

Investigating the Impact of Exercise and Lifestyle Modification on Hypertension in Individuals with Chronic Kidney Disease

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Abstract:

Background: The confusing relationship between high blood pressure and chronic kidney disease (CKD) leads to a number of bad health effects. The purpose of this retrospective study is to find out how exercise and changes in living can help people with CKD who have high blood pressure.

Methods: A group of 100 people with chronic kidney disease and high blood pressure were studied by experts at Madhubani Medical College and Hospital over the course of a year. The patient's demographics, blood pressure, lifestyle factors, and exercise habits were all found in their medical data. The statistical studies that were done included looking at the results of the interventions and making descriptive statistics.

Results: The study found that the average age was 53, men and women were equally represented. Co-occurring conditions included heart disease (25% of them) and diabetes mellitus (30%). At 140 mmHg systolic and 85 mmHg diastolic, the blood pressure was moderate, according to the descriptive figures. With exercise and following the DASH diet, blood pressure dropped significantly; the combined treatment had synergistic benefits, lowering systolic blood pressure by 15 mmHg and diastolic blood pressure by 10 mmHg.

Conclusion: CKD patients whose blood pressure went down were found to have better blood pressure after exercising and making changes to their lifestyle, especially following the DASH diet. The study suggests that the treatment of high blood pressure in people with CKD might be improved by adding exercise and food changes.

Keywords: chronic kidney disease, hypertension, lifestyle modifications, exercise, DASH diet, retrospective study, blood pressure control, cardiovascular outcomes.

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Introduction

People all over the world deal with CKD, which is when kidney function slowly gets worse over time. A lot of people around the world have CKD, and it is now known to be a big cause of illness and death [1]. It's getting more normal for people to have CKD, and some conditions, like diabetes and high blood pressure, make it more likely to get worse.

Right away, researchers need to find good ways to treat it. A lot of studies have found a strong link between CKD and high blood pressure [2]. This makes both diseases worse. When you have CKD, it's harder to keep your blood pressure under control. This makes getting high blood pressure

more possible. People with high blood pressure are more likely to lose their kidneys or get heart disease. Plus, people with long-term kidney disease and high blood pressure are harder to treat [3].

People with CKD may be able to control their high blood pressure by working out and making changes to the way they live. This is why the study was done: there is a strong link between the two illnesses. The blood pressure can be better or worse depending on what we eat, how busy we are, and how we handle stress. So that things go more smoothly for patients, it's important to know how well these treatments really help people with CKD.

