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Research Article

Effectiveness Of Aerobic Exercise On Physical Functions, Autonomic Functions, Sleep Quality, Depression, Anxiety, And Stress In Patients With Chronic Kidney Disease

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ABSTRACT

Background and objectives
CKD has become the primary cause of illness and death worldwide. A routine of aerobic exercise and healthy living are essential to preventing the development of CKD. Recently, research from across the world has been conducted to support the relatively new notion of regular low-intensity exercise for renal patients, and its prospective advantages.
Method: In this narrative review, we look at the research that has been done on how aerobic exercise affects the course of chronic kidney disease (CKD) and how well it works for patients' physical and autonomic functioning as well as their sleep quality, stress levels, depression, and anxiety. Results: Based on available data, it is evident that engaging in low-intensity aerobic exercise and implementing healthy lifestyle habits provide distinct benefits for surviving.
Discussion: The length of follow-up and the small sample sizes of several of the current research are their limitations because there were few articles and varying definitions of behaviours, referent groups, and CKD progression, doing meta-analyses took a lot of work. Therefore, additional study is required to give practical ways for measuring how effectively aerobic exercise impacts physical functions, autonomic functions, sleep quality, depression, anxiety, and stress levels in persons with renal illness.

Keywords: aerobic exercise; chronic kidney disease; CKD; physical activity; Physical Functions; Autonomic Functions; Sleep Quality; Depression, Anxiety; Stress

INTRODUCTION

Chronic kidney disease (CKD) has become the leading cause of mortality and morbidity worldwide and is recognized as a major public health concern. Over 800 million adults worldwide have CKD, with roughly 4 million of them needing kidney replacement treatment (KRT). The prevalence of CKD is rapidly spreading throughout the world with a projected 10 % annual growth comes with a similar financial and clinical burden. [1] The rising prevalence of diabetes, hypertension, obesity, and ageing are the key factors contributing to the global rise in CKD. [2] There have been many serious worries raised about the possibility that CKD would spread like an epidemic and will exhaust the limited resources of less "robust" nations. [3-4] Patients with CKD have severe functional impairments and are generally inactive. Sedentary behaviour has been associated with increased mortality in the general population. Recent studies have shown the systemic effects of chronic kidney disease (CKD) on physical performance. Specifically, walking ability, muscular strength, fatigability, balance, and fine motor functions all decline with decreasing GFR [5-7]. Previous studies data suggest that many patients with CKD diseases had seen their physiological state, physical fitness, psychological, emotional, and social status deteriorate over time, eventually worsening their condition [8-9]. Numerous risk factors for CKD share characteristics with those for cardiovascular disease, including some that are unavoidable, such as age, gender, and family history. To reduce the risk of developing end-stage renal disease (ESRD), death, and other CKD complications, patients with CKD and their clinicians are seeking ways to change the course of their condition. It's crucial to implement prevention measures for CKD development and

progression. Primary prevention of CKD is linked to lifestyle-related factors like boosting vegetable intake, upping physical activity, lowering salt intake, and limiting alcohol usage. [10] One of the alternatives is making dietary adjustments. [11] Engaging in low- or light-intensity activities instead of sitting down provides a survival benefit in the general or CKD populations. The current recommendations for managing chronic kidney disease (CKD) include that patients maintain a healthy weight, exercise for at least 150 minutes a week, and maintain a good diet. However, the relationship between aerobic activity and the onset of CKD has not been well studied [12]. Studies have been carried out internationally in recent years to support the possible advantages of frequent low-intensity exercise for renal patients, which is a relatively novel idea in renal rehabilitation [13]. In this systematic review, we focus on historical and recent data on the role of aerobic exercise in the course of the progression of CKD, with a special emphasis on aerobic exercise that has been shown to improve physical functions, autonomic functions, sleep quality, depression, anxiety, and stress parameters may improve conditions of individuals and slow the onset of ESRD.

METHODS

This review aims to achieve the following objectives: Aerobic exercise has been shown to improve patients' conditions and halt the progression of end-stage renal disease (ESRD) by improving physical functions, autonomic functions, sleep quality, depression, anxiety, and stress parameters in patients with kidney disorders. We searched the English-language literature using the electronic databases PubMed, MEDLINE, Embase, and Google. The keywords that were used in the search were "aerobic exercise," "CKD," "renal disease," "physical function," "autonomic function," "sleep quality," "depression," "anxiety," or "stress." The required papers were archived with help from the writers' expertise and topic knowledge. The reviews that follow exclusively include pieces that adhere to these criteria: Studies that focus only on chronic kidney disease (CKD), aerobic exercise, bodily processes, autonomic processes, sleep quality, depression, anxiety, and stress are taken into account. Studies completed in the last ten years and the English language is also included. The PRISMA-based research methodology is shown in Figure 1.

