International Journal of Biology and Life Sciences
ISSN: 2957-9511 | Vol. 3, No. 2, 2023

Effect of Resistance Exercise with Moderate and Low Intensity on Quality of Life and Mental Health in Maintenance Hemodialysis Patients

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Abstract: It was to explore the effects of resistance exercise with moderate and low intensity on quality of life (QoL) and mental health of patients with maintenance hemodialysis (MHD). From June 2022 to December 2022, 90 patients receiving MHD treatment in Blood Purification Center of XXX Hospital were randomly divided into observation group and controls, with 45 patients in each group. The controls received routine hemodialysis care, and observation group received resistance exercise with moderate and low inte in addition to routine hemodialysis care. QoL measurement tool adopted 36-Item Short Form Health Survey (SF-36), Hamilton Rating Scale for Depression (HAMD), and Hamilton Anxiety Scale (HAMA) to evaluate patients. The physical function was 67.64±25.62 and mental health was 71.68±28.55 in controls, and those was 71.11±25.42 and 73.48±13.59 in observation group; in terms of physical function and mental health in QoL, observation group was obviously higher; and HAMD and HAMA scores in observation group were clearly lower as against controls ($P < 0.05$). The effect of resistance exercise with moderate and low inte was obvious on the physical function and mental state of QoL in MHD patients, but not obvious on other aspects. Resistance exercise with moderate and low inteis beneficial to improve patients' mental health.

Keywords: Hemodialysis; Resistance Exercise; QoL; Mental Health.

1. Introduction

According to statistics, end stage renal disease (ESRD) is the fifth stage of chronic kidney disease. It is a common clinical syndrome in which various primary and secondary renal diseases progress to renal failure. In recent years, the number of patients with ESRD in China has continued to increase [1]. Patients must undergo renal replacement therapy, generally kidney transplantation, peritoneal dialysis, and hemodialysis to survive for a long time. Among them, MHD has been widely adopted. In China, the patients with ESRD who have chosen hemodialysis as a treatment account for 91% of the total dialysis patients. With continuous progress, hemodialysis technology has become increasingly mature and become a routine treatment method, enabling many ESRD patients to survive for a long time [2]. However, it also has its limitations. Hemodialysis is still a treatment with unsatisfactory QoL and high mortality. Skeletal muscle atrophy is a common yet easily overlooked problem in dialysis patients, and it has been reported that the incidence of skeletal muscle atrophy is about 50% in the population receiving dialysis [3]. At present, the definition is not uniform, and the pathological process is not clear. Skeletal muscle atrophy in dialysis patients is the result of a combination of reasons, involving malnutrition and too little exercise [4]. Skeletal muscle atrophy leads to muscle structure and function disorders, which must greatly affect the physical function and QoL of MHD patients. Studies have shown that muscle strength plays a key role in maintaining activities such as activities of daily living and is one of the most important factors affecting physical function [5]. Studies have shown that more than one third of patients require assistance to complete maintenance activities of daily living. Physical function is an important component of QoL, and most likely determines the patient's own evaluation of QoL. Impairment of physical function translates into reduced QoL [6]. In addition, due to skeletal muscle atrophy, patients have lower levels of physical activity and a more sedentary lifestyle than age-matched normal populations. Low levels of physical activity interact with skeletal muscle atrophy, creating a vicious cycle that leads to reduced QoL and increased risk of death [7]. Therefore, if effective interventions can be taken to prevent and delay the progression of skeletal muscle atrophy and enhance the muscle strength of this population, it is expected to improve physical function, further improve QoL, and reduce the risk of death [8]. However, there is no effective treatment for skeletal muscle atrophy in patients, but exercise therapy has become a routine recommendation [9,10]. Exercise therapy can be divided into exercise during dialysis and exercise for non-dialysis purposes, depending on the time: it can be roughly divided into aerobic training and resistance training, depending on the mode. Aerobic exercise requires the participation of major muscle groups throughout the body, has a long duration and a sense of rhythm, and the main purpose is to improve activity tolerance. Resistance exercise refers to the exercise that needs to overcome external resistance during muscle contraction [11]. It has long been recognized as one of the best ways to increase muscle strength, muscle mass, and endurance. It can improve skeletal muscle protein synthesis and help skeletal muscle growth.

