Research Article

Effect of a Structured Yoga Intervention on Quality of Life and Biochemical Parameters in Patients on Maintenance Hemodialysis: A Prospective Single-Arm Interventional Study from North India

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Abstract

Background: Patients undergoing maintenance hemodialysis experience substantial physical limitations, biochemical imbalances, and impaired health-related quality of life despite advances in renal replacement therapy. Non-pharmacological interventions such as yoga may offer holistic benefits by improving physiological regulation and psychological well-being. Material and Methods: This prospective interventional study included clinically stable adult patients on maintenance hemodialysis. 60 participants were enrolled after applying predefined inclusion and exclusion criteria. The intervention consisted of a supervised structured yoga program six days per week for 60–90 minutes over six months. The protocol included Sukshma Vyayama, selected asanas, pranayama techniques, and guided meditation. Clinical parameters were monitored during dialysis sessions. Laboratory investigations included serum albumin, hemoglobin, calcium, phosphorus, urea, creatinine and C-reactive protein. Quality of life was assessed at baseline and at six months using the KDQOL-SF-36 questionnaire. Statistical analysis was performed using the Wilcoxon Signed Ranks test for paired comparisons Results: Significant improvements were observed in hemodialysis patients after yoga therapy Mean serum albumin increased from 3.66 ± 0.42 g/dL to 3.97 ± 0.43 g/dL ($p < 0.0001$), hemoglobin from 7.47 ± 1.0 g/dL to 8.53 ± 0.85 g/dL ($p < 0.0001$).. HR-QoL scores showed statistically significant improvement in physical and social functioning, emotional well-being and vitality domains ($p < 0.001$). Conclusions: Yoga therapy is a safe and associated with improved biochemical parameters and quality of life indicators when used as adjunctive therapy for patients on maintenance hemodialysis. Larger randomized controlled trials with longer follow-up are warranted to determine long-term clinical benefits.

Keywords: chronic kidney disease, hemodialysis, holistic care, quality of life, Yoga therapy.

1. Introduction

Chronic kidney disease (CKD) has emerged as a pandemic leading to global public health challenge with an estimated prevalence of 13.24% worldwide.[1] In India there is a significant increase of approximately 2.2 lakh cases of chronic renal disease per year. As a result the need for dialysis increases manifold reaching as high as 34 million dialysis cycles annually. [2]

Despite numerous developments in the field of hemodialysis, the survival of dialysis patients has improved only marginally over the past few decades. Dialysis primarily substitutes the excretory functions of the kidney. Hormonal and other functions namely erythropoietin deficiency associated anemia, vitamin D deficiency and calcium and phosphate imbalance, require pharmacological management. Consequently, patients undergoing long-term dialysis, experience not only reduced five-year survival compared to the general population but also substantial physical limitations, psychological distress, and social challenges that adversely affect their quality of life.[3]

Though kidney transplant is the best treatment option, only few patients can undergo kidney transplant, due to lack of donor availability and financial constraints. Therefore, there is an urgent need to explore adjunctive, comprehensive strategies aimed at improving both survival and overall wellbeing in CKD patients. Yoga therapy represents one such non pharmacological holistic intervention which may influence psychological well-being and physical functioning.

Yoga encourages relaxation, alleviates stress and promotes overall health and emotional wellbeing. Its role in management of various medical disorders has been defined and discussed recently.[4] But its application in patients of hemodialysis is limited and needs further evaluation.

Hence the current study was conducted with the objective to evaluate the role of regular yoga intervention on the overall quality of life and wellbeing in hemodialysis patients.

2. Methods

Study design: Prospective interventional study
Study population: Adult patient aged 18 and above on maintenance hemodialysis
Selection Criteria
Inclusion criteria

1. Adult patients on maintenance hemodialysis.
2. Patients clinically stable for at least 1 month.
3. Patients more than 18 years of age
4. Patients willing to undergo Yoga practice for 6 months

Exclusion criteria

1. Patients with significant physical limitation which would hinder in performing yoga activity
2. Patients with poor cardiac function with cardiac ejection fraction less than 30%,
3. Patients with history of stroke, limb amputation, gross ascites, persistent breathlessness or active infections.

Yoga Intervention
All eligible patients were given introductory orientation session on yoga practices by trained yoga instructor. Patients were demonstrated various yoga postures and breathing exercises. Patients who agreed to follow Yoga therapy for 6 months were enrolled.

Yoga Protocol
Patients who enrolled were adhered to a well-structured yoga program in the morning, six days per week, with each session lasting for 60–90 minutes under the supervision of a trained instructor. The sessions could be attended online or in person at the hemodialysis center. The yoga practices carried out followed a systematic and structured regime of yoga postures [Table 1].