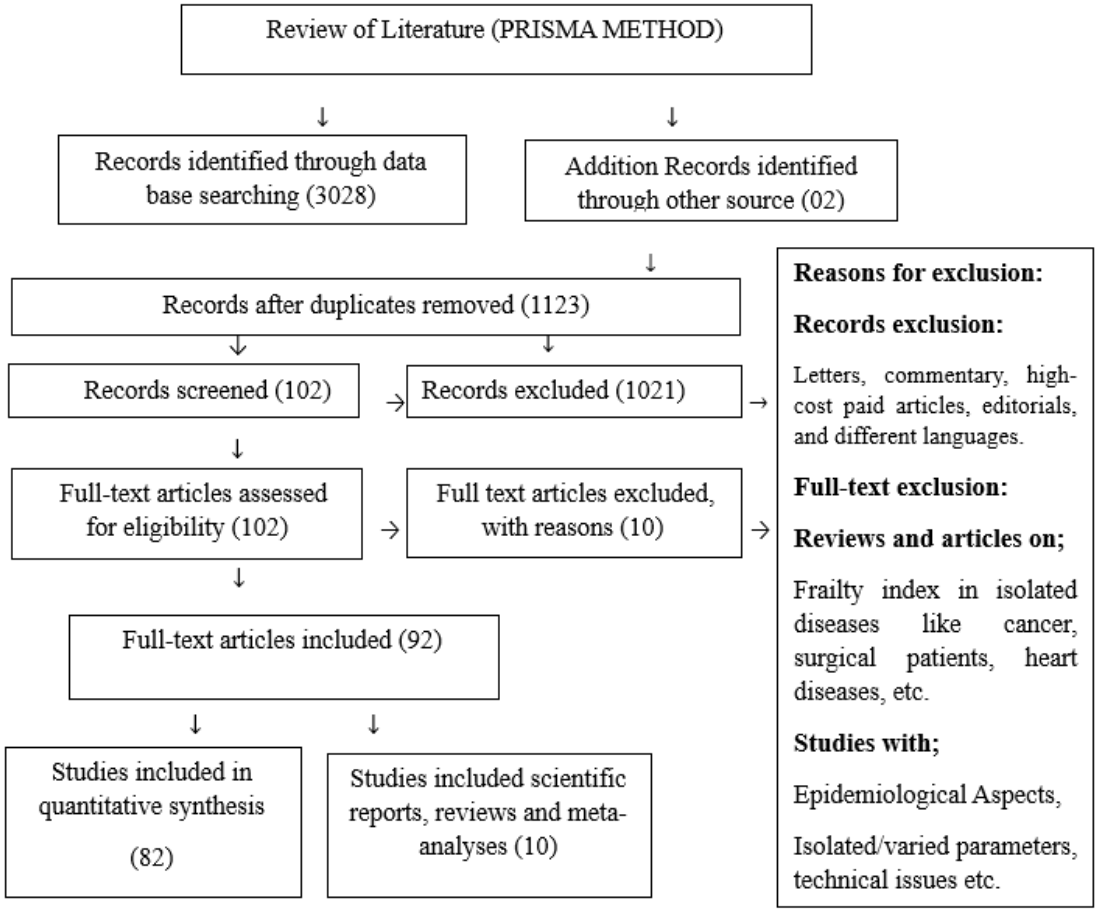

Figure-1: depicts the research technique using the PRISMA method.

3.6. PHYSICAL FUNCTIONS

Physical activity is any movement of the body that requires energy and is generated by the skeletal muscles. Urge them to exercise for a minimum of thirty minutes, five days a week, in a way that is safe for their

