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Original Research Article

IMPACT OF SUPERVISED YOGA-BASED EXERCISE TRAINING PROGRAMME ON SELF-REPORTED SYMPTOM BURDEN, PHYSICAL FUNCTION AND HEALTH-RELATED QUALITY OF LIFE IN PATIENTS WITH CHRONIC KIDNEY DISEASE ON MAINTENANCE HAEMODIALYSIS - A PROSPECTIVE HOSPITAL-BASED NON-RANDOMISED COMPARATIVE STUDY

Sona S[1], Gomathy S.[2], Devi S. Sruthi[3], Deepa K.P.[4]

[1]Assistant Professor, Department of Nephrology, Government T.D. Medical College, Alappuzha.
[2]Professor and Head, Department of Nephrology, Government T.D. Medical College, Alappuzha
[3]Associate Professor, Department of Nephrology, Government T.D. Medical College, Alappuzha.
[4]Senior Resident, Department of Nephrology, Government T.D. Medical College, Alappuzha.

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Corresponding Author:
Dr. Devi S. Sruthi
Email: devisru@gmail.com

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ABSTRACT

Background: Patients with end-stage renal disease (ESRD) on maintenance dialysis experience a multitude of symptoms and substantial impairments in quality of life. Yoga, an ancient Indian practice combining mindfulness, breathing, and physical movements, has been proposed as a safe and culturally acceptable rehabilitation programme. This study was undertaken to evaluate whether yoga could be utilised as an intervention to reduce symptom burden and improve quality of life in dialysis patients. **Aim:** The objective was to assess the effect of a six-month supervised yoga-based exercise programme on self-reported symptom burden, health-related quality of life, physical function, and selected biochemical and clinical parameters in adults receiving maintenance haemodialysis. **Materials and Methods:** This hospital-based prospective non-randomised comparative study was conducted in a tertiary care centre in South India. Sixty patients undergoing thrice-weekly maintenance haemodialysis were enrolled, with thirty patients choosing to participate in yoga and thirty serving as controls. Symptom burden was assessed using the Leicester Uremic Symptom Scale (LUSS), while health-related quality of life and physical function were measured using the SF-36 score. Clinical and laboratory parameters, including haemoglobin and albumin, were also evaluated. Assessments were performed at baseline, three months, and six months. Independent-samples t-tests were used for between-group comparisons, while paired t-tests were used to assess within-group changes from baseline. A p value <0.05 was considered statistically significant. **Results:** The mean age of patients in the yoga group was 58.83 ± 7.67 years, while in the non-yoga group it was 63.8 ± 6.42 years. At baseline, the mean number of symptoms was 9.97 ± 0.89 in the yoga group and 10.2 ± 0.88 in the control group, with no significant difference. Following yoga-based exercise, the mean number of symptoms in the yoga group was 9.70 ± 1.11 at three months (p=0.013) and 8.73 ± 1.63 at six months (p<0.001). Yoga was also associated with reductions in the total symptom frequency and intrusiveness scores. Improvements were noted in specific symptoms such as shortness of breath, loss of muscle strength, pain in bones and joints, restless legs, sleep disturbance, excessive tiredness, poor concentration, and muscle spasms. Quality of life, assessed using the SF-36, showed significant gains in physical function, role limitations due to physical problems, vitality, mental health, general health, social functioning, and role limitations due to emotional problems in the yoga group compared with controls. Biochemical analysis revealed significant improvements in haemoglobin and albumin levels, while no changes were observed in blood pressure or blood sugar. **Conclusion:** Six months of yoga-based exercise was associated with reduced symptom burden, symptom frequency and intrusiveness, and improvements in several physical and mental domains of health-related quality of life. Improvements in haemoglobin and albumin were also observed. Yoga-based exercise may therefore be considered a feasible adjunctive rehabilitation strategy for patients receiving maintenance haemodialysis.

INTRODUCTION

Patients with end-stage renal disease (ESRD) on maintenance haemodialysis experience multiple physical and emotional symptoms, high rates of depression, and impaired quality of life (QOL).[1-11] Fatigue, pain, cramps, sleep disturbance, and sexual dysfunction affect over half of dialysis patients.[12-14] Chronic kidney disease (CKD) is also associated with muscle wasting, reduced strength, impaired physical function, and diminished cardiorespiratory fitness, contributing to cardiovascular risk and increased morbidity and mortality.[15-17]

Although international guidelines recommend exercise for CKD, they provide little detail on type, duration, or intensity, and randomised trial evidence remains limited.[18,19] Resistance training improves muscle size and metabolism, while aerobic exercise enhances cardiovascular capacity and protection. However, most studies linking exercise to improved health-related quality of life (HRQoL) have focused on Western populations, where socioeconomic and ethnic differences may influence HRQoL outcomes.[20] Prior interventions in dialysis patients largely used aerobic or resistance modalities such as treadmill or cycle ergometer.

