable clinical repercussions if accidentally interrupted. Searches for articles were carried out in the Bireme, Scielo, Pubmed databases and on the official website of the Brazilian Society of Nephrology, with the inclusion of articles from 2009 to 2022. The selected studies had as similarity the application time in the first hours of session, however different types of exercises, including aerobic, resistance, mixed and alternative, contemplated the types of approaches of the authors. In view of this review, we concluded that it is of fundamental importance to outline a strategy for these patients and that the mixed modality seemed to be the most applicable given the benefits obtained, including improved physical conditioning and consequent improvement in quality of life and disposition, and these should be monitored and accompanied by professional physiotherapists during the applicability of the exercises.

**Keywords:** Renal Dialysis. Renal Insufficiency, Chronic. Physical Therapy Modalities. Renal Dialysis.

### Resumo

*A doença renal crônica manifesta-se por uma lesão nos rins que pode causar consequente necessidade de substituição de sua função. Essa substituição é realizada por meio uma terapia invasiva por cateterização e é denominada Hemodiálise. Esta terapia tem como o objetivo corrigir alterações metabólicas com o processo de filtragem extra corpórea do sangue. Por trata-se de um processo crônico, tal substituição ocorre com determinada frequência, podendo, a depender da necessidade clínica do indivíduo, ser realizada diariamente, causando desta forma, importante prejuízo na capacidade funcional destes pacientes. Neste contexto, surge a necessidade desta revisão bibliográfica, objetivando avaliar qual melhor tipo de intervenção fisioterapêutica para aplicar no paciente enquanto é submetido a hemodiálise, visto tratar-se de uma terapia invasiva de previsível repercussão clínica caso interrompida acidentalmente. As buscas por artigos foram feitas nas bases de dados Bireme, Scielo, Pubmed e no site oficial da Sociedade Brasileira de Nefrologia, com a inclusão de artigos de 2009 a 2022. Os estudos selecionados tiveram como semelhança o tempo da aplicação nas primeiras horas de sessão, porém diferentes tipos de exercícios dentre eles aeróbicos, resistidos, mistos e alternativos, contemplaram os tipos de abordagens dos autores. Diante desta revisão, concluímos que é de fundamental importância delinear uma estratégia para estes pacientes e que a modalidade mista pareceu ser a mais aplicável visto os benefícios obtidos estando dentre eles a melhora do condicionamento físico e consequente melhora da qualidade de vida e disposição, devendo estes ser monitorizados e acompanhados por profissionais fisioterapeutas durante a aplicabilidade dos exercícios.*

**Palavras-chave:** Dialise Renal. Insuficiência Renal Crônica. Modalidades de Fisioterapia. Diálise Renal.

---

## 1 Introduction

Chronic disease has been growing every day, and kidney disease is one of these. According to the Brazilian Society of Nephrology in the last decade, the cases have doubled to 10 million Brazilians, and of these cases it is estimated that 126 thousand need to be dialyzed, but 70% of the individuals when they arrive at this stage are already seriously impaired<sup>1,2</sup>.

With this increase, the mortality rate of this specific group has one of the factors with the highest prevalence of cardiovascular disease, such as arterial hypertension, left ventricular hypertrophy, heart failure and cardiac arrhythmias,

followed by the second major cause which is Sepsis<sup>3-5</sup>.

The kidneys are responsible for the homeostasis of the human body, they are the ones that separate the toxins from our blood, so that it returns clean to the body. The regulation of blood and bone formation, blood pressure and the chemical and liquids control of our body. Chronic kidney disease (CKD) is a pathology that affects the kidneys, kidney damage may occur, and progressive loss of its function such as glomerular, tubular and endocrine, so if adequate identification and treatment are not present, it can no longer perform its function internally, causing its paralysis and may affect other organs and systems.

The main causes of kidney failure are hypertension, Diabetes mellitus and family history for CKD<sup>6,7</sup>.