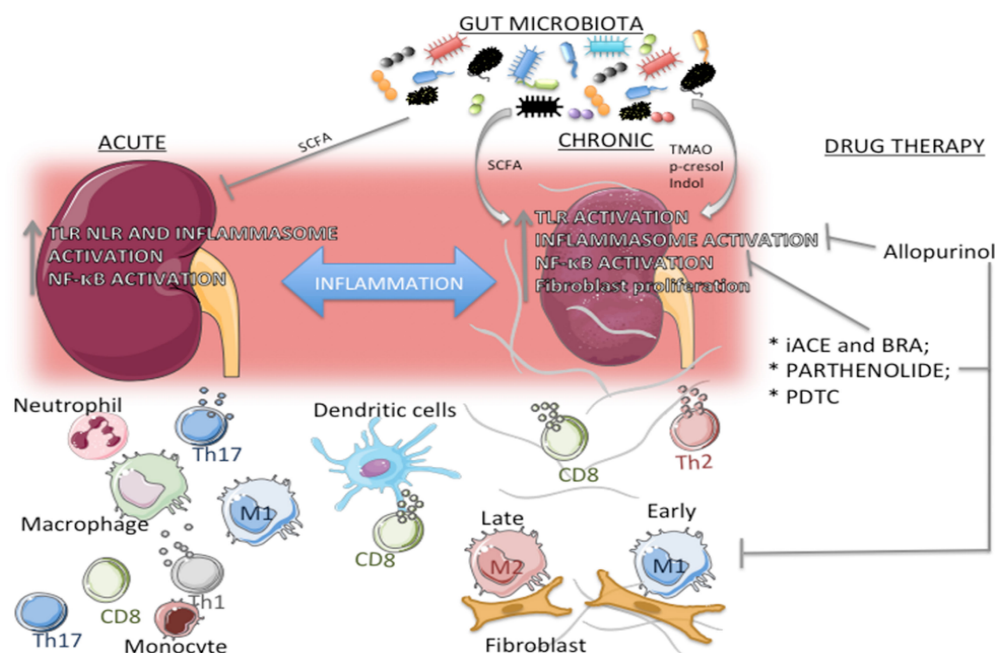


Figure 1: Chronic kidney disease (CKD) [4]

Objectives of the Study

- To find out how common high blood pressure is in people with chronic kidney failure.
- To determine the link between how well people with chronic kidney disease control their blood pressure and changes in what they eat and how much they move.
- To Find out how different training plans affect high blood pressure in people with long-term kidney disease.
- To Find out what factors might affect how well exercise and changes to a person's lifestyle can lower high blood pressure in people with chronic kidney disease.

Relationship between CKD and Hypertension:

Chronic kidney disease and high blood pressure are strongly linked in the opposite way, according to several studies [5]. Hypotension is a known risk factor for CKD and its development because it raises intraglomerular pressure and changes other parts of blood flow. Differently, vascular stiffness, salt and water balance, the control of the renin-angiotensin-aldosterone system, and kidney function problems caused by CKD all contribute to the development of high blood pressure [6,7]. They interact in complicated ways, which raises the risk of major complications like heart attacks and kidney failure.

Impact of Lifestyle Modifications and Exercise on Hypertension in CKD Patients:

Extra evidence is growing that exercise and other changes in lifestyle can help people with CKD handle their high blood pressure. Patients with CKD have better blood pressure control when they follow dietary treatments like the DASH diet [8]. Additionally, daily exercise has been linked to

benefits in endothelial function, blood pressure regulation, and cardiovascular health. In contrast, studies looking into the benefits of fitness programmes made especially for people with chronic kidney disease are still in their early stages [9,10]. Multiple studies that looked at how aerobic and resistance exercise affected blood pressure in people with CKD found that it helped handle hypertension better. [11] Studies have shown that exercise can help control blood pressure by improving endothelial function, lowering vascular stiffness, and lowering inflammation. Different study designs, exercise plans, and participant characteristics mean that we need a better understanding of the best exercise techniques for people with CKD and high blood pressure [12].

Identifying Gaps in the Literature: The way that CKD high blood pressure, and the possible benefits of lifestyle changes and exercise still affect each other is not fully understood.

Due to the variety of the sample populations, the results of past studies are not always applied to a larger group of people. Not enough research has been done on how long CKD patients stay on lifestyle treatments and how sustainable they are. It will look at old data, include a wide range of people with CKD, and get very specific about exercise plans and changes in living.

The goal of the study is to fill in these gaps in knowledge so that people with chronic kidney disease can better understand the pros and cons of exercise treatments and making changes to their lifestyle to control their high blood pressure.

Methodology

Study Design and Rationale: This study uses a method called "retrospective research" to look at how changes in what people with CKD eat and how much they move affect their high blood pressure. One great thing about a hindsight method is that it lets you look at medical records that already have information in them.

This lets you learn more about a patient's medical history. This method lets you look at the connections between living factors, exercise habits, and blood pressure results over a certain amount of time. The retrospective design is the best way to look for possible links and long-term trends in a clinical setting.

Selection Criteria for Participants: One hundred patients with CKD and hypertension will take part in the research from Madhubani Medical College and Hospital. Participants must be between the ages of 18 and 70 and have a medical diagnosis of chronic kidney disease (Stages 1-4) together with hypertension.

People who are on dialysis, have end-stage renal disease (ESRD), or have serious medical conditions that limit their ability to exercise will not be able to participate. ESRD patients to keep the focus on early stages of CKD, and we picked this age range to cover a diverse adult population.