Yoga, integrating mindfulness, breathing, and physical movements, has shown benefits including improved sleep, reduced fatigue, enhanced energy, muscle tone, circulation, and relief from pain and stiffness, along with reductions in blood pressure, glucose, cholesterol, and body weight.[21] Kashinath et al. described its potential role in CKD.[22] Given that diabetes and hypertension, major causes of CKD, are positively influenced by yoga, it is reasonable to explore yoga as a rehabilitation strategy in dialysis patients.

Aim

To evaluate the effect of a six-month supervised yoga-based exercise programme on self-reported symptom burden, HRQoL, physical function, and selected biochemical and clinical parameters in adults receiving maintenance haemodialysis.

MATERIALS AND METHODS

This hospital-based prospective non-randomised comparative study was conducted at Government T.D. Medical College, Alappuzha, South India, over a one-year period (March 2021–March 2022). Adults with end-stage renal disease (ESRD) receiving maintenance haemodialysis for at least one month were eligible. Ethical approval was obtained from the Institutional Ethics Committee (IEC approval number: EC:72/2020), and written informed consent was secured from all participants.

Sample Size and Participants

All adult CKD patients on thrice-weekly haemodialysis for at least one month at the study centre (inclusion criteria) during March 2021–March 2022 were screened. Seventy patients were assessed; ten were excluded due to recent myocardial infarction, unstable neurological/orthopaedic conditions, peripheral arterial disease, or inability to consent. The final sample included sixty participants. Thirty undertook yoga-based exercise for six months, while thirty served as controls. Group allocation was based on patient preference, and both groups received routine care and medical advice.

Yoga exercises were taught by a certified yoga therapist. The protocol comprised three techniques, physical postures (asanas), breathing practices (pranayama), and meditation/visualisation (dhyana), in sessions of 15–20 minutes.[23] Sets of asanas were selected according to patient flexibility and feasibility, including Ardha Chakrasana, Hasta Padasana, Tadasana, Nitambasana, Ardha Matsyendrasana, and Shavasana. Pranayama was practiced for 10–15 minutes, followed by meditation. Patients attended supervised sessions thrice weekly for three months, then continued home practice for another three months, reporting weekly to the principal investigator. Bystanders maintained diaries to ensure adherence, and yoga was withheld during acute illness.

Safety was assessed by heart rate and oxygen saturation before and after each session, while feasibility was evaluated through interviews on difficulty and enjoyment. Socio-demographic and clinical variables (age, sex, BMI, dialysis vintage, comorbidities, smoking/alcohol use, blood pressure) were collected using a structured proforma, and biochemical parameters (albumin, haemoglobin) were measured.

Symptom burden, physical activity, and health-related quality of life were assessed at baseline, three months, and six months. Symptom burden was measured using the Leicester Uremic Symptom Scale (LUSS),[24] which evaluates number, frequency (0–4), and intrusiveness (0–4) of 11 symptoms, generating summative scores: LUSS-1 (number, 0–11), LUSS-2 (frequency, 0–44), and LUSS-3 (intrusiveness, 0–44). Quality of life was assessed using the SF-36, which measures eight domains—physical functioning, role limitation due to physical problems, pain, general health, vitality, social function, mental health, and role limitation due to emotional problems—with scores transformed from 0 to 100, higher scores indicating better health.

The primary outcome was change in total symptom burden from baseline to six months. Secondary outcomes included individual LUSS domains, SF-36 scores, physical activity, haemoglobin, albumin, blood pressure, random blood sugar, serum creatinine, sodium, and potassium.

Data were analysed using SPSS v22. Quantitative variables were summarised as mean ± SD, and categorical variables as frequency and percentage. Independent-samples t-tests were used to compare means between groups, paired t-tests were used to compare baseline with follow-up values within groups, and Pearson chi-square or Fisher's exact tests

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were used to compare categorical variables. Statistical significance was set at $p<0.05$.

RESULTS

Baseline demographic characteristics are shown in Table 1. No significant differences were observed between groups in age, sex, dialysis duration, or comorbidities, though BMI was higher in the yoga group. Mean dialysis vintage was 6.27±2.98 years in the yoga group and 6.8±1.9 years in controls. Clinical and biochemical parameters were comparable at baseline (Table 2).

At study entry, the mean symptom number was 9.97±0.89 in the yoga group and 10.2±0.88 in controls, with no significant difference. At 3 months, the mean symptom number was 9.70±1.11 in the yoga group (between-group $p=0.013$), and at 6 months it was 8.73±1.63 (between-group $p<0.001$). Excessive tiredness and impotence were the most frequent baseline symptoms (100%) (Table 3).