It aimed to explore the effects of moderate and low intensity resistance exercise on QoL and mental health of MHD patients.

2. Materials and Methods

2.1. Subjects

90 patients who underwent MHD treatment in the Blood Purification Center of XXX Hospital from June 2022 to December 2022 were enrolled and randomly grouped:

observation group and controls, with 45 cases in each group. There were 25 men and 20 women in observation group. The mean age was 53.12. Controls had 22 men and 23 women, with mean age of 51.42. There was no clearly different in the basic data between two groups (P > 0. 05). With the approval by the Medical Ethics Committee of XXX Hospital, all patients' families signed the consent form to participate in the trial.

Inclusion criteria: (1) age ≥18 years old; (2) patients were given with hemodialysis for at least 90 days and their condition was stable; (3) Hemodialysis three times per week; (4) Muscle strength 3+ grade; (5) clear consciousness and normal intelligence.

Exclusion criteria: (1) uncontrolled hypertension (systolic blood pressure ≥200 mmHg or diastolic blood pressure ≥120 mmHg), heart failure, arrhythmia; (2) unstable angina; (3) uncontrolled diabetes; (4) acute lower extremity thrombosis; (5) patients with malignant tumors or acute diseases, infectious diseases.

2.2. Resistance Exercise Equipment

Scanning equipment and parameters: The elastic belt adopts Thera-Band elastic belt with eight colors produced by Hufu Company in China. With the change of color, the resistance of the elastic belt increased gradually. The sandbag was the leggings sandbag produced by Lijin Sports sandbag company. 1kg, 2kg, and 3kg sandbags were adopted.

2.3. Research Methods

Controls performed routine hemodialysis care: close observation of the patient's vital signs and state of consciousness; monitoring of vascular access; monitoring of extracorporeal circulation every hour to observe whether the blood connection was tight and to prevent massive bleeding caused by joint loosening; monitoring of dialysis pathway; timely detecting the emergency complications in the process of dialysis, reporting to the doctor, and dealing with them in time; dealing with various alarms of dialysis machine. Nursing after hemodialysis: following the doctor's advice to take blood test and observe the effect of dialysis treatment; after the end, re-measuring and recording the weight and checking the actual water removal.

On the basis of routine hemodialysis nursing, observation group carried out moderate and low intensity resistance exercise: the appropriate elastic band and ankle sandbag were selected according to the basic muscle strength of patients, and the exercise intensity was determined by Borg subjective fatigue score. During the exercise, the subjects were asked to evaluate their fatigue degree according to their subjective feelings. A score of 6 indicates no effort at all and a score of 20 indicates exhaustion. If subjects chose a range of 10 to 13 points, it indicated that moderate to low intensity exercise was appropriate for them. Exercise twice a week; exercise time: 2h to 4h after hemodialysis, depending on the time to complete the prescribed time. The progression cycle was 12 weeks.

2.4. Observation Indicators

QoL was measured by SF-36, which included 8 domains of somatic function, physiological function, somatic pain, general health, energy, social function, affective function, mental health. The sum of the scores of the 8 domains is a comprehensive score. The higher the score, the lighter the functional impairment and the better the QoL.

HAMD and HAMA were adopted to evaluate the mental status of patients before and after intervention. The higher the score, the worse the mental health status.

2.5. Statistical Analysis

All data were analyzed by SPSS 23.0 statistical package. Normally distributed data for continuous variables were presented as mean ± standard deviation, and unpaired *t*-test was sdopted to compare continuous changes, univariate factor repeated measures and simple single effect analysis for multi-period comparison. Chi-square test was adopted, Log-Rank test to compare the differences between two groups. $P < 0.05$ was considered statistically meaningful.

3. Results

3.1. Comparison of Basic Information

There were 45 cases in each group. There were 25 men and 20 women in observation group. The mean age was 53.12. Controls had 22 men and 23 women. The mean age was 51.42 (Table 1).