Table 1: ***Yoga Intervention Protocol***

Category	Practice	Repetitions	Duration
1. Yogic Sukshma Vyayama	Neck movements (up–down, left–right, twisting, rotation)	10 each	5 min
	Shoulder rotation	10	2 min
	Arm stretching	10	2 min
	Lungs exercise	5	2 min
	Wrist rotation	10	1 min
2. Yoga Asanas	Dandasana	1	1 min
	Vajrasana	1	1 min
	Sitting Tadasana	1	1 min
	Paschimottanasana	10	2 min
	Mandukasana	3	2 min
	Marjariasana	15	2 min
	Shashankasana	1	1 min
	Bhujangasana	3	3 min
3.Breathing Exercises	Deep breathing	—	5 min
	Chandra Bhedi / Surya Bhedi Pranayama	—	5 min
	Anulom–Vilom	—	5 min

	Bhramari Pranayama	—	3 min
4.Preksha Meditation	Kayotsarga with contemplation and chanting of *Hraing* Beej mantra on kidneys with green-color visualization	—	30 min

This protocol was formulated in consultation with a team of yoga experts from a leading yoga institute in Delhi. Team of 5 yoga instructors who belonged to Adhyatm Sadhna Kendra in Chhatarpur, Delhi was responsible for conducting yoga training sessions. There qualifications included graduation and post graduate diploma or masters in yoga and science of living from various universities in India. Each session comprised of four components: Yogic Sukshma Vyayama (gentle loosening exercises), yoga postures, breathing practices (pranayama), and Preksha meditation. The Sukshma Vyayama segment included ten repetitions each of neck movements (five minutes), shoulder rotation exercises and arm stretches (two minutes each), five repetitions of lung expansion exercises (two minutes), and last of all ten repetitions wrist rotations movements (one minute).

The asanas to be done were Dandasana,Vajrasana, Sitting Tadasana, Paschimottanasana, Mandukasana, Marjariasana, Shashankasana, and Bhujangasana. The pranayama practices included deep breathing, Chandrabhedi/Surya Bheda, Anulom-Vilom, and Bhramari [Figure1].

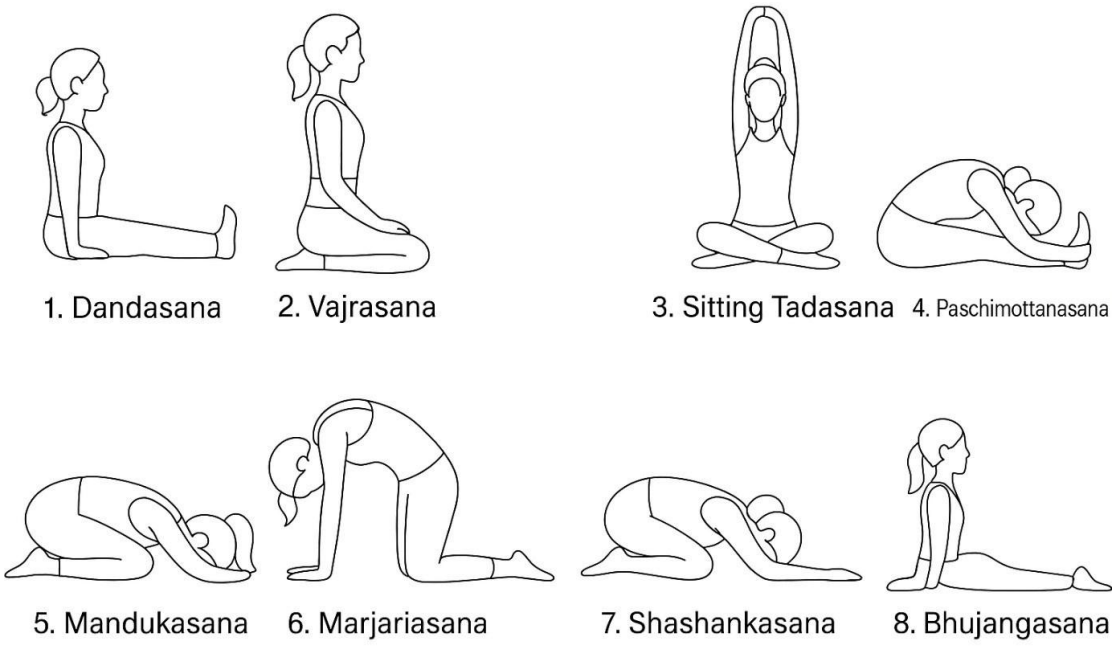

Figure 1. Yoga asanas performed by patients

The session concluded with Preksha meditation involving guided contemplation and chanting. Instructional videos were also provided to reinforce proper technique and ensure adherence and safety. Only patients with at least 70% compliance with yoga protocol were included in final analysis.