No group differences in individual symptoms were noted at baseline or 3 months. After 6 months, significant improvements were seen in shortness of breath, muscle strength, pain in bones/joints, and restless legs in the yoga group (Table 3). Symptom frequency was highest for impotence/lack of sex drive (Table 4). Significant reductions in frequency of sleep disturbance, tiredness, pain, poor concentration, muscle weakness, spasms, shortness of breath, and restless legs were observed in the yoga group at 3 and 6 months (Tables 4–5). Total frequency score declined from 23.03±4.05 at baseline to significantly lower values at 6 months (Table 5).

Intrusiveness scores were also highest for impotence at baseline. Yoga led to significant reductions in intrusiveness of sleep disturbance, tiredness, pain, poor concentration, muscle weakness, spasms, shortness of breath, and restless legs at 3 and 6 months (Table 6). Total intrusiveness score decreased from 23.03±4.05 at baseline to significantly lower values after yoga (Table 7).

Health-related quality of life (SF-36) showed no baseline differences. After yoga, significant improvements were noted in physical function, role limitations by physical problems, vitality, mental health, general health, social functioning, and role limitations by emotional problems compared to controls (Tables 8–9).

Biochemical analysis revealed significant increases in haemoglobin and albumin in the yoga group at 6 months, with no effect on blood pressure (Table 2).

Table 1: Characteristics of Study Subjects

Variable	Doing Yoga Exercise (N=30)	Not Doing Yoga (N=30)	P value
Age (years)			
Mean ± SD	58.83 ± 7.67	63.80 ± 6.42	0.059
Age Distribution - no (%)			
30–40 years	1 (3.3%)	0 (0%)	
41–50 years	2 (6.7%)	1 (3.3%)	
51–60 years	13 (43.3%)	10 (33.3%)	0.552
61–70 years	13 (43.3%)	16 (53.3%)	
71–80 years	1 (3.3%)	3 (10.0%)	
Sex - no (%)			
Male	16 (53.3%)	19 (63.3%)	0.432
Female	14 (46.7%)	11 (36.7%)	
BMI (kg/m²)			
Mean ± SD	21.58 ± 1.09	20.56 ± 0.81	<0.001*
Duration of HD (years)			
Mean ± SD	6.27 ± 2.98	6.80 ± 1.90	0.412
CKD Etiology - no (%)			
Diabetic nephropathy	15 (50.0%)	13 (43.3%)	
Ischemic nephropathy	10 (33.3%)	9 (30.0%)	
Chronic glomerulonephritis	4 (13.3%)	4 (13.3%)	0.268
Reflux nephropathy	1 (3.3%)	0 (0%)	
Obstructive nephropathy	0 (0%)	4 (13.3%)	
Smoker - no (%)			
Yes	12 (40.0%)	12 (40.0%)	1.000
No	18 (60.0%)	18 (60.0%)	
Alcoholic - no (%)			
Yes	8 (26.7%)	10 (33.3%)	0.573
No	22 (73.3%)	20 (66.7%)	
Diabetes Mellitus - no (%)			
Yes	15 (50.0%)	13 (43.3%)	0.605
No	15 (50.0%)	17 (56.7%)	
Hypertension - no (%)			
Yes	30 (100.0%)	30 (100.0%)	1.000
No	0 (0%)	0 (0%)	
Coronary Artery Disease (CAD) - no (%)			
Yes	15 (50.0%)	16 (53.3%)	0.796
No	15 (50.0%)	14 (46.7%)	

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Dyslipidemia - no (%)			
Yes	22 (73.3%)	18 (60.0%)	0.273
No	8 (26.7%)	12 (40.0%)	

Table 2: Blood Pressure and Biochemical Parameters at Baseline, 3 Months and 6 Months

Variable	Yoga Baseline	Non-Yoga Baseline	P	Yoga 3 mo	Non-Yoga 3 mo	P	Yoga 6 mo	Non-Yoga 6 mo	P
systolic BP (mm Hg)	149.67 ± 12.53	148.63 ± 10.78	0.733	146.07 ± 9.81	148.63 ± 10.78	0.339	144.40 ± 8.36	148.93 ± 9.89	0.060
diastolic BP (mm Hg)	89.87 ± 7.51	89.47 ± 6.87	0.827	88.67 ± 5.71	89.47 ± 6.60	0.618	88.67 ± 5.07	91.40 ± 6.08	0.064
Random blood sugar (mg/dL)	162.23 ± 18.36	159.57 ± 16.87	0.560	159.57 ± 16.57	159.67 ± 17.17	0.982	157.83 ± 17.08	160.27 ± 18.21	0.596
Serum creatinine (mg/dL)	9.74 ± 1.59	9.68 ± 1.10	0.873	9.33 ± 1.49	9.81 ± 1.11	0.158	9.10 ± 1.46	10.21 ± 1.30	0.066
Haemoglobin (g/dL)	9.22 ± 1.22	8.87 ± 0.96	0.225	9.28 ± 0.96	8.85 ± 0.81	0.064	9.67 ± 0.91	9.02 ± 0.91	0.007*
Serum albumin (g/dL)	3.73 ± 0.64	3.63 ± 0.43	0.515	3.77 ± 0.40	3.87 ± 0.35	0.313	4.07 ± 0.34	3.68 ± 0.35	<0.001*
Serum sodium (mEq/L)	133.47 ± 4.81	135.87 ± 4.56	0.052	134.20 ± 4.04	135.57 ± 3.25	0.155	136.70 ± 2.96	137.37 ± 3.61	0.438
Serum potassium (mEq/L)	4.98 ± 0.89	5.02 ± 0.84	0.882	4.81 ± 0.75	5.16 ± 0.68	0.059	4.70 ± 0.69	5.54 ± 0.69	0.068