The treatment of chronic kidney patient will depend on the phase and classification that it is, the Glomerular Filtration Rate (GFR) in mL/min/1.73m<sup>2</sup> which is measured through laboratory tests. Stage 1:  $\geq 90$ ; stage 2: 60 to 89; stage 3: 30 to 59; stage 4: 15 to 29; stage 5:  $< 15$ <sup>8</sup>.

After the stage is confirmed, the individual is submitted to the appropriate treatment, in the most advanced stages the Hemodialysis (HD), a mechanical and extracorporeal procedure, which aims to remove toxic substances and excess liquid in the body, carried out by means of a machine, it is usually done in two hours over a period of six days a week, or four hours on three days a week, as a result it significantly interferes with physical and mental health, functionality, independence and well-being, limiting his or her work capacity and daily life activities<sup>9</sup>.

Since hemodialysis patients have important factors due to their complications, follow-up with early Physiotherapy and during treatment with therapeutic procedures may be beneficial for delayed progression and patients, with the reduction of suffering and an increase in the quality of life.

The main objective of this study was to observe, through more recent studies, the efficacy in the applicability of an

exercise program in patients undergoing hemodialysis.

## 2 Development

### 2.1 Methodology

A search was performed on articles in the databases: BIREME (Latin American and Caribbean Center on Health Sciences Information), SciELO (Scientific Electronic Library Online), Pubmed (National Library of Medicine) and also the official site of the Brazilian Society of Nephrology (SBN). The words employed during the search were: Diálise Renal (*Renal Dialysis*), Insuficiência Renal Crônica (*Renal Insufficiency, Chronic*), Fisioterapia (*Physical Therapy Specialty*), Hemodiálise (*Hemodialysis*).

This review project adopted as inclusion criteria articles between 2009 and 2020 and exclusion articles older than ten years that did not focus on hemodialysis exercises.

### Results and Discussion

The bibliographic review adopted, verified results and several interventions on the subject, but contained the duration of its similar intervention protocol, being it within the first two hours after the start of hemodialysis treatment, thus, the seven studies described below show the report of the analyzes described in Table 1.

**Table 1** - Data Extraction

	Authors	Types of Intervention	Significant Results
A	Reboredo MM et al. <sup>5</sup>	Warm-up, cardiovascular exercises with the horizontal electromagnetic ergometer cycle.	There was a reduction in blood pressure, improved Kt/V, quality of life, and functional capacity. However, there was no improvement in heart rate variability and left ventricular function.
B	Oliveros MS et al. <sup>13</sup>	Aerobic exercises with pedal cycle and isotonic with the use of Thera-band varying resistance.	The group had an increase in functional and physical capacity, and the follow-up was safely performed, whereas the Kt/V indices did not show significant changes
C	Paluchamy T, Vaidyanathan R. <sup>14</sup>	Warm up with mixed movements, and after that, stationary bike was used.	Safe intervention without high costs and expressed improvement in the quality of life, physical and mental health. And increased the effective Kt/V indexes in dialysis, creatinine and urea.
D	Brown PD et al. <sup>15</sup>	Three groups in which I did not exercise, II exercises with 55% of the predicted maximum heart rate (HRmax) capacity for age and III with 70% of the HRmax capacity.	The results were positive, but there were no changes in the II for the III group in relation to the HRmax capacity for the increase in Kt/V. There was damage in catheter displacement.
E	Anding K et al. <sup>16</sup>	Resistance training with exercise cycle, muscle groups with individual training for each patient, physical capacity tests with 6MWT, sitting-rising and timing.	Improvement of quality of life and resistance, placing the exercise protocol as primordial in the hemodialysis routine
F	Silva SF et al. <sup>17</sup>	Stationary bike, stretching, strengthening upper and lower limbs.	The results were significant, and that the physiotherapy program may be effective in the quality of life of patients undergoing hemodialysis.
G	Freire APCF et al. <sup>19</sup>	Isotonic exercises and music therapy.	Isotonic exercises improve dialytic efficiency, increase the Kt/V index and consequently the quality of life.