Clinical and laboratory parameters

As patients were regularly undergoing hemodialysis sessions, their physical parameters were measured and documented each time. These clinical parameters included pulse rate, blood pressure readings and weight. The blood investigations were also done regularly. The blood measured were serum urea, serum creatinine, serum calcium, serum phosphorus, serum albumin, blood hemoglobin and inflammatory marker C-reactive protein (CRP).

Quality of life outcome assessment

The general wellbeing of the patient was analyzed based on the kidney disease quality of life short form -36(KDQOL-SF 36) health survey, a widely used validated instrument designed to evaluate the quality-of-life outcomes in patients with chronic kidney disease. It comprises of 36 items assessing eight health domain namely physical functioning, role limitation due to physical health, bodily pain, general health perception, vitality, social functioning, role limitation due to emotion problems and emotional wellbeing/mental health. The patients were administered the survey at the time of enrollment and then after 6 months of Yoga therapy.

Sample size calculation:

The sample size of this study was calculated on the basis of variation in overall quality of life (KDQOL-SF 36 score) as the primary outcome. The formula used for comparison of paired mean is given below:

$n = ((Z\alpha/2 + Z\beta)^2 \times \sigma d^2)/d^2$

A 95% confidence level with 80% statistical power were assumed. The predicted improvement in mean score was of 5 points in KDQOL-SF 36 score following yoga intervention, the predicted standard deviation was of 11.5 points, so the sample size obtained was 41.47. It was rounded off to include 42 patients.

Statistical analysis

Categorical variables are presented as frequencies and percentages. Continuous variables are presented as mean ± standard deviation (SD) when normally distributed and as median (25th–75th percentile) otherwise; normality was assessed with the Shapiro–Wilk test, applied to the within-patient differences for paired comparisons. Changes from baseline to six months were tested with the paired t test when the differences were normally distributed and with the Wilcoxon signed-rank test otherwise. The within-patient change is reported as the mean change with its 95% confidence interval (CI) and Cohen's dz (mean change divided by the SD of the change) for the paired t test, and as the Hodges–Lehmann median change with a bootstrap 95% CI (2,000 resamples) and the rank effect size r ($|Z|/\sqrt{n}$) for the Wilcoxon signed-rank test. The eight KDQOL-SF36 domains were tested separately, and Bonferroni-corrected p values (unadjusted p multiplied by 8) are reported alongside the unadjusted values. The change in the number of antihypertensive drugs among patients on treatment at baseline was tested with the Wilcoxon signed-rank test, and the change in insulin use among diabetic patients with the exact McNemar test. Spearman's rank correlation related the six-month change in each laboratory value to the change in each KDQOL-SF36 domain; because 56 domain-level pairs were tested, Holm-adjusted p values are reported. Multivariable linear regression modelled the change in each domain on age, diabetes status, dialysis vintage and the baseline domain score, with heteroscedasticity-consistent (HC3) standard errors; multicollinearity was assessed with variance inflation factors, all of which were below 2. Two-sided $p < 0.05$ was taken as statistically significant. Analyses were performed in Python 3.14.6 with SciPy 1.18.1 and statsmodels 0.14.6

Ethical consideration and consent:

Ethical clearance was obtained from the PSRI Ethics committee vide reference no. PSRI/EC/2021/22 dated 8 December 2021 prior to commencement of the research. Informed consent taken from all participants. Participant information was handled confidentially, data was stored in research cell and was accessible only to research team, identifying information was not included in the analytical dataset or manuscript.

3.Results

One hundred and five CKD patients on hemodialysis were screened for inclusion in the study. Out of these, 45 patients had physical limitations and were considered unfit to participate. Out the remaining 60 patients 14 patients were non-compliant to yoga protocol and were excluded from the study [Figure 2].