Table 3: Leicester Uremic Scale Symptom Prevalence at Baseline, 3 Months and 6 Months

Symptom	Yoga Baseline	Non-Yoga Baseline	P	Yoga 3 mo	Non-Yoga 3 mo	P	Yoga 6 mo	Non-Yoga 6 mo	P
Itching	26 (86.7%)	27 (90.0%)	1.000	26 (86.7%)	27 (90.0%)	1.000	26 (86.7%)	29 (96.7%)	0.353
Sleep disturbance	28 (93.3%)	28 (93.3%)	1.000	28 (93.3%)	29 (96.7%)	1.000	23 (76.7%)	29 (96.7%)	0.052
Loss of appetite	28 (93.3%)	28 (93.3%)	1.000	28 (93.3%)	29 (96.7%)	1.000	28 (93.3%)	29 (96.7%)	1.000
Excessive tiredness	29 (96.7%)	30 (100.0%)	1.000	28 (93.3%)	30 (100.0%)	0.492	26 (86.7%)	30 (100.0%)	0.112
Pain in bones/joints	29 (96.7%)	28 (93.3%)	1.000	27 (90.0%)	29 (96.7%)	0.612	24 (80.0%)	30 (100.0%)	0.024*
Poor concentration/mental alertness	28 (93.3%)	29 (96.7%)	1.000	28 (93.3%)	30 (100.0%)	0.492	24 (80.0%)	30 (100.0%)	0.024*
Impotence/lack of sex drive	30 (100.0%)	30 (100.0%)	1.000	30 (100.0%)	30 (100.0%)	1.000	30 (100.0%)	30 (100.0%)	1.000
Loss of muscle strength/power	28 (93.3%)	28 (93.3%)	1.000	27 (90.0%)	28 (93.3%)	1.000	22 (73.3%)	28 (93.3%)	0.038*
Shortness of breath	20 (66.7%)	22 (73.3%)	0.573	20 (66.7%)	25 (83.3%)	0.136	16 (53.3%)	25 (83.3%)	0.025*
Muscle spasm/stiffness	28 (93.3%)	27 (90.0%)	1.000	27 (90.0%)	28 (93.3%)	1.000	24 (80.0%)	28 (93.3%)	0.254
Restless legs	23 (76.7%)	25 (83.3%)	0.519	22 (73.3%)	25 (83.3%)	0.347	18 (60.0%)	25 (83.3%)	0.045*

Table 4: Leicester Uremic Scale Symptom Frequency and Total Symptom Burden at Baseline, 3 Months and 6 Months

Variable	Yoga Baseline	Non-Yoga Baseline	P	Yoga 3 mo	Non-Yoga 3 mo	P	Yoga 6 mo	Non-Yoga 6 mo	P
Frequency of itching	2.20 ± 1.27	2.40 ± 1.16	0.527	1.87 ± 1.07	2.37 ± 1.12	0.084	1.67 ± 0.99	2.33 ± 0.97	0.065
Frequency of sleep disturbance	2.33 ± 1.02	2.47 ± 1.00	0.614	1.47 ± 0.62	2.33 ± 0.88	<0.001*	1.03 ± 0.76	2.37 ± 0.89	<0.001*
Frequency of loss of appetite	2.37 ± 0.99	2.57 ± 0.85	0.409	1.80 ± 0.76	2.30 ± 0.79	0.056	1.43 ± 0.62	2.20 ± 0.84	0.065
Frequency of excessive tiredness	2.23 ± 0.817	2.33 ± 0.80	0.634	1.53 ± 0.68	2.27 ± 0.78	<0.001*	1.13 ± 0.68	2.43 ± 0.77	<0.001*
Frequency of pain in bones/joints	2.23 ± 0.97	2.30 ± 0.95	0.789	1.50 ± 0.77	2.13 ± 0.86	0.004*	1.03 ± 0.66	2.23 ± 0.77	<0.001*