cardiovascular health and tolerance [14]. Recommendations for Physical Exercise: To maximise the health benefits of physical exercise, individuals should walk more throughout the day and sit less. They should also participate in moderate-to-intense physical activity. It is well acknowledged that physical exercise has positive effects on general health. A minimum of 75 minutes of intense exercise or 150 minutes of moderate exercise per week is recommended for adults to achieve significant health benefits. To get extra health advantages, adults should also do moderate-to-intense strengthening exercises at least twice a week. While physical activities of all intensities are called "exercise," the term "exercise" exclusively refers to moderate to intensive physical activity [12]. It is necessary to conduct randomized control trials (RCTs) of exercise programmes or physical activity to directly assess the effects of physical activity on the course of chronic kidney disease (CKD) in individuals with existing CKD. There was no difference observed in serum creatinine, proteinuria, or estimated glomerular filtration rate (eGFR) between the intervention and control groups in the two most recent meta-analyses investigating the effects of RCTs testing physical activity and exercise interventions on the progression of CKD in individuals with CKD. [12] [16] However the short durations, low participant numbers, and inadequate observational length to evaluate the influence of illness progression risk restricted the above meta-analyses' inclusion of RCTs. Moreover, since serum creatinine and muscle mass are correlated, minor rises in creatinine levels during an exercise program due to increased muscle metabolism and physical activity may be hard to assess. This might lead to an underestimation of eGFR and, eventually, kidney function. [17]

On clinically stable outpatients receiving hemodialysis, a prospective cohort study was conducted. In the research there were 282 participants' steps were recorded using an accelerometer. Fifty-five per cent of the participants were female, and their average age was 65. A total of 56 people died throughout the 56-month follow-up period. It has been shown that exercise reduces the mortality risk among hemodialysis patients. The results of this study showed a significant reduction in mortality for those who walk at least 4,000 steps daily. Patients receiving hemodialysis may get this recommendation as their first minimum from their medical professionals. (Matsuzawa et al, 2018)

To compare physical activity (PA) on HD and non-HD days and to evaluate the variables connected to low levels of PA in patients with CKD, descriptive research was conducted. The research included 79 patients with HD, who were categorized as Moderate and Vigorous PA (MVPA) individuals based on accelerometer sensors worn on them. Data on clinical status, demographics, and health-related quality of life (HRQoL) were analyzed and connected to PA. 35.5% of samples could perform 150 minutes of MVPA every week. Poorer MVPA was associated with ageing and a poorer HRQoL score. On HD days, MVPA spending was 74.9% less than on non-HD days. Because of this, we are encouraged to come up with ways to increase physical activity throughout HD day. For example, exercising during HD day may help CKD patients get the current level of PA that they need. (Rosa et al, 2017)

At Satellite HD units affiliated with a Canadian teaching hospital, one-group repeated assessments were used to assess the effects of a 20-week intradialytic exercise regimen on the quality of life, physical performance, and effectiveness of dialysis in self-care hemodialysis (HD) patients. Thirty minutes on a mini-stepper and thirty minutes on a cycle ergometer made up the fifteen minutes of low-intensity exercise that was administered during the first two hours of dialysis, three times a week for five months. Through the convenience sample strategy, 13 HD persons who practice self-care were chosen by the researchers. The selected patients were well and had received dialysis for a minimum of six months. The effectiveness of dialysis was evaluated both before the start of the exercise regimen and at the end of every month. Physical function and HD patient efficacy are improved by low-intensity intradialytic exercise regimens, according to the research. (Parsons et al, 2016)

HD patients were compared with controls from the Nephrology Unit of the University Hospital of the Federal University of Juiz de Fora, Brazil, in a case-control study conducted at a single centre. The objective was to determine the association between physiological factors and physical activity, as well as to assess daily physical activity measurements in HD populations. Nineteen HD patients and nineteen control subjects were compared for the number of steps they took, the amount of time they spent in various postures, and the everyday activities they engaged in and found HD people tended to be less active and preferred to just lie down, rather than moving about or standing up. Generally speaking, on dialysis days, people were more likely to be sedentary. Based on the amount of steps they did daily, 10.5% of the control group and 47.4% of HD patients were sedentary. Significant correlations were found between walking and active time and haemoglobin level, lower limb muscle strength, and physical functioning, as measured by the SF-36 questionnaire. Consequently, it's critical to motivate HD patients to engage in more physical exercise. (Gomes et al, 2015)

A single-centre pilot study assessed the therapeutic, social, and psychological barriers that may prevent chronic dialysis patients from engaging in physical activity in a Parma, Italy hospital. The average age of 104 patients was 69 years, with 65% of the patients being male and 79% being older than 60. Their ADL (Activities of Daily Living) score was 79. 85 per cent of the participants, or 92 in total, said they had some difficulty engaging in physical activity. People said that chest pressure, grief, and fear about having too many medical issues were challenges. The two primary barriers that physicians discovered are the lack of time for exercise counselling and the pervasive notion that people don't exercise or don't want to exercise. (Fiaccadoria, 2014)