**Legend:** HRmax - Maximum Heart Rate; Kt/V - Dialysis Quality Index; TC6 - six minute walk test.

**Source:** research data

**Table 2** - percentage representation of the strategy used in each study

Type of activity	Aerobic	Resistance	Mixed	Static Visual Audio Activity
<b>Study</b>	A	D-F	B-C-E	G
<b>(%)</b>	12.5	25	37.5	12.5

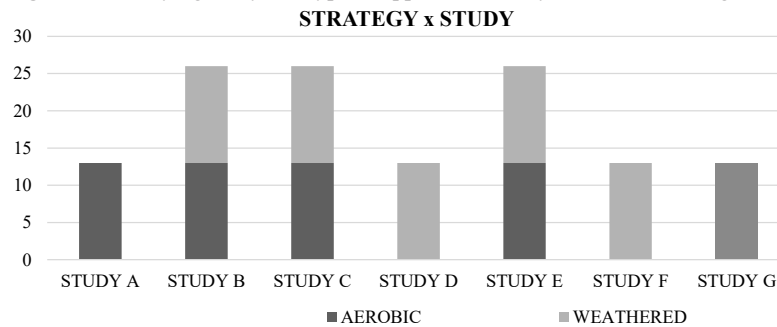
**Source:** Research data.

There was a predominance of mixed activity, understood by the combination of strategies with resistance and aerobic exercises among the authors studied.

Chronic kidney disease presents numerous important complications in quality of life, and hemodialysis also

generates rapid changes and is usually irreversible for the patient, and one of the main changes is functional capacity. In view of these situations, studies try to compare changes in the quality of life of individuals who have a physiotherapeutic program included in their dialysis treatment<sup>8,10</sup>.

**Figure 1-** stratifying study and type of approach used by the authors during hemodialysis



Source: Research data.

Each author used a strategy to approach the patient during hemodialysis. The types of approach have brought different results. There were some studies as represented in the chart (B, C and E) that used resistance and aerobic activities. Others as represented in the chart (D and F) that used only resistance activities and one last that used aerobic activities. Alternatively, study G presents the use of music therapy to patients during hemodialysis.

In some studies, the authors mention Kt/V, which is a reference on the quality of the dialysis of this patient, it is measured as follows, with K varying according to the size of the dialyzer the flow of blood and dialysate (in ml/minutes), the T of time (in minutes) that is in dialysis and this parameter varies according to the patient and clinic, and V is the volume of urea distributed, which normally stands at 55% of the patient's body weight<sup>11</sup>.

Rocha et al.<sup>12</sup> evaluated 13 patients in total with respiratory functional evaluations, quality of life and manual grip strength and intervened for twenty-five minutes with upper and lower limb exercises in their own HD chair in the first two hours of dialysis. The results were not statistically significant, but some patients exhibited improvement in daily life activities due to lower tiredness and greater mood. They concluded that more interventions need to be made and with more time.

Reboredo et al.<sup>5</sup> carried out a study with 22 patients and performed the application of cardiovascular exercises with lower limb stretching, low load and low rotation conditioning and the use of a horizontal electromagnetic ergometer cycle and the prescribed load was that tolerated by each patient individually in the first two hours of dialysis for 12 weeks, resulting in no change in heart rate variability, more time is indicated to see if there is modification to these parameters.

Oliveiros et al.<sup>13</sup> surveyed 11 patients in 16 weeks, had a work of aerobic and isotonic exercises with the use of Thera-band adapting the patient's position in HD, the evolution

was established according to the motor performance and perception of his or her effort, the work was done in the first two hours of dialysis, three times a week.

Paluchamy et al.<sup>14</sup> worked on their study with 20 patients, and carried out the program in the first two hours of dialysis and showed the efficacy of physical exercise for the expressive increase of Kt/V, creatinine, urea, potassium and phosphorus. And in quality of life, such as physical and mental health, in the kidney disease itself and patient satisfaction when compared to the control group.