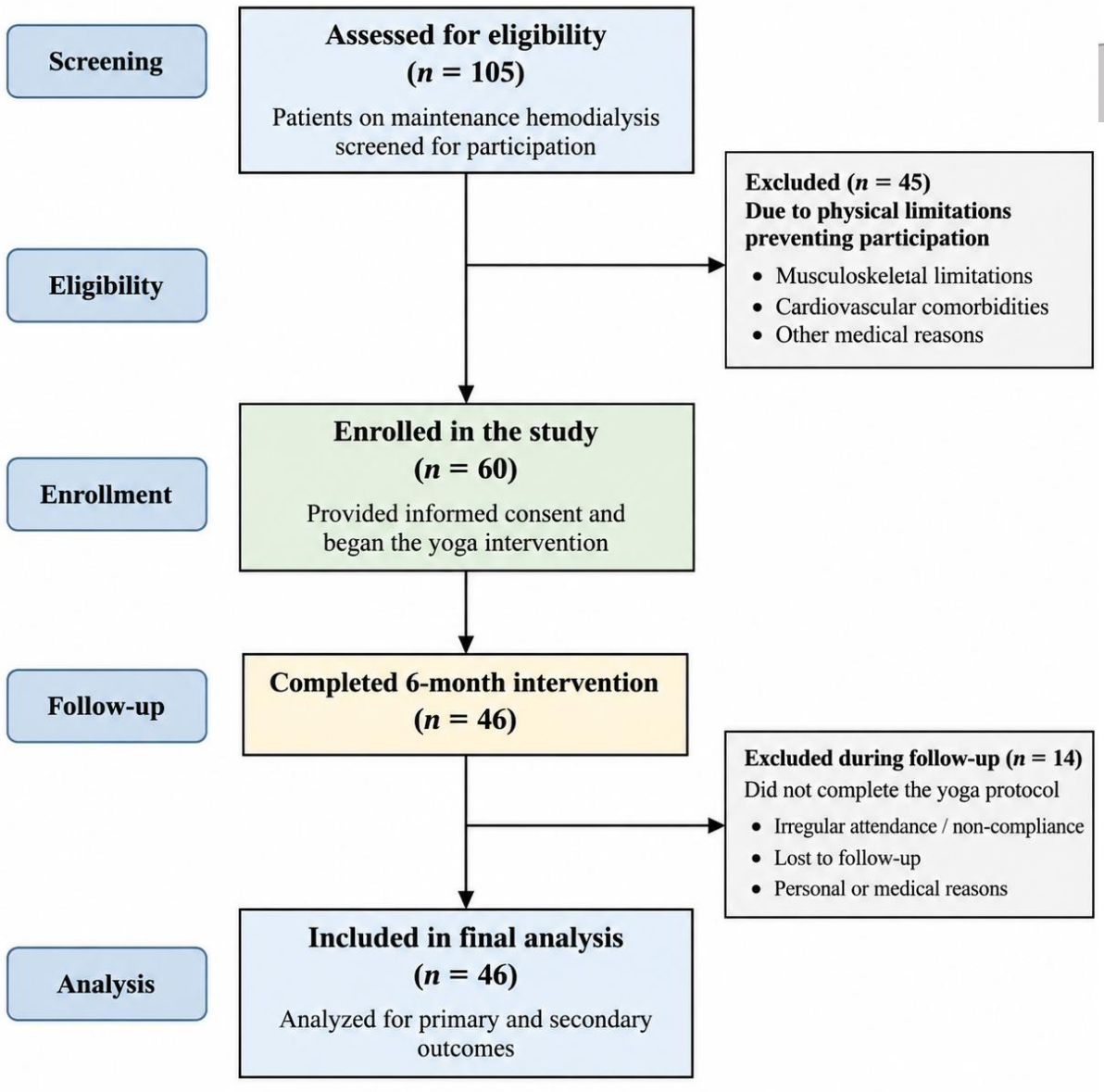

Figure 2. Participant Flow Diagram

The study population comprised of 46 patients, mean age in years was 38.83 ± 13.8, with a range of 18 to 68 years. The 46 participants included comprised of 36 (78.26%) were male and 10 (21.74%) were female patients. Diabetes mellitus was present in 10 (21.74%) participants, while hypertension was observed in 32 (69.57%) participants.

Blood pressure medication use in hypertensive patients was compared before yoga therapy and after 6 months of regular yoga practice. Among 32 patients on antihypertensives at baseline the number of drugs decreased in 13, was unchanged in 18 and increased in 1, mean 1.50 to 1.03 drugs per patient, Wilcoxon signed-rank p = 0.002. There was a steady decline in blood pressure readings leading to decrease in antihypertensive medicines. Patients reported less variation in day to day BP and lesser need of extra medicine or emergency visits for uncontrolled BP.

Diabetes medication use in diabetic patients was comparable before yoga and after 6 months of yoga and was statistically insignificant (p value = 0.368).

Significant improvements were observed in laboratory parameters after 6 months of yoga compared to baseline. Albumin increased from 3.66 ± 0.42 g/dL to 3.97 ± 0.43 g/dL ($p < 0.0001$), hemoglobin from 7.47 ± 1 g/dL to 8.53 ± 0.85 g/dL ($p < 0.0001$), and calcium from 8.15 ± 0.66 mg/dL to 8.46 ± 0.4 mg/dL ($p = 0.003$). Median (25th–75th percentile) phosphorus decreased significantly from 5.9 (5.05–7.0) mg/dL to 4.9 (4.6–5.4) mg/dL ($p < 0.0001$). After 6 months of yoga therapy, haemoglobin, albumin, and calcium increased significantly, while phosphorus and CRP decreased significantly (all $p<0.05$). Urea and creatinine showed no significant change ($p=0.388$ and $p=0.302$, respectively) [Table 2].