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Frequency of poor concentration/mental alertness	2.20 ± 0.92	2.23 ± 0.85	0.885	1.50 ± 0.73	2.27 ± 0.74	<0.001*	1.00 ± 0.69	2.37 ± 0.71	<0.001*
Frequency of impotence/lack of sex drive	3.00 ± 0.78	3.03 ± 0.76	0.869	2.63 ± 0.76	3.00 ± 0.78	0.073	2.17 ± 0.91	2.87 ± 0.68	0.066
Frequency of loss of muscle strength/power	2.00 ± 0.87	2.03 ± 0.85	0.881	1.40 ± 0.67	1.93 ± 0.78	0.007*	0.97 ± 0.71	1.97 ± 0.76	<0.001*
Frequency of shortness of breath	1.10 ± 0.92	1.23 ± 0.89	0.573	0.87 ± 0.77	1.40 ± 0.85	0.014*	0.73 ± 0.78	1.43 ± 0.89	0.002*
Frequency of muscle spasm/stiffness	2.17 ± 0.87	2.17 ± 0.83	1.000	1.63 ± 0.76	2.07 ± 0.78	0.034*	1.17 ± 0.79	2.13 ± 0.81	<0.001*
Frequency of restless legs	1.20 ± 0.88	1.33 ± 0.84	0.553	0.93 ± 0.69	1.33 ± 0.84	0.049*	0.67 ± 0.60	1.40 ± 0.85	<0.001*
Total frequency score	23.03 ± 4.05	24.10 ± 3.70	0.292	17.13 ± 2.96	23.40 ± 3.73	<0.001*	13.00 ± 3.64	23.93 ± 3.98	<0.001*
Total symptom number	9.97 ± 0.89	10.20 ± 0.88	0.313	9.70 ± 1.11	10.33 ± 0.75	0.013*	8.73 ± 1.63	10.40 ± 0.67	<0.001*

Table 5: Change in Leicester Uremic Scale Symptom Frequency from Baseline to 3 Months and 6 Months

Variable	Yoga Δ 0–3 mo	P	Non-Yoga Δ 0–3 mo	P	Yoga Δ 0–6 mo	P	Non-Yoga Δ 0–6 mo	P
Change in frequency of itching	0.33 ± 0.47	0.065	0.03 ± 0.32	0.573	0.53 ± 0.68	0.056	-0.13 ± 0.73	0.326
Change in frequency of sleep disturbance	0.87 ± 0.68	<0.001*	0.13 ± 0.57	0.211	1.30 ± 0.95	<0.001*	0.10 ± 0.66	0.415
Change in frequency of loss of appetite	0.57 ± 0.56	0.058	0.27 ± 0.45	0.066	0.93 ± 0.69	0.066	0.37 ± 0.66	0.086
Change in frequency of excessive tiredness	0.70 ± 0.46	<0.001*	0.07 ± 0.25	0.161	1.10 ± 0.75	<0.001*	-0.10 ± 0.60	0.375
Change in frequency of pain in bones/joints	0.73 ± 0.69	<0.001*	0.17 ± 0.37	0.066	1.20 ± 0.88	<0.001*	0.07 ± 0.52	0.489
Change in frequency of poor concentration/mental alertness	0.70 ± 0.53	<0.001*	-0.03 ± 0.41	0.662	1.20 ± 0.76	<0.001*	-0.13 ± 0.50	0.161
Change in frequency of impotence/lack of sex drive	0.37 ± 0.49	0.066	0.03 ± 0.18	0.326	0.83 ± 0.74	0.074	0.17 ± 0.53	0.096
Change in frequency of loss of muscle strength/power	0.60 ± 0.49	<0.001*	0.10 ± 0.30	0.083	1.03 ± 0.76	<0.001*	0.07 ± 0.45	0.423
Change in frequency of shortness of breath	0.23 ± 0.43	0.006*	-0.17 ± 0.53	0.096	0.37 ± 0.61	0.003*	-0.20 ± 0.61	0.083
Change in frequency of muscle spasm/stiffness	0.53 ± 0.50	<0.001*	0.10 ± 0.30	0.083	1.00 ± 0.74	<0.001*	0.03 ± 0.32	0.573
Change in frequency of restless legs	0.27 ± 0.45	0.003*	0.00 ± 0.26	1.000	0.53 ± 0.73	<0.001*	-0.07 ± 0.25	0.161
Change in total frequency score	5.90 ± 2.09	<0.001*	0.70 ± 1.64	0.270	10.03 ± 4.00	<0.001*	0.17 ± 2.69	0.737
Change in total symptom number	0.27 ± 0.52	0.009*	-0.13 ± 0.43	0.103	1.20 ± 1.13	<0.001*	-0.20 ± 0.48	0.066