Table 1. Basic information of the patients

Categories	Observation group	Controls
Age range (years)	53.12	51.42
Male/female (cases)	25/20	22/23
On/off the job	8/37	9/36

3.2. Comparison of QoL Scores after Intervention

The somatic function, physiological function, somatic pain, general health, energy, social function and affective function, and mental health of QoL scale were compared. Scores in somatic function, physiological function, somatic pain, general health, energy, social function, affective function, and mental health in observation group were found were markedly higher as against controls ($P < 0.05$). However, the other dimensions were not statistically meaningful (Figure 1).

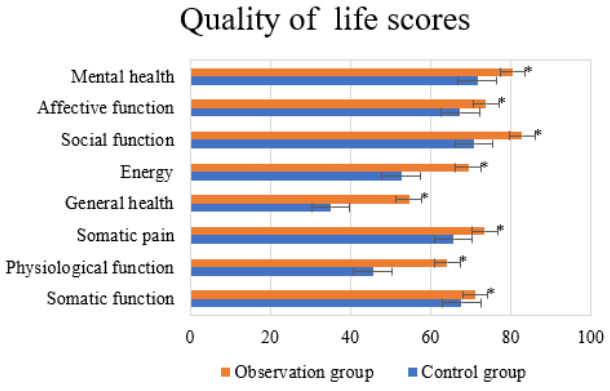


Figure 1. Contrast of dimensions in QoL between two groups. (x±s, scores) (* indicates P < 0.05 compared with controls)

3.3. Comparison of Mental State after Intervention

The HAMD score was 17.22±4.12 in observation group and 21.34±6.08 in controls (Figure 2). The HAMA score was 19.13±4.99 in observation group and 22.54±5.58 in controls (Figure 3). The scores of the two scales in observation group were clearly inferior as against controls ($P < 0.05$).

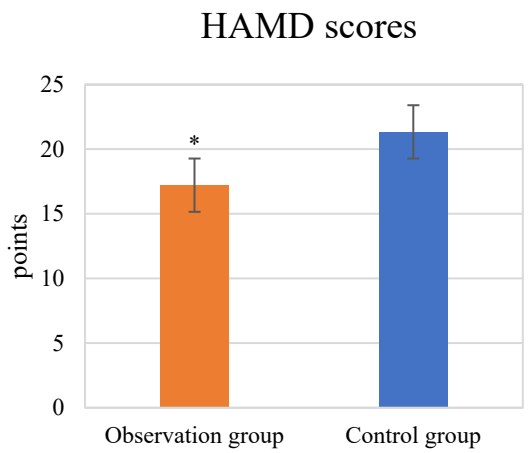


Figure 2. Contrast of mental state HAMD between two groups (x±s, score)

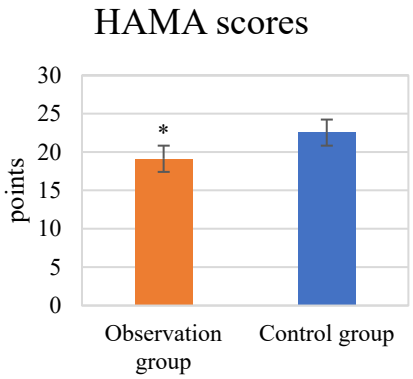


Figure 3. Contrast of mental status HAMA between two groups. (x±s, scores) (* represents relative to controls, P < 0.05)

4. Discussion

MHD patients are prone to problems such as long course of disease, repeated course of disease, discomfort in dialysis treatment, high medical costs, dietary restrictions, and limited social activities, and are prone to anxiety, depression, and other adverse emotions, which seriously affect the QoL of patients and the effect of dialysis [12,13]. QoL is an important indicator for comprehensive evaluation of dialysis treatment. A large number of studies have conducted questionnaire surveys on large samples of MHD patients from different countries and regions and compared their QoL with that of normal people. They found that the QoL of hemodialysis patients was lower than that of normal people [14]. There are many factors affecting QoL in MHD patients, such as socio-demographic factors, disease-related factors, and psychosocial factors [15,16]. In addition, as an important component of QoL in MHD patients, the level of physical function largely determines the patient's own QoL evaluation [17]. The present results suggested that moderate-to-low intensity resistance exercise had no obvious effect on the other QoL dimensions from the eight dimensions, possibly because this QoL includes a wide range of contents and many influencing factors, and even if it improved physical function, it did not clearly improve patients' QoL. 96.1% of the subjects agreed with the use of moderate and low intensity resistance exercise intervention [18]. Elastic bands and sandbags are introduced for easy implementation and high safety. Therefore, the acceptance of MHD patients is high.