TABLE 2: Laboratory parameters before and after 6 months of yoga therapy

Parameter	Before yoga (n = 46)	After6 months (n = 46)	Within-patient change (95% CI)	Effect size	p value
Haemoglobin (g/dL)	7.47 ± 1.00	8.53 ± 0.85	1.07 (0.74 to 1.39)	0.97	<0.001[a]
Albumin (g/dL)	3.66 ± 0.42	3.97 ± 0.43	0.31 (0.20 to 0.41)	0.86	<0.001[a]
Phosphorus (mg/dL)	5.90 (5.05–7.00)	4.90 (4.60–5.40)	-1.15 (-1.50 to -0.71)	0.74	<0.001[b]
Calcium (mg/dL)	8.15 ± 0.66	8.46 ± 0.40	0.31 (0.11 to 0.52)	0.46	0.003[a]
Urea (mg/dL)	98.66 ± 24.39	93.71 ± 29.31	-4.96 (-16.40 to 6.49)	-0.13	0.388[a]
Creatinine (mg/dL)	6.20 (4.28–7.83)	5.50 (4.65–7.95)	-0.45 (-1.15 to 0.45)	0.15	0.302[b]
CRP (mg/L)	10.50 ± 5.41	7.19 ± 1.95	-3.31 (-5.01 to -1.62)	-0.58	<0.001[a]

Values are mean ± SD with Cohen's dz (mean change / SD of change) where the paired differences were normally distributed, and median (25th–75th percentile) with the Hodges-Lehmann median change and the rank effect size r ($|Z|/\sqrt{n}$) otherwise. CI = confidence interval (t based for the mean change; bootstrap, 2000 resamples, for the Hodges-Lehmann change). CRP = C-reactive protein. [a]Paired t test. [b]Wilcoxon signed-rank test.

Significant improvement was observed in KDQOL-36 scores after 6 months of yoga compared to baseline. Median (25th–75th percentile) physical functioning increased from 32 (20–50) to 70 (50–80), the improvement in role limitations because of impaired physical wellbeing was seen from 40 (25–50) to 72 (50–80).

There was a marked improvement in role restriction secondary to emotional distress from 30 (15–43.8) to 70 (50–80) (all $p < 0.0001$). Similarly, energy improved from 32 (20–50) to 70 (50–80), emotional well-being from 35 (25–50) to 72 (51.2–80), social functioning from 36 (25–50) to 70 (56.2–80), pain from 57 (40–70) to 80 (61.2–90), and general health from 38 (30–50) to 80 (53.8–90) (all $p < 0.0001$). After 6 months of yoga therapy, all KDQOL-SF36 domains improved significantly, including physical, emotional and social functioning, energy/fatigue, pain, and general health (all adjusted $p<0.001$), with large effect sizes across all domains [Table 3].

Table 3. KDQOL-SF36 domain scores (0–100) before and after 6 months of yoga therapy (n = 46)

Domain	Before yoga	After 6 months	Within-patient change (95% CI)	Cohen's dz	r	p	Bonferroni p	Holm p
Physical functioning	32 (20–50)	70 (50–80)	32.5 (22.5 to 37.5)	1.22	0.80	<0.001	<0.001	<0.001
Role limitation: physical health	40 (25–50)	72 (50–80)	30.0 (20.0 to 37.5)	0.96	0.74	<0.001	<0.001	<0.001
Role limitation: emotional problems	30 (15–44)	70 (50–80)	32.5 (20.0 to 42.5)	0.87	0.69	<0.001	<0.001	<0.001
Energy / fatigue	32 (20–50)	70 (50–80)	32.5 (25.0 to 40.0)	1.66	0.85	<0.001	<0.001	<0.001
Emotional well-being	35 (25–50)	72 (51–80)	30.0 (22.5 to 37.5)	1.33	0.80	<0.001	<0.001	<0.001
Social functioning	36 (25–50)	70 (56–80)	30.0 (22.5 to 35.0)	1.25	0.81	<0.001	<0.001	<0.001
Pain	58 (40–70)	80 (61–90)	22.5 (17.5 to 27.5)	1.38	0.84	<0.001	<0.001	<0.001
General health	38 (30–50)	80 (54–90)	32.5 (25.0 to 40.0)	1.42	0.82	<0.001	<0.001	<0.001

Scores are median (25th–75th percentile). Within-patient change is the Hodges-Lehmann median of paired changes with a bootstrap 95% CI. Cohen's dz = mean change / SD of change. r = |Z|/√n from the Wilcoxon signed-rank test (0.1 small, 0.3 medium, 0.5 large). Bonferroni and Holm p values correct for the eight domains tested. All p values are from the Wilcoxon signed-rank test.