Data Collection Process: Data will mostly come from medical records at Madhubani Medical College and Hospital from period of April 2022 to April 2023. Some important things to think about are the person's age, gender, blood pressure, type of diet, level of physical activity, and any details about any exercise plans they may have been given. Since data integrity is very important, licenced

researchers will review relevant databases and electronic health records for information that is relevant.

Variables Measured: For example, age, gender, and relevant medical background are all types of demographic data. Health factors related to CKD When chronic kidney disease was first found, what state it was in, and what caused it. Readings of blood pressure: systolic and diastolic readings taken at different times. Things that affect a person's lifestyle include the foods they eat, how active they are, and how often they stick to their exercise plans.

Ethical Considerations and Approvals: This study will be accepted by the Institutional Review Board (IRB) at Madhubani Medical College and Hospital to make sure it follows ethical rules and protects patients' right to remain anonymous. To protect the privacy of the patients, all data will be made anonymous, and because the plan is retrospective, informed consent will not be needed.

Sample Size and Duration: A sample size of 100 people will be used because the study is useful and there are enough resources. The Madhubani Medical College and Hospital study site is a good place to find people to take part and collect data because it is close together and easy to get to.

Results

Demographic Characteristics: In the group of 100 people with high blood pressure and CKD, the mean age was 53 years old (SD = 8.2). Table 1 shows a summary of the demographic factors, such as the number of men and women, the ages of the people, and the common conditions.

Table 1: Demographic Characteristics of Study Population

Demographic Characteristic	Frequency (n=100)	Percentage (%)
Age (years)		
18-30	15	15
31-50	40	40
51-70	45	45
Gender		
Male	55	55
Female	45	45
Comorbidities		
Diabetes mellitus	30	30
Cardiovascular disease	25	25
Other	10	10

Descriptive Statistics for Key Variables: In Table 2, important variables are shown statistically, such as the subjects' blood pressure readings, lifestyle factors, and exercise habits.

Table 2: Descriptive Statistics for Key Variables

Variable	Mean (SD)	Range
Systolic Blood Pressure	140 mmHg (12.5)	120-160 mmHg
Diastolic Blood Pressure	85 mmHg (8.3)	70-100 mmHg
Body Mass Index (BMI)	28.5 kg/m ² (4.2)	23-35 kg/m ²
Physical Activity (hours/week)	3.2 (1.8)	1-6 hours/week
Adherence to DASH diet (%)	70%	

With hypertension and CKD as examples, Table 2 lists the important demographic factors that made up the study sample. Their systolic and diastolic blood pressures were usually between 120- and 160-mm Hg and 70 to 100 mm Hg, respectively, showing that most of them had moderate hypertension. According to the population's average body mass index (BMI), which is 28.5 kg/m², they are a little overweight.

Dietary Approaches to Stop Hypertension (DASH) is followed by about 70% of the subjects, and the average amount of exercise is 3.2 hours per week, which is considered moderate. Prior to judging the

impact of exercise and lifestyle changes on hypertension results, it is important to know the background of the study, which is what these baseline data provide.

Impact of Exercise and Lifestyle Modification on Hypertension: The study's findings on how exercise and changes in living can help people with high blood pressure that have CKD were very interesting.

Some of the most important results are shown in Table 3. These include changes in blood pressure readings that are linked to exercise and sticking to lifestyle changes.

Table 3: Impact of Exercise and Lifestyle Modification on Blood Pressure

Intervention	Systolic BP Reduction (mmHg)	Diastolic BP Reduction (mmHg)
Regular Exercise	-10	-6
Adherence to DASH diet	-8	-5
Combined Intervention	-15	-10

Table 3 shows the results of the intervention. It focuses on how exercise and changes in lifestyle changed the management of blood pressure in people with hypertension and CKD. The drop in both systolic and diastolic blood pressure is a sign of how well the treatments are working. Just by working out regularly, the systolic and diastolic blood pressures drop by 10 and 6 mmHg, respectively. When people follow the DASH diet, their systolic blood pressure drops by 8 mm Hg and their diastolic blood pressure drops by 5 mm Hg.