Brown et al.<sup>15</sup> suggest that exercises are important even if they do not reach the maximum capacity of the individual. In their study, they used three types of protocol started after 60 minutes of HD, one without exercise, the second of 30 minutes reaching up to 55% of the maximum heart rate (HRmax) and the third of 30 minutes reaching 70% of HRmax, and there were no changes of Kt/V from the second to the third protocol.

Anding et al.<sup>16</sup> tested a program with customized resistance and cardiovascular exercises for approximately five years in the first 60 minutes of dialysis and had 80% adherence. The authors emphasize that the exercise protocol in therapy should be taken as one of the main strategies and put into practice in the HD routine, along with the adherence of the patient and the group that makes therapy better. By improving quality and his or her physical function.

Silva et al.<sup>17</sup> applied an exercise program after five minutes from the beginning of the dialysis, and lasted 20 minutes and the results obtained after the program had statistical differences, the patients got less tired to perform the tests again and increased their distance in the six-minute test, consequently more physical resistance. In the studies of Chaves et al.<sup>18</sup> there was no statistical difference in muscle strength of patients who performed the proposed exercises that lasted thirty minutes in the first two hours of the dialysis, but the patients reported improvement in mood and quality of

life, the follow-up of the physiotherapist in dialysis centers is advised.

According to Freire et al.<sup>19</sup> with the applicability of isotonic exercises lasting 30 minutes of HD over a period of three months, had good results in functional capacity, quality of life, muscle strength, physical performance and dialytic efficiency, and also complements with its cost and application mode that were accessible to enhance the dialysis treatment, with improved Kt/V by muscle perfusion, increased blood flow, in 20% the removal of urea<sup>19</sup>.

However, it is observed that the studies discussed in this review show the importance of inserting exercises in the routine of the patient under hemodialysis, which seems to result in an improvement in the quality of life, promoted by improving the physical conditioning of these individuals.

### 3 Conclusion

In view of this bibliographic analysis, we can conclude that using the kinesiotherapeutic strategy, especially of a mixed characteristic involving aerobic and resistance activities during hemodialysis, is of great relevance, even if there is no sequence for the applicability of the exercises, the individualized evaluation aiming to observe and respect the location where the catheter is implanted for hemodialysis will provide criteria for the therapeutic design during the procedure. Physiotherapeutic intervention with the multidisciplinary team in the routine of hemodialysis may improve the physical-functional capacities contributing to the quality of life of these patients with dialytic nephropathy, in addition to being considered a low cost and safe applicability therapy, provided that it is performed after patient stabilization, after the start of dialytic therapy, in a period of up to 40 minutes, monitoring of hemodynamics and oximetry is indispensable.

On the Kt/V ratio, studies are still scarce, but the benefits achieved with exercises during dialytic therapy are evidenced. The few evidences highlight the acceleration of vascular blood flow, increase of muscle perfusion and consequent aid in electrolytic removal, which increases the effectiveness of dialysis, however, new studies about this scenario are necessary for stratification of this topic.