However, there are some patients who should recognize more diverse devices. In addition, during baseline data collection, most MHD patients reported walking (aerobic exercise) as their daily physical activity, and the role of resistance exercise is poorly understood [19]. The acceptance of resistance exercise increased when it was recognized that it and aerobic exercise had different physical benefits and it could not be replaced [20,21]. However, it was found that some subjects thought that compared with the upper limbs, the lower limbs had less exercise, and the muscle strength of the lower limbs was more important in the activities of daily life, so they hoped to strengthen the exercise of the lower limbs. In addition, due to the limitation of body position during hemodialysis, the researchers screened the literatures and consulted the professionals of the physical therapy department of the China Rehabilitation Research Center, and simple movements were formed to facilitate the supine position [22,23]. The HAMD score was 17.22±4.12 in observation group and 21.34±6.08 in controls. The HAMA score in observation group was 19.13±4.99, and was 22.54±5.58 in controls. HAMD and HAMA scores in observation group were markedly lower as against controls ($P < 0.05$). Moderate and low intensity resistance exercise intervention has obvious effect on the physical function and psychological state of QoL of MHD patients, but has no clear outcome on other aspects [24]. Moderate and low intensity resistance exercise is beneficial to improve the mental health of patients. The intervention of moderate and low intensity resistance exercise can improve the correct cognition of patients, promote the improvement of their psychological, physiological, and social life status, and then improve their physical and mental health [25]. It was to explore the effects of moderate and low intensity resistance exercise on QoL and mental health of MHD patients.

5. Conclusion

In conclusion, moderate-to-low intensity resistance exercise has clear outcome on physical function and psychological state of QoL in MHD patients, but has no obvious effect on other aspects. Moderate and low intensity resistance exercise is beneficial to improve the mental health status of patients, improve their QoL, and promote the physical, psychological, and social rehabilitation of patients, which is worthy of promotion and application. More cases are needed to obtain more information and provide efficient and direct basis for clinical diagnosis and treatment.

Acknowledgments

Shaanxi Provincial People's Hospital 2022 Science and Technology Development Incubation Fund Project; Fund No.: 2022HL-9

References

[1] Jamshidpour B, Bahrpeyma F, Khatami MR. The effect of aerobic and resistance exercise training on the health related quality of life, physical function, and muscle strength among hemodialysis patients with Type 2 diabetes. J Bodyw Mov Ther. 2020 Apr;24(2):98-103. doi: 10.1016/j.jbmt.2019.1 0.003. Epub 2019 Oct 5. PMID: 32507160.

[2] Greenwood SA, Koufaki P, Macdonald JH, Bulley C, Bhandari S, Burton JO, Dasgupta I, Farrington K, Ford I, Kalra PA, Kumwenda M, Macdougall IC, Messow CM, Mitra S, Reid C, Smith AC, Taal MW, Thomson PC, Wheeler DC, White C, Yaqoob M, Mercer TH. Exercise programme to improve quality of life for patients with end-stage kidney disease receiving haemodialysis: the PEDAL RCT. Health Technol

Assess. 2021 Jun;25(40):1-52. doi: 10.3310/hta25400. PMID: 34156335; PMCID: PMC8256322.

[3] Rhee SY, Song JK, Hong SC, Choi JW, Jeon HJ, Shin DH, Ji EH, Choi EH, Lee J, Kim A, Choi SW, Oh J. Intradialytic exercise improves physical function and reduces intradialytic hypotension and depression in hemodialysis patients. Korean J Intern Med. 2019 May;34(3):588-598. doi: 10.3904/ kjim. 2017. 020. Epub 2017 Aug 25. PMID: 28838226; PMCID: PMC 6506736.

