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CROSS-SECTIONAL STUDY OF THE IMPACT OF LIFESTYLE INTERVENTIONS ON CHRONIC KIDNEY DISEASE

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Abstract
Background: Chronic Kidney Disease (CKD) represents a growing public health problem, with lifestyle factors playing a significant role in its progression and management. **Objective:** This study investigates the effectiveness of lifestyle interventions on the clinical and biochemical parameters in patients with CKD. **Methods:** We conducted a cross-sectional study involving 120 patients diagnosed with CKD stages 1-4. The study assessed the impact of implemented lifestyle interventions, including dietary modifications, physical activity, and smoking cessation over a six-month period. **Results:** Preliminary analysis indicates a significant improvement in kidney function markers and quality of life among participants adhering to the prescribed lifestyle changes. **Conclusion:** Lifestyle interventions could be beneficial in managing CKD, potentially slowing disease progression and improving patient outcomes.
Keywords: Chronic Kidney Disease, Lifestyle Intervention, Kidney Function.

Introduction

Chronic Kidney Disease (CKD) is a prevalent condition characterized by a gradual loss of kidney function over time. It is commonly a result of diabetes, hypertension, and other chronic conditions, which damage the kidneys, leading to reduced functionality and various complications. The global prevalence of CKD has been rising, making it a critical focus of medical research and public health initiatives.[1]

Lifestyle factors such as diet, physical activity, and tobacco use significantly impact the progression and management of CKD. Dietary interventions, particularly those reducing sodium and protein intake, have shown promise in managing CKD progression. Similarly, physical activity can improve cardiovascular health and manage weight, further benefiting kidney health. Smoking cessation is crucial as tobacco use exacerbates renal damage.[2]

The influence of lifestyle modifications on CKD outcomes has not been thoroughly quantified, especially in diverse populations. [3]

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Aim

To evaluate the impact of lifestyle interventions on the progression of Chronic Kidney Disease in patients.

Objectives

1. To assess the effect of dietary modifications on kidney function in CKD patients.
2. To evaluate the influence of physical activity on the progression of CKD.
3. To examine the impact of smoking cessation on kidney health in CKD patients.

Material and Methodology

Source of Data: Data were sourced from 120 CKD patients who voluntarily participated in the study.

Study Design: A cross-sectional observational study design was employed.

Study Location: The study was conducted at a tertiary care hospital's nephrology department.

Study Duration: The duration of the study was from January 2023 to December 2023.

Sample Size: A total of 120 patients were included in the study based on calculated sample size estimations to achieve sufficient statistical power.

Inclusion Criteria: Patients aged 18 years and older diagnosed with stages 1-4 CKD, and willing to participate in the lifestyle intervention program were included.

Exclusion Criteria: Patients with stage 5 CKD, those on dialysis, or with a kidney transplant, and those unable to participate in regular physical activity were excluded.

Procedure and Methodology: Participants underwent baseline evaluation of kidney function, followed by enrollment in a program that included dietary advice, physical activity guidelines, and support for smoking cessation. Follow-up assessments were conducted at three and six months.

Sample Processing: Blood samples were collected and processed using standard biochemical methods to measure renal function markers such as serum creatinine and urea.

Statistical Methods: Data were analyzed using SPSS software. Descriptive statistics, paired t-tests, and regression analyses were conducted to assess the impact of lifestyle interventions.

Data Collection: Data collection involved recording dietary habits, physical activity levels, smoking status, and regular biochemical tests to monitor changes in kidney function.

Observation and Results

Table 1: Impact of Lifestyle Interventions on CKD Progression

Variable	Count	Percentage	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Improved kidney function	80	66.7%	2.0	1.34-2.98	0.005
No improvement	40	33.3%	1.0	Reference	-

This table presents data from a study evaluating the effectiveness of lifestyle interventions in 120 patients with Chronic Kidney Disease (CKD). A significant portion of the cohort, 66.7% (80 patients), showed improved kidney function after adopting lifestyle interventions, which was statistically significant with an odds ratio (OR) of 2.0 and a 95% confidence interval (CI) of 1.34-2.98 (P-value = 0.005). In contrast, 33.3% (40 patients) saw no improvement, serving as the reference group.

Table 2: Effect of Dietary Modifications on Kidney Function

Variable	Count	Percentage	Odds Ratio	95% Confidence	P-

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			(OR)	Interval (CI)	value
Improved GFR	65	54.2%	1.4	0.94-2.08	0.09
No improvement	55	45.8%	1.0	Reference	-

The impact of dietary changes on kidney function was studied. Out of 120 patients, 65 (54.2%) experienced improvements in Glomerular Filtration Rate (GFR), with an OR of 1.4 and a 95% CI ranging from 0.94 to 2.08, indicating a trend towards significance (P-value = 0.09). Meanwhile, the remaining 55 patients (45.8%) did not observe any improvement, serving as the baseline comparison.

Table 3: Influence of Physical Activity on CKD Progression

Variable	Count	Percentage	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Increased physical activity	70	58.3%	1.6	1.07-2.38	0.02
No increase	50	41.7%	1.0	Reference	-

The influence of increased physical activity on CKD progression was evaluated among the study participants. Seventy patients (58.3%) increased their physical activity levels and showed a beneficial impact with an OR of 1.6 (95% CI of 1.07-2.38, P-value = 0.02), suggesting significant effectiveness. The other 50 patients (41.7%) did not increase their activity levels and were used for reference comparisons.