Regression of quality-of-life change on age, diabetes, dialysis vintage and baseline score was done. Lower baseline KDQOL-SF36 scores independently predicted greater improvement in all domains except general health (p=0.073), and also predicted greater improvement in the overall mean score (p<0.05). Older age was associated with less improvement in social functioning (p=0.046), while diabetes and dialysis vintage were not significant predictors [Table 4].

Table 4. Multivariable linear regression: adjusted change in each KDQOL-SF36 domain (coefficient, 95% CI)

Change in domain score	Age, per 10 years	Diabetes, yes vs no	Dialysis vintage, per 12 months	Baseline score, per 10 points	R^2
Physical functioning	-3.8 (-9.2 to +1.6); p = 0.169	+0.8 (-19.4 to +21.0); p = 0.936	-0.4 (-11.2 to +10.4); p = 0.944	-7.9 (-11.4 to -4.5); p = <0.001	0.42
Role limitation: physical health	-1.5 (-9.7 to +6.8); p = 0.724	+8.8 (-11.1 to +28.7); p = 0.385	+4.4 (-11.5 to +20.3); p = 0.587	-8.2 (-12.1 to -4.2); p = <0.001	0.43
Role limitation: emotional problems	-4.9 (-14.4 to +4.5); p = 0.305	+8.0 (-14.2 to +30.2); p = 0.480	+3.2 (-12.6 to +19.0); p = 0.690	-10.6 (-14.4 to -6.9); p = <0.001	0.56
Energy / fatigue	-2.8 (-9.3 to +3.7); p = 0.390	+2.4 (-16.0 to +20.8); p = 0.800	+5.9 (-4.1 to +15.8); p = 0.251	-5.1 (-7.7 to -2.5); p = <0.001	0.26
Emotional well-being	-4.6 (-12.0 to +2.9); p = 0.229	-0.2 (-21.8 to +21.3); p = 0.983	+4.7 (-6.8 to +16.2); p = 0.420	-7.3 (-10.4 to -4.2); p = <0.001	0.25
Social functioning	-6.8 (-13.6 to -0.1); p = 0.046	+4.2 (-16.3 to +24.7); p = 0.688	+1.0 (-11.2 to +13.1); p = 0.874	-7.0 (-11.1 to -2.9); p = <0.001	0.28
Pain	-2.6 (-6.9 to +1.6); p = 0.227	+3.7 (-8.2 to +15.7); p = 0.541	-1.0 (-9.7 to +7.6); p = 0.814	-3.5 (-5.6 to -1.3); p = 0.002	0.22
General health	-2.0 (-10.4 to +6.5); p = 0.647	+1.0 (-23.3 to +25.2); p = 0.937	+1.9 (-9.8 to +13.6); p = 0.753	-4.6 (-9.6 to +0.4); p = 0.073	0.08
KDQOL mean of 8 domains	-3.5 (-10.2 to +3.2); p = 0.311	+4.2 (-13.8 to +22.2); p = 0.650	+2.3 (-8.8 to +13.5); p = 0.682	-6.3 (-12.1 to -0.5); p = 0.033	0.15

Coefficients are points of change on the 0–100 scale. Robust (HC3) standard errors. Gender and hypertension were not included because the reviewer did not ask for them and the sample supports only four predictors.
Correlation between biochemical change and quality-of-life change was done. Several weak-to-moderate correlations were significant at the unadjusted level, particularly for haemoglobin, albumin, phosphorus, and calcium changes with KDQOL-SF36 improvement. However, none of the 56 domain-level correlations remained significant after Holm correction, indicating that these findings should be considered exploratory [Table 5].

Table 5. Spearman correlation (p value) between change in laboratory values and change in KDQOL-SF36 domains