[4] Huang M, Lv A, Wang J, Xu N, Ma G, Zhai Z, Zhang B, Gao J, Ni C. Exercise Training and Outcomes in Hemodialysis Patients: Systematic Review and Meta-Analysis. Am J Nephrol. 2019;50(4):240-254. doi: 10.1159/000502447. Epub 2019 Aug 27. PMID: 31454822.

[5] Yabe H, Kono K, Yamaguchi T, Ishikawa Y, Yamaguchi Y, Azekura H. Effects of intradialytic exercise for advanced-age patients undergoing hemodialysis: Arandomized controlled trial. PLoS One. 2021 Oct 22;16(10):e0257918. doi:10. 1371/ journal.pone .0257918. PMID: 34679101; PMCID: PMC 8535393.

[6] Myers J, Chan K, Chen Y, Lit Y, Patti A, Massaband P, Kiratli BJ, Tamura M, Chertow GM, Rabkin R. Effect of a Home-Based Exercise Program on Indices ofPhysical Function and Quality of Life in Elderly Maintenance Hemodialysis Patients. Kidney Blood Press Res. 2021;46(2):196-206. doi: 10.1159/ 000514269.Epub 2021 Mar 26. PMID: 33774634.

[7] Zhao J, Qi Q, Xu S, Shi D. Combined aerobic resistance exercise improves dialysis adequacy and quality of life in patients on maintenance hemodialysis. Clin Nephrol. 2020 Jun; 93(6):275-282. doi: 10.5414/CN110033. PMID: 32271146.

[8] Zhang F, Huang L, Wang W, Shen Q, Zhang H. Effect of intradialytic progressive resistance exercise on physical fitness and quality of life in maintenance haemodialysis patients. Nurs Open. 2020 Aug 21;7(6):1945-1953. doi:10.1002/nop2.585. PMID: 33072380; PMCID: PMC7544880.

[9] Regolisti G, Sabatino A, Fiaccadori E. Exercise in patients on chronic hemodialysis: current evidence, knowledge gaps and future perspectives. Curr Opin Clin Nutr Metab Care. 2020 May;23(3):181-189. doi:10.1097/MCO.0000000000000656. PMID: 32235267.

[10] Marzougui H, Maaloul R, Ben Dhia I, Toumi S, Kammoun K, Ben Hmida M, Ayadi F, Turki M, Elleuch MH, Ghroubi S, Hammouda O. Effects of intradialytic exercise in combination with melatonin supplementation on functional capacity, postural balance, and quality of life in hemodialysis patients. Ther Apher Dial. 2022 Dec 29. doi: 10.1111/1744-9987.13964. Epub ahead of print. PMID: 36579842.

[11] Abdelbasset WK, Ibrahim AA, Althomali OW, Hussein HM, Alrawaili SM, Alsubaie SF. Effect of twelve-week concurrent aerobic and resisted exercise training in non-dialysis day on functional capacity and quality of life in chronic kidney disease patients. Eur Rev Med Pharmacol Sci. 2022 Sep;26(17):6098-6106. doi:10.26355/eurrev_202209_29626. PMID: 36111910.

[12] Bernier-Jean A, Beruni NA, Bondonno NP, Williams G, Teixeira-Pinto A, Craig JC, Wong G. Exercise training for adults undergoing maintenance dialysis. Cochrane Database Syst Rev. 2022 Jan 12;1(1):CD014653. doi:10. 1002/ 14651858. CD014653. PMID: 35018639; PMCID: PMC 8752366.

[13] Hu H, Liu X, Chau PH, Choi EPH. Effects of intradialytic exercise on health-related quality of life in patients undergoing maintenance haemodialysis: a systematic review and meta-analysis. Qual Life Res. 2022 Jul;31(7): 1915-1932.doi: 10. 1007/ s11136-021-03025-7. Epub 2021 Nov 3. PMID: 34731388.

[14] Rosa CSDC, Nishimoto DY, Souza GDE, Ramirez AP, Carletti CO, Daibem CGL, Sakkas GK, Monteiro HL. Effect of continuous progressive resistance training during hemodialysis on body composition, physical function and quality of lifein end-stage renal disease patients: a randomized controlled trial. Clin Rehabil. 2018 Jul;32(7):899-908. doi: 10.1177/ 026921 5518760696. Epub 2018 Mar 4.PMID: 29504416.