Table 4: Impact of Smoking Cessation on Kidney Health

Variable	Count	Percentage	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Quit smoking	30	25%	3.0	1.67-5.36	0.001
Continued smoking	90	75%	1.0	Reference	-

Table highlights the outcomes of smoking cessation among CKD patients. Only 30 patients (25%) successfully quit smoking and demonstrated a markedly improved kidney health profile with an OR of 3.0 and a 95% CI of 1.67-5.36, which was highly significant (P-value = 0.001). The majority, 90 patients (75%), continued smoking and were referenced as the baseline group.

Discussion

Table 1: Impact of Lifestyle Interventions on CKD Progression Our study demonstrated that 66.7% of participants showed improved kidney function following lifestyle interventions, with an Odds Ratio (OR) of 2.0. This finding is statistically significant (P-value = 0.005) and supports the hypothesis that comprehensive lifestyle changes can beneficially impact kidney health in CKD patients. These results echo the findings of Lightfoot CJ *et al.*(2023)[4] & Ardavani A *et al.*(2023),[5] who reported that lifestyle modifications, including diet and exercise, were associated with improved renal outcomes in CKD patients. However, our study provides a more pronounced effect size, possibly due to the tailored interventions based on individual patient needs.

Table 2: Effect of Dietary Modifications on Kidney Function Our findings indicate a positive trend (P-value = 0.09) towards improved Glomerular Filtration Rate (GFR) with dietary modifications, with an OR of 1.4. While not statistically significant, the trend is consistent with the results from Pereira RA *et al.*(2023)[6] & Sheshadri A *et al.*(2023),[7] who observed that reduced protein and salt intake led to better kidney function metrics in a similar

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CKD cohort. The slight discrepancy in significance could be attributed to different dietary protocols or adherence levels among study populations.

Table 3: Influence of Physical Activity on CKD Progression Increased physical activity was associated with a significant improvement in CKD progression (OR = 1.6; P-value = 0.02). This aligns with the research by Letton ME *et al.*(2024)[8] & Greenwood SA *et al.*(2024),[9] which highlighted the role of exercise in reducing the rate of decline in kidney function among patients with mild to moderate CKD. The consistency of these findings underscores the importance of physical activity as a key component of CKD management.

Table 4: Impact of Smoking Cessation on Kidney Health The significant improvement in kidney health following smoking cessation (OR = 3.0; P-value = 0.001) is one of the most compelling findings from our study. This result is supported by Chen TK *et al.*(2023)[10] & Wang J *et al.*(2023),[11] who noted that quitting smoking led to marked improvements in renal function and a decrease in the progression of renal disease. Our study's higher odds ratio may reflect the intensive support and follow-up provided to participants aiming to quit smoking.

Conclusion

This cross-sectional study provided substantial evidence supporting the beneficial impact of lifestyle interventions on patients with Chronic Kidney Disease (CKD). Through the analysis of 120 patients subjected to dietary modifications, increased physical activity, and smoking cessation, the study demonstrated that targeted lifestyle changes could significantly improve kidney function and potentially slow the progression of CKD.

Key findings include a notable improvement in kidney function in two-thirds of the participants following comprehensive lifestyle changes, underscoring the effectiveness of personalized interventions. Additionally, the study highlighted the promising effects of increased physical activity and smoking cessation on renal health. While the improvements attributed to dietary modifications were not statistically significant, they showed a positive trend that warrants further investigation.

These results are critical as they reinforce the role of non-pharmacological interventions in managing CKD, aligning with previous research that emphasizes the importance of lifestyle factors in chronic disease management. Health professionals should consider integrating and promoting lifestyle modification programs as part of standard care for CKD patients to optimize clinical outcomes and enhance quality of life.

In conclusion, this study contributes to the growing body of evidence suggesting that lifestyle interventions are crucial in managing CKD and should be a key component of care strategies. Future research should aim to explore the long-term effects of these interventions and further refine guidelines for their implementation in clinical practice.

Limitations of Study

1. **Cross-Sectional Design:** The cross-sectional nature of this study limits the ability to establish causality between lifestyle interventions and improvements in kidney function. Longitudinal studies are needed to confirm the direction of these relationships and to monitor the long-term effects of lifestyle changes on CKD progression.
2. **Sample Size and Diversity:** Although a sample size of 120 patients provides initial insights, it may not be large enough to generalize findings across the diverse spectrum of CKD patients. Furthermore, the study may not have adequately represented all demographics, particularly concerning age, race, and underlying comorbidities, which can influence the outcomes of lifestyle interventions.

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3. **Self-Reported Data:** The reliance on self-reported measures for dietary intake, physical activity, and smoking cessation may introduce bias and affect the reliability of the data. Objective measures or corroborated data sources would enhance the validity of the study findings.
4. **Lack of Control Group:** The absence of a control group that did not receive any interventions limits the ability to compare and contrast the outcomes directly attributable to the lifestyle modifications versus natural progression of the disease.
5. **Adherence to Interventions:** The study did not thoroughly monitor or report adherence levels to the prescribed lifestyle interventions. Variations in adherence could significantly affect the study outcomes and the interpretation of the efficacy of these interventions.
6. **Confounding Variables:** While adjustments were made for several known confounders, there could be additional unmeasured factors such as socioeconomic status, access to healthcare, and educational background that might influence both the likelihood of engaging in lifestyle changes and the progression of CKD.
7. **Short Duration of Follow-Up:** Given the short duration of the study, it may not capture the delayed effects of lifestyle interventions on kidney function, which could manifest after the study period.

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