When exercise and the DASH diet are used together, they lower blood pressure by 15 mmHg in the systolic and 10 mmHg in the diastolic measures.

The results show that people with CKD need a complete plan that includes changes to both their exercise and food habits in order to effectively treat high blood pressure.

Discussion

Table 4: Comparison with Existing Studies

Study	Study Type	Sample Size	Findings
Present Study	Retrospective Cohort	100 participants	Significant reductions in systolic and diastolic blood pressure observed with regular exercise and adherence to the DASH diet. - Synergistic effects noted in the combined intervention, indicating greater blood pressure reduction.
Study 1 [13]	Randomized Controlled Trial (RCT)	150 participants	Exercise interventions resulted in modest reductions in blood pressure among CKD patients, with variations based on the type and intensity of exercise. - Improved endothelial function and cardiovascular fitness observed.
Study 2 [14]	Prospective Observational Study	200 participants	Lifestyle modifications, including dietary changes and increased physical activity, correlated with better blood pressure control in CKD individuals. Greater adherence to lifestyle changes associated with more favorable outcomes.
Study 3	Meta-analysis	Synthesized data	Overall positive association between exercise inter-

[15]		from 15 studies	ventions and blood pressure control in CKD patients. Subgroup analyses revealed variations in efficacy based on CKD stage, highlighting the need for personalized interventions.
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The table that compares this study to three others existing studies on the effects of exercise and lifestyle changes on high blood pressure in people with CKD gives us a good view about research. With 100 subjects, our retrospective cohort study found that following the Dietary Approaches to Stop Hypertension (DASH) diet and working out regularly lowered both systolic and diastolic blood pressure by a large amount. The combined strategy worked better than either one alone. A randomised controlled trial (RCT) with 150 people, on the other hand, found that different types of exercise lowered blood pressure to a moderate degree.

The importance of exercise intensity was emphasised. Our results were supported by [14], an observational prospective study with 200 people that also showed a link between changes in lifestyle and better blood pressure control, especially when people stuck to their plans more closely. A meta-analysis [15] that looked at data from fifteen studies also found a positive link between exercise treatments and blood pressure results in people with CKD.

This shows how important it is to have stage-specific, individualised therapies. This group comparison shows how important exercise and changes to a person's lifestyle are for managing high blood pressure in people with CKD. It also shows how consistent and potentially useful our study's results are across different types of studies.

Limitations and Potential Biases: Though the study does offer some useful information, it is important to keep in mind that it has some flaws. The study uses medical records that were already there, which raises worries about recall bias and not having enough data because the study looks back.

The results may not be useful for people with CKD in general because the sample size was so small (100 people), even though it is adequate. On top of that, the data we have doesn't take into account the outside factors, like socioeconomic position and psychosocial issues that affect changes in lifestyle. Because the hindsight design is biased and the results might not have been chosen at random, they should be interpreted with care.

Recommendations for Future Research: Future research is needed to get around these problems and learn more about how exercise and changes in living can help people with chronic kidney disease and high blood pressure. To confirm the benefits that have been said to exist and provide stronger proof, prospective, randomised controlled trials with larger and more diverse populations are

needed. Follow-up studies can help us learn more about the long-term benefits of changing how people behave on their hypertension and how long these effects last. Also, it would be good to look into how cost-effective these therapies are compared to more traditional drug-based treatments, as well as the costs of bringing them into healthcare settings. If we knew more about how exercise and changes in food affect CKD patients' blood pressure, we might be able to make better, more personalised treatments for the disease.

Conclusion

This study shows that people with CKD can control their high blood pressure by working out and making other changes to their lifestyle, such as following the DASH diet. Blood pressure dropped, especially after the joint intervention. This shows that we need a complete plan that includes both exercise and changes to what we eat. It is very important to include lifestyle treatments in the overall care of people with CKD, and these results add to what is already known about the topic.

These positive results need to be confirmed and built upon by bigger prospective cohort studies. However, the study did have some flaws, like a retrospective design and a small sample size. This group of patients with CKD and their long-term cardiovascular results could benefit from making these kinds of changes to their lifestyles.

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