Change in	PF	RP	RE	VT	EW	SF	BP	GH	Mean of 8
Haemoglobin	+0.18 (0.230)	+0.22 (0.139)	+0.30 (0.041)	+0.20 (0.187)	+0.25 (0.096)	+0.40 (0.007)	+0.21 (0.169)	+0.26 (0.080)	+0.30 (0.043)
Albumin	+0.25 (0.092)	+0.35 (0.016)	+0.27 (0.072)	+0.26 (0.080)	+0.29 (0.048)	+0.31 (0.033)	+0.24 (0.109)	+0.23 (0.119)	+0.33 (0.024)
Phosphorus	-0.17 (0.263)	-0.19 (0.207)	-0.13 (0.404)	-0.36 (0.013)	-0.33 (0.025)	-0.33 (0.027)	-0.05 (0.765)	-0.27 (0.075)	-0.28 (0.059)
Calcium	+0.35 (0.016)	+0.20 (0.191)	+0.28 (0.060)	+0.33 (0.024)	+0.35 (0.017)	+0.35 (0.017)	+0.32 (0.030)	+0.17 (0.271)	+0.34 (0.022)
Urea	-0.07 (0.631)	-0.15 (0.334)	+0.10 (0.521)	-0.04 (0.769)	-0.09 (0.532)	+0.05 (0.731)	-0.06 (0.685)	-0.10 (0.512)	-0.03 (0.863)
Creatinine	+0.16 (0.295)	-0.22 (0.150)	-0.03 (0.859)	+0.13 (0.397)	+0.21 (0.166)	+0.25 (0.092)	+0.19 (0.198)	+0.18 (0.225)	+0.10 (0.488)
CRP	+0.08 (0.616)	-0.05 (0.755)	+0.03 (0.850)	+0.15 (0.316)	+0.05 (0.744)	+0.21 (0.154)	-0.05 (0.723)	-0.05 (0.743)	+0.05 (0.757)

PF physical functioning; RP role limitation due to physical health; RE role limitation due to emotional problems; VT energy / fatigue; EW emotional well-being; SF social functioning; BP pain; GH general health; Mean of 8 = average of the eight domain scores. Unadjusted p values; 56 domain-level pairs were tested and none is significant after Holm correction.

Self-reporting of clinical symptoms was done by patients during yoga sessions. No yoga-related serious adverse events were reported during the intervention period.

4. Discussion

Patients receiving maintenance hemodialysis for CKD who have exhausted all modalities of treatment including medicines, blood transfusions, organ support and regular doctor visits, still suffer from ill health in form of general weakness, decreased energy levels, fatigue and emotional stress. This underscores the need for adjunctive strategies aimed at improving the overall well-being of the patients beyond conventional dialysis care. Yoga as a non-pharmacological intervention may have an important role in these patients. In the present study though 105 patients were screened, only 60 were considered fit enough to undergo the yoga protocol. This highlights the fact that these patients have significant comorbidities and functional disabilities.

This finding reflects the substantial disease burden in the dialysis population and signifies the importance of designing feasible, low-intensity interventions tailored to this group. Our protocol emphasized gentle postures and controlled breathing techniques to ensure safety and adherence among patients with significant medical complexity.

Yoga therapy is primarily manifested as meditation and breathing practices. They have remarkable impact on cognitive functions, psychological well-being and physiological processes.[5] Structured postural training coordinates breathing and movement in structured sequences. Different yoga activities vary in focus. Some emphasize vigorous activity, others promote stability while some breathing exercises (pranayamas) are performed slowly. Previous researches depicted lot of heterogeneity in the delivered yoga protocol and the outcome parameters studied. [6]

Also the yoga practices followed should be more descriptive rather than using a broad term like “meditation” or “yoga”. To overcome this, we defined a set protocol of yoga to be followed in hemodialysis patients.

Significant improvements were observed in selected laboratory parameters after 6 months of structured yoga practices compared to baseline in our study. Albumin increased from 3.66 ± 0.42 g/dL to 3.97 ± 0.43 g/dL ($p < 0.0001$), hemoglobin from 7.47 ± 1 g/dL to 8.53 ± 0.85 g/dL ($p < 0.0001$), and calcium from 8.15 ± 0.66 mg/dL to 8.46 ± 0.4 mg/dL (p value = 0.003). Observed changes in biochemical parameters should be interpreted cautiously as the study did not have a control group.

The study investigator team did not interfere with day-to-day medical management of the patients which was taken care by the dialysis center team. The dialysis prescription (blood flow, filter type and frequency of dialysis) was not

changed during the study period. Dialysis patients can also present with mental health concerns like anxiety and depression, emotional dysregulation and mood swings. Few published literature documented the positive effect of yoga therapy in chronic diseases like lupus nephritis, neurological impairments and malignancy.[7]

Our findings further support the significant impact of yoga on QOL in hemodialysis patients. KDQOL-SF-36 questionnaire scoring used to assess QOL depicted that there is marked enhancement in physical and emotional health which is statistically significant. ($p < 0.001$) and ($p < 0.001$) respectively. Social functioning and vitality parameters also showed positive impact (p value <0.001) after 6 months of yoga therapy. These findings align with previous study.[3]

Several mechanisms have been proposed through which yoga-based practices may influence psychological and physiological well-being, including changes in stress perception, breathing patterns, physical activity, and autonomic regulation..[8] Yoga practices may be linked to improvement in regulation of thoughts and emotions, cognitive performance, stress , behavior and neuropsychiatric diseases by strengthening the parasympathetic activity.[9-11]

Yoga therapy reduces sympathetic tone and improves parasympathetic tone which reduce pulse rate, systolic BP as well as diastole BP.[12] However, these mechanisms were not evaluated in the present study and should not be interpreted as explanations for the observed changes. Future mechanistic studies incorporating appropriate physiological and psychological measurements are required. A conceptual/mechanistic framework kinking yoga to clinical outcomes is shown in Figure 3.