Table 6: Symptom Intrusiveness Scores at Baseline, 3 Months and 6 Months

Variable	Yoga Baseline	Non-Yoga Baseline	P	Yoga 3 mo	Non-Yoga 3 mo	P	Yoga 6 mo	Non-Yoga 6 mo	P
Intrusiveness of itching	2.20 ± 1.27	2.17 ± 1.28	0.920	1.87 ± 1.07	2.23 ± 1.19	0.216	1.67 ± 0.99	2.33 ± 1.12	0.059
Intrusiveness of sleep disturbance	2.37 ± 1.03	2.30 ± 1.06	0.806	1.50 ± 0.68	2.20 ± 0.92	0.001*	1.03 ± 0.76	2.37 ± 0.71	<0.001*
Intrusiveness of loss of appetite	2.33 ± 0.99	2.20 ± 1.06	0.618	1.80 ± 0.76	2.27 ± 0.94	0.059	1.47 ± 0.68	2.33 ± 0.84	0.065
Intrusiveness of excessive tiredness	2.27 ± 0.82	2.23 ± 0.77	0.873	1.57 ± 0.72	2.23 ± 0.96	0.001*	1.13 ± 0.68	2.27 ± 0.74	<0.001*
Intrusiveness of pain in bones/joints	2.20 ± 0.96	2.20 ± 0.96	1.000	1.50 ± 0.77	2.20 ± 0.96	0.003*	1.03 ± 0.66	2.33 ± 0.84	<0.001*

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Intrusiveness of poor concentration/mental alertness	2.20 ± 0.92	2.17 ± 0.91	0.889	1.50 ± 0.73	2.13 ± 0.90	0.004*	1.00 ± 0.69	2.20 ± 0.80	<0.001*
Intrusiveness of impotence/lack of sex drive	2.97 ± 0.80	3.07 ± 0.69	0.609	2.63 ± 0.76	3.00 ± 0.69	0.057	2.17 ± 0.91	3.00 ± 0.69	0.058
Intrusiveness of loss of muscle strength/power	2.03 ± 0.89	1.97 ± 0.80	0.762	1.43 ± 0.72	1.97 ± 0.80	0.009*	1.00 ± 0.78	2.13 ± 0.62	<0.001*
Intrusiveness of shortness of breath	1.10 ± 0.92	1.17 ± 0.91	0.779	0.87 ± 0.77	1.97 ± 0.80	0.088	0.73 ± 0.78	1.47 ± 0.81	0.001*
Intrusiveness of muscle spasm/stiffness	2.17 ± 0.87	2.17 ± 0.87	1.000	1.63 ± 0.76	2.13 ± 0.81	0.018*	1.17 ± 0.79	2.13 ± 0.81	<0.001*
Intrusiveness of restless legs	1.20 ± 0.88	1.27 ± 0.86	0.770	0.93 ± 0.69	1.27 ± 0.86	0.105	0.70 ± 0.65	1.37 ± 0.85	0.001*
Total intrusiveness score	23.03 ± 4.05	23.17 ± 3.39	0.898	17.23 ± 3.24	22.87 ± 3.60	<0.001*	13.10 ± 4.03	24.00 ± 3.37	<0.001*

Table 7: Change in Symptom Intrusiveness from Baseline to 3 Months and 6 Months

Variable	Yoga Δ 0–3 mo	P	Non-Yoga Δ 0–3 mo	P	Yoga Δ 0–6 mo	P	Non-Yoga Δ 0–6 mo	P
Change in intrusiveness of itching	0.33 ± 0.47	0.058	-0.07 ± 0.36	0.326	0.53 ± 0.68	0.059	-0.167 ± 0.531	0.096
Change in intrusiveness of sleep disturbance	0.87 ± 0.68	<0.001*	0.10 ± 0.40	0.186	1.33 ± 0.88	<0.001*	-0.067 ± 0.640	0.573
Change in intrusiveness of loss of appetite	0.53 ± 0.57	0.066	-0.07 ± 0.52	0.489	0.86 ± 0.77	<0.001*	-0.133 ± 0.571	0.211
Change in intrusiveness of excessive tiredness	0.70 ± 0.46	<0.001*	0.00 ± 0.45	1.000	1.13 ± 0.681	<0.001*	-0.033 ± 0.183	0.326
Change in intrusiveness of pain in bones/joints	0.70 ± 0.70	<0.001*	0.00 ± 0.37	1.000	1.16 ± 0.91	<0.001*	-0.133 ± 0.346	0.063
Change in intrusiveness of poor concentration/mental alertness	0.70 ± 0.53	<0.001*	0.03 ± 0.18	0.326	1.20 ± 0.76	<0.001*	-0.033 ± 0.414	0.662
Change in intrusiveness of impotence/lack of sex drive	0.33 ± 0.47	0.058	0.07 ± 0.25	0.161	0.80 ± 0.76	0.058	0.067 ± 0.254	0.161
Change in intrusiveness of loss of muscle strength/power	0.60 ± 0.49	<0.001*	0.00 ± 0.37	1.000	1.03 ± 0.76	<0.001*	-0.167 ± 0.461	0.057
Change in intrusiveness of shortness of breath	0.23 ± 0.43	0.006*	-0.07 ± 0.25	0.161	0.367 ± 0.61	0.003*	-0.300 ± 0.651	0.058
Change in intrusiveness of muscle spasm/stiffness	0.53 ± 0.50	<0.001*	0.03 ± 0.32	0.573	1.00 ± 0.743	<0.001*	0.033 ± 0.320	0.573
Change in intrusiveness of restless legs	0.27 ± 0.45	0.003*	0.00 ± 0.26	1.000	0.50 ± 0.77	0.001*	-0.100 ± 0.305	0.083
Change in total intrusiveness score	5.80 ± 2.29	<0.001*	0.30 ± 0.91	0.083	9.93 ± 4.26	<0.001*	-0.833 ± 2.019	0.066