The question of whether hemodialysis patients are less active than healthy (sedentary controls) is being investigated. In this study, eighty healthy inactive people and thirty-four hemodialysis patients took part. An activity questionnaire and a three-dimensional accelerometer were used to measure the physical activity during seven days. According to this research, 16 healthy, sedentary controls were shown to be more active than hemodialysis patients and found as individuals age, their degree of physical activity decreases. There is a connection between dialysis patients' nutritional condition and their degree of physical activity. These results demonstrate a connection between rising death rates in the general population and ageing dialysis patients who are sedentary. (Johansen et al, 2000)

3.7. AUTONOMIC FUNCTIONS

It is now well acknowledged that heart rate variability, or HRV, is a key indication of cardiovascular health. Papadakis et al. measured HRV responses after continuous moderate-intensity exercise (CMIE) and high-intensity interval exercise (HIIE), both of which were the same in terms of duration and intensity, in individuals with mid-severity CKD. After either CMIE or HIIE for 30 minutes, HRV indices dropped, indicating an autonomic imbalance in favour of vagal modulation. Furthermore, autonomic function analysis revealed that HRV's reactions to HIIE and CMIE were identical; hence, this resemblance may help recommend and programming of exercises for cardiovascular disease. [18]

3.8. SLEEP QUALITY

Individuals suffering from end-stage renal disease (ESRD) often encounter problems and challenges related to sleep. (19) Several studies have shown that between 30 and 80 per cent of these individuals have poor sleep quality overall, as well as sleep disorders such as insomnia, sleep apnea, periodic limb movement disorder (PLMD), and restless legs syndrome [19–20]. Research indicates that inadequate sleep duration and poor quality significantly exacerbate the three primary risk factors for chronic kidney disease (CKD), which are diabetes type 2, high blood pressure, and obesity. According to recent research, getting poor-quality sleep is associated with an increased risk of death in those with pre-ESRD and the onset of cardiovascular disease [21–24]. Recent studies have shown a connection between poor sleep quality and the progression of cardiovascular disease (CVD). The primary cause of mortality for almost all stages of CKD patients is cardiovascular illness [25–27]. Numerous studies have shown that disturbed sleep is a common side effect of restless legs syndrome (RLS) and often the most alarming one. As a result, individuals with primary and secondary RLS often report experiencing sleep problems [28]. Aerobic resistance exercise substantially decreased the severity of RLS compared to no activity (2 trials, 48 participants: MD -7.56, 95% CI -14.20 to -0.93; I2 = 65%) and exercise with minimal resistance (1 study, 24 participants: MD -11.10, 95% CI -17.11 to -5.09). As no research has been done on kidney transplant recipients, peritoneal dialysis patients, or non-dialysis CKD patients, further investigation is necessary before any conclusions can be made. Improving the quality of sleep via therapy may benefit cardiovascular disease as well as general quality of life. Aerobic resistance training may prove to be an effective treatment alternative in the future. [29-30]

3.9. DEPRESSION, ANXIETY, AND STRESS

Research indicates that depression is more common in CKD patients. Moreover, oxidative damage, chronic inflammation, and cardiovascular diseases have been connected to chronic kidney disease (CKD). Consequently, treatments that lessen stress and guard against cardiovascular problems are required. One alternative to drug methods to reduce stress and anxiety and prevent depression is to exercise [31–36]. Anxiety and depression worsen life quality and increase morbidity and death in people with chronic kidney disease [37–39]. Several earlier researches have shown that regular physical activity reduces symptoms of stress, anxiety, and depression. This has positive effects on both psychological and physical moods as well as comprehensive life quality [38–41]. Frequent exercise reduces depression because it increases blood supply to the hippocampal region and promotes neuronal growth there [42]. Exercise releases beta-endorphins, which are essential for the growth of hippocampal neurons and the reduction of depression and mitigate depression by modulating growth and cortisol hormones. [43-45] Individuals who exercise aerobically are in better general condition, with more psychological and physical wellness as well as a lower overtime need for external assistance. Furthermore, it reduces the cost of medical procedures [46].

CONCLUSION

In conclusion, earlier research indicated that numerous exercise techniques can help for different kidney diseases, inside as well as outside of dialysis sessions; and aerobic, resistance, or combined training can be beneficial to patients with kidney disease if safety precautions are taken. The advantages include enhanced muscle protein synthesis, boosted or retained power, enhanced physical appearance, a better quality of life, and various other health-related factors. There have been few previous studies indicating that exercise intolerance is a basic disturbance that causes deconditioning, reduced functional ability, weariness, social isolation, and a worsening of quality of life in people with chronic kidney disease (CKD).

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There are no conflicts of interest.

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