### References

- 1- Número de doentes renais no Brasil dobra em uma década, alertam médicos. 2012. [access 28 fev 2022]. Available from: <https://www.abc.com.br/2012/12/numero-de-doentes-renais-no-brasil-dobra-em-uma-decada-alertam-medicos>.
- 2- Thomé FS, Sesso RC, Lopes AA, Lugon JR, Martins CT. *Braz Chronic Dialysis Surv* 2019;41(2):208-14.
- 3- Peres LA, Matsuo T, Ann HK, Camargo MTA, Rohde NRS, Uscocovich VSM, et al. Causas de óbitos em pacientes renais crônicos em programa dialítico. *Rev Bras Clin Med*. 2010;8(6):495-9.
- 4- Azevedo DF, Correa MC, Botre L, Mariano RM, Assis RR, Grossi L, Puy TD, Junir JMP. Sobrevida e causas de mortalidade em pacientes hemodialíticos. *RMMG* 2009;19(2):117-22.
- 5- Reboredo MM, Pinheiro BV, Neder JA, Avila MPW, Ribeiro MLBA, Mendonça AF, et al. Efeito do exercício aeróbico durante as sessões de hemodiálise na variabilidade da frequência cardíaca e na função ventricular esquerda em pacientes com doença renal crônica. *Braz J Nephrol* 2010;32(4):372-9. doi: <https://doi.org/10.1590/S0101-28002010000400006>
- 6- Compreendendo os rins. Sociedade Brasileira de Nefrologia: SBN; [cited 2020 Feb 28]; [1]. Available from: <https://www.sbn.org.br/o-que-e-nefrologia/compreendendo-os-rins/>
- 7- Romão Junior JE. Doença renal crônica: definição, epidemiologia e classificação. *J Bras Nefrol* 2004;26(3):1-3.
- 8- TN, Oliveira AR, Silva AK. Taxa de filtração glomerular estimada em adultos: características e limitações das equações utilizadas. *Bras J Clin Anal* 2016;48(1):7-12.
- 9- Schardong TJ, Janice Luisa Lukrafka JL, Garcia VD. Avaliação da função pulmonar e da qualidade de vida em pacientes com doença renal crônica submetidos a hemodiálise. *J Bras Nefrol* 2008;30(1):40-7.
- 10- Xavier VB. Impacto da ventilação não invasiva em pacientes com doença renal crônica submetidos à hemodiálise. *Rev Bras Ter Intensiva* 2013;25(3):251-257
- 11- Breitsameter G, Figueiredo AE, Kochhann DS. Cálculo de Kt/V em hemodiálise: comparação entre fórmulas. *J Bras Nefrol* 2012;34(1):22-6
- 12- Rocha E, Magalhães SM, Lima VP. Repercussão de um protocolo fisioterapêutico intradialítico na funcionalidade pulmonar, força de preensão manual e qualidade de vida de pacientes renais crônicos. *Braz J Nephrol* 2010;32(4):359-71.
- 13- Oliveros MS, Avendaño M, Bunout D., Hirsch S, De La Maza MP, Pedreros C, et al. Estudo piloto sobre treinamento físico durante hemodiálise. *Rev Med Chil* 2011;139:1046-53.
- 14- Paluchamy T, Vaidyanathan R. Effectiveness of intradialytic exercise on dialysis adequacy, physiological parameters, biochemical markers and quality of life: a pilot study. *Saudi J Kidney Dis Transpl* 2018;29(4):902-10.
- 15- Brown PD, Rowed K, Shearer J, Mac Rae JM, Parker K. Impact of intradialytic exercise intensity on urea clearance in hemodialysis patients. *Appl Physiol Nutr Metab* 2018;43:101-104. doi 10.1139/apnm-2017-0460.
- 16- Anding K, Bär T, Trojniak-Hennig J, Kuchinke S, Krause R, Rost JM, Halle M. A structured exercise programme during haemodialysis for patients with chronic kidney disease: clinical benefit and long-term adherence. *BMJ Open* doi: 10.1136/bmjopen-2015-008709 2015;5(8):1-9.
- 17- Silva SF, Pereira AA, Silva WA, Simões R, Neto JRB. Fisioterapia durante a hemodiálise de pacientes com doença renal crônica. *Braz J Nephrol* 2013;35(3):170-76. doi: <https://doi.org/10.5935/0101-2800.20130028>
- 18- Chaves ST, Fernandes TF, Carvalho MP, Rabuske M. Fisioterapia transdiálise em doentes renais crônicos. *Arq Cienc Saude Uniapar* 2011;15(1):71-7.
- 19- Freire APCF, Rios CS, Moura RS, Burneiko RCVM, Padulla SAT, Lopes FS. Aplicação de exercícios isotônico durante a hemodiálise melhora a eficiência dialítica. *Fisioter Mov* 2013;26(1):167-74.