Table 8: RAND SF-36 Domain Scores at Baseline, 3 Months and 6 Months

Domain	Yoga Baseline	Non-Yoga Baseline	P	Yoga 3 mo	Non-Yoga 3 mo	P	Yoga 6 mo	Non-Yoga 6 mo	P
Physical function	49.50 ± 10.45	50.00 ± 9.82	0.849	54.83 ± 6.39	49.00 ± 6.74	0.001*	58.50 ± 4.38	48.33 ± 5.77	<0.001*
Role limitations by physical problems	45.58 ± 17.49	45.92 ± 17.17	0.941	51.75 ± 11.33	45.50 ± 13.98	0.017*	56.83 ± 7.71	46.00 ± 11.09	<0.001*

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Pain	56.83 ± 11.26	55.50 ± 10.09	0.631	58.08 ± 10.07	55.00 ± 9.05	0.064	57.67 ± 7.62	54.00 ± 8.74	0.066
Vitality/energy	49.07 ± 7.87	49.07 ± 7.87	1.000	53.08 ± 6.52	48.67 ± 6.94	0.014*	56.50 ± 4.93	48.33 ± 6.20	<0.001*
Mental health/emotions	54.77 ± 7.42	54.50 ± 7.51	0.890	57.35 ± 6.88	51.88 ± 7.25	0.004*	58.17 ± 6.06	50.83 ± 6.30	<0.001*
General health	39.50 ± 9.13	39.50 ± 9.13	1.000	46.33 ± 6.14	40.50 ± 6.86	0.001*	52.58 ± 5.19	40.50 ± 6.34	<0.001*
Social functioning	50.08 ± 8.77	50.33 ± 8.42	0.911	54.08 ± 6.58	48.75 ± 7.03	0.004*	56.50 ± 6.18	48.00 ± 6.64	<0.001*
Role limitations by emotional problems	43.33 ± 11.56	43.88 ± 10.80	0.848	48.17 ± 7.39	43.61 ± 10.47	0.056	52.83 ± 5.36	43.33 ± 10.19	<0.001*

Table 9: Change in RAND SF-36 Domain Scores from Baseline to 3 Months and 6 Months

Domain	Yoga Δ 0–3 mo	P	Non-Yoga Δ 0–3 mo	P	Yoga Δ 0–6 mo	P	Non-Yoga Δ 0–6 mo	P
Physical function	5.33 ± 5.82	<0.001*	1.00 ± 4.23	0.206	9.0 ± 8.44	<0.001*	1.7 ± 4.97	0.077
Role limitations by physical problems	6.17 ± 8.57	<0.001*	0.42 ± 5.80	0.697	11.3 ± 12.04	<0.001*	-0.1 ± 8.31	0.957
Pain	1.25 ± 3.45	0.057	3.50 ± 2.75	0.066	0.8 ± 6.57	0.493	4.5 ± 3.37	0.066
Vitality/energy	4.02 ± 3.12	<0.001*	0.40 ± 3.08	0.484	7.4 ± 5.34	<0.001*	0.7 ± 4.77	0.407
Mental health/emotions	2.58 ± 1.82	<0.001*	2.62 ± 2.70	0.058	3.4 ± 4.30	<0.001*	3.7 ± 3.59	0.058
General health	6.83 ± 4.99	<0.001*	1.00 ± 4.62	0.246	13.1 ± 6.81	<0.001*	1.0 ± 5.31	0.312
Social functioning	4.00 ± 3.86	<0.001*	1.58 ± 3.37	0.066	6.4 ± 5.71	<0.001*	2.3 ± 4.54	0.066
Role limitations by emotional problems	4.84 ± 6.48	<0.001*	0.28 ± 2.27	0.511	9.5 ± 10.29	<0.001*	0.6 ± 2.60	0.254