[15] Grigoriou SS, Krase AA, Karatzaferi C, Giannaki CD, Lavdas E, Mitrou GI, Bloxham S, Stefanidis I, Sakkas GK. Long-term intradialytic hybrid exercisetraining on fatigue symptoms in patients receiving hemodialysis therapy. Int Urol Nephrol. 2021 Apr; 53(4):771-784. doi: 10.1007/s11255-020-02711-8. Epub 2021Jan 2. PMID: 33387217.

[16] Gopaluni S, Sherif M, Ahmadouk NA. Interventions for chronic kidney disease-associated restless legs syndrome. Cochrane Database Syst Rev. 2016 Nov 7;11(11):CD010690. doi: 10.1002/14651858.CD010690.pub2. PMID: 27819409; PMCID: PMC6464953.

[17] Segura-Ortí E, Kouidi E, Lisón JF. Effect of resistance exercise during hemodialysis on physical function and quality of life: randomized controlled trial. Clin Nephrol. 2009 May; 71(5): 527-37. doi: 10.5414/cnp71527. PMID:19473613.

[18] Ribeiro R, Coutinho GL, Iuras A, Barbosa AM, Souza JA, Diniz DP, Schor N.Effect of resistance exercise intradialytic in renal patients chronic in hemodialysis. J Bras Nefrol. 2013 Jan-Mar;35(1):13-9. English, Portuguese. doi:10.5935/ 01012800. 20130003. PMID: 23598747.

[19] Lu Y, Wang Y, Lu Q. Effects of Exercise on Muscle Fitness in Dialysis Patients: A Systematic Review and Meta-Analysis. Am J Nephrol.2019;50(4):291-302. doi: 10.1159/000502635. Epub 2019 Sep 3. PMID: 31480056.

[20] Wilund KR, Jeong JH, Greenwood SA. Addressing myths about exercise in hemodialysis patients. Semin Dial. 2019 Jul;32(4):297-302. doi:10.1111/sdi.12815. Epub 2019 Apr 25. PMID: 31025450.

[21] Gomes Neto M, de Lacerda FFR, Lopes AA, Martinez BP, Saquetto MB. Intradialytic exercise training modalities on physical functioning and health-related quality of life in patients undergoing maintenance hemodialysis:systematic review and meta-analysis. Clin Rehabil. 2018 Sep;32(9):1189-1202. doi: 10.1177/0269215518760380. Epub 2018 Feb 26. PMID: 29480025.

[22] Martins do Valle F, Valle Pinheiro B, Almeida Barros AA, Ferreira Mendonça W, de Oliveira AC, de Oliveira Werneck G, de Paula RB, Moura Reboredo M. Effects of intradialytic resistance training on physical activity in daily life, muscle strength, physical capacity and quality of life in hemodialysis patients: a randomized clinical trial. Disabil Rehabil. 2020 Dec;42(25):3638-3644. doi:10.1080/09638288.2019.1606857. Epub 2019 Apr 29. PMID: 31034264.

[23] Moraes C, Marinho S, Lobo JC, Stockler-Pinto MB, Barros AF, Jacobson LV, da Nobrega AC, Rosa ML, Denise M. Effects of resistance exercise training on acyl-ghrelin and obestatin levels in hemodialysis patients. Ren Fail. 2015 Jun;37(5):851-7. doi: 10.3109/0886022X.2015.1033634. Epub 2015 Apr 21. PMID: 25897771.

[24] Huang M, Lv A, Wang J, Zhang B, Xu N, Zhai Z, Gao J, Wang Y, Li T, Ni C. The effect of intradialytic combined exercise on hemodialysis efficiency in end-stage renal disease patients: a randomized-controlled trial. Int Urol Nephrol.2020 May; 52 (5): 969-976. doi: 10.1007/s11255-020-02459-1. Epub 2020 Apr 16. PMID:32301053.

[25] Cai X, Zeng D, Deng J. A systematic review and meta-analysis of the efficacy of aerobic exercise combined with resistance training on maintenance hemodialysis patients. Ann Palliat Med. 2022 Apr;11(4):1360-1368. doi:10.21037/apm-22-226. PMID: 35523744.