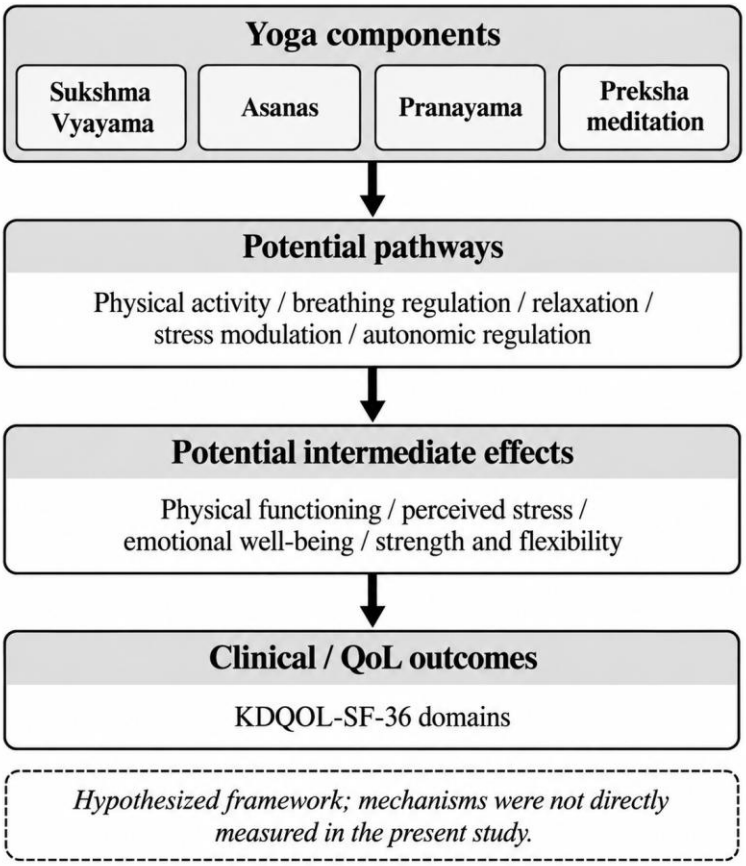

Figure 3. Conceptual/mechanistic framework linking yoga to clinical outcomes

The results of our study are in accordance with the earlier research demonstrating that yoga contributes significantly to stabilizing systolic & diastolic blood pressure with a reduction in number of antihypertensives drugs used by patients.

Long-term yoga practice leads to reduced negative emotions, stress, anxiety and depression as well as increased calmness. [13] After yoga therapy, the physiological measures have shown a great reduction in heart rate and respiratory rates, better aerobic fitness, reduced inflammation markers, and increased morning cortisol levels.[14]

Our findings highlight improvement in CRP values suggesting improvement in systemic inflammatory state. Given the expanding burden of CKD globally, and the profound effect of hemodialysis on multiple dimensions of patients' QOL, the incorporation of non-pharmacological modalities—including structured yoga interventions emerges as a promising strategy to support comprehensive patient care. Through an evidence-based analysis of yoga's efficacy in enhancing the physical, emotional, and psychological well-being of hemodialysis patients, the present study underscores the importance of adopting a holistic and patient-centered approach to managing chronic kidney disease and its associated complications and support the role of yoga as a complimentary intervention to enhance the overall health related quality of life in CKD patients undergoing maintenance hemodialysis.

Limitations

The study had a short follow-up for 6 months so its extrapolation to long term improvement remains to be established. Increased sample sizes and prolonged follow up periods are required to assess the effectiveness of yoga therapy as an adjunctive treatment option in dialysis patients. Our study was non-randomized and did not have a control group.

5. Conclusion

Yoga has the potential to cultivate a sense of purpose, reduce stress, and improve negative thought patterns, which may collectively contribute to better long-term outcomes. Structured yoga practices may support improved treatment tolerance, enhance functional capacity, and promote overall resilience among patients undergoing dialysis. Six months yoga program is associated with improvement in the QOL and can play a vital role as an adjuvant therapy to conventional hemodialysis treatment. Continued research in this area may pave the way for integrating yoga as a supportive and accessible adjunct in renal care

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6. References

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