DISCUSSION

At baseline, the mean number of symptoms reported by participants in the yoga group was 9.97 ± 0.89 compared with 10.2 ± 0.88 in the non-yoga group, with no significant difference between groups. At three months, the mean symptom number was 9.70 ± 1.11 in the yoga group (between-group p=0.013), and at six months it was 8.73 ± 1.63 (between-group p<0.001). The most commonly reported symptoms at the start of the study were excessive tiredness and impotence, both present in 100% of participants, followed by pain in bones and joints (96.7%), poor concentration (96.7%), loss of appetite (93.3%), sleep disturbance (93.3%), loss of muscle strength (93.3%), muscle stiffness (93.3%), itching (86.7%), and restless legs (76.7%). These findings are consistent with earlier reports. Brown et al,[25] found that 96% of dialysis patients experienced at least one symptom, with excessive tiredness (81%), sleep disturbance (70%), and joint pain (69%) being the most common, while Danquah et al,[26] similarly identified tiredness as the predominant symptom among 99 haemodialysis patients.

At baseline, the frequency score was highest for impotence or lack of sex drive and lowest for shortness of breath. After yoga intervention, significant reductions were observed in the frequency of sleep disturbance, excessive tiredness, joint pain, poor concentration, muscle weakness, muscle spasm, shortness of breath, and restless legs. The total symptom frequency score declined significantly after six months of yoga. Parallel improvements were seen in intrusiveness scores, with reductions in sleep disturbance, fatigue, joint pain, poor concentration, muscle weakness, muscle spasm, shortness of breath, and restless legs at both three and six months. These results align with the findings of Wilkinson et al,[27] who showed that exercise reduced the total number of symptoms by 17% and had favorable effects on fatigue in both aerobic and combined aerobic resistance exercise groups. Kosmadakis et al,[28] also reported declines in symptom frequency after six months of walking, while a systematic review and meta-analysis by Hargrove et al,[29] confirmed that aerobic exercise improved restless leg syndrome, muscle cramping, and fatigue. Son et al,[30] further demonstrated that exercise training was effective in reducing depression, fatigue, and restless leg syndrome.

Additional studies support these observations. Montedayen et al,[31] found that intradialytic training reduced fatigue, Yurtkuran et al,[32] reported that twelve weeks of yoga improved fatigue, sleep disturbance, and grip strength, Salehi et al,[33] showed that three months of exercise reduced fatigue, Mortazavi et al,[34] demonstrated that sixteen weeks of aerobic exercise improved restless leg syndrome, and Afshar et al,[35] observed that intradialytic cycling enhanced sleep quality.

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With respect to quality of life, measured by SF-36 domains, no differences were noted between groups at baseline. Following yoga, however, significant improvements were seen in physical function, role limitations due to physical problems, vitality, mental health, general health, social functioning, and role limitations due to emotional problems. In contrast, Wilkinson et al,[27] reported no significant changes in SF 36 scores, while Parsons et al,[36] found that eight weeks of exercise had no effect on quality of life. Mustata et al,[37] observed clinically important improvements in role limitations caused by physical problems, and Ouzouni et al,[38] noted significant quality of life gains after ten months of exercise. Pandey et al,[39] confirmed that six months of yoga improved both physical and psychological domains of quality of life, while Huang et al,[40] concluded that aerobic or combined exercise for eight to twelve months enhanced aerobic capacity, walking ability, and health-related quality of life.

Biochemical parameters also showed improvement. The yoga group demonstrated significant increases in haemoglobin and serum albumin after six months, although no changes were observed in blood pressure, blood sugar, sodium, or potassium. These findings are consistent with Yurtkuran et al,[32] who reported improved hematocrit after yoga, while Pandey et al,[39] noted blood pressure improvements that were not replicated in the present study.

Limitation

The study has several limitations, including the small sample size, relatively short follow-up period, and non-randomised design. Allocation based on patient preference introduces the possibility of selection bias, and the higher baseline BMI in the yoga group may have acted as a confounder. In addition, adherence during the home-based phase was assessed through self-report and caregiver-maintained diaries. Larger randomised controlled trials with longer follow-up are required to confirm these findings.

CONCLUSION

Six months of yoga-based exercise was associated with improvements in overall symptom burden among patients receiving maintenance haemodialysis. Reductions were observed in symptom number, total frequency, and intrusiveness scores on the Leicester Uremic Symptom Scale. Specific improvements were noted in shortness of breath, muscle weakness, joint pain, restless legs, sleep disturbance, fatigue, poor concentration, and muscle spasms.

Quality of life, assessed using the SF-36, improved across several domains, including physical function, vitality, mental health, general health, social functioning, and role limitations due to physical and emotional problems. Higher haemoglobin and albumin levels were also observed, whereas no significant changes were seen in blood pressure or blood sugar. These findings support yoga-based exercise as a feasible adjunctive rehabilitation strategy, although larger randomised studies are needed to confirm efficacy.

Key Message

Yoga-based exercise appears to be a safe and feasible adjunctive rehabilitation strategy for patients receiving maintenance haemodialysis and was associated with improvements in symptom burden and several domains of health-related quality of life.

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