RESEARCH PAPER

Effectiveness of Mindfulness based intervention on Blood Pressure Control in Dialysis Patients: A Pilot Study

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ABSTRACT
A major global health concern, chronic kidney disease (CKD) is exacerbated by hypertension, contributing to renal impairment and increased cardiovascular risk, particularly in hemodialysis patients with intradialytic hypertension. This pilot study assessed the efficacy of mindfulness-based stress reduction (MBSR) in managing blood pressure among patients undergoing maintenance hemodialysis. Ten participants, selected from a tertiary hospital dialysis unit, were divided into experimental and control groups using a quasi-experimental pre-test–post-test design. While the control group continued with standard treatment, the experimental group engaged in an eight-week MBSR program. Blood pressure measurements were taken pre-, during, and post-dialysis using a calibrated mercury sphygmomanometer, with data analyzed using repeated measures ANOVA and independent t-tests. The results indicated a significant reduction in systolic blood pressure in the experimental group ($p = 0.02$), while diastolic changes were not significant. Notably, systolic, and diastolic pressures were more stable in the experimental group during dialysis, contrasting with gradual increases in the control group. These differences became significant starting at 1.5 hours ($p < 0.05$). Clinical and demographic factors such as age, gender, duration of illness, and cause of renal failure were correlated with post-test blood pressure outcomes. The findings suggest that MBSR could be an effective adjunct therapy for managing blood pressure and improving clinical outcomes in hemodialysis patients..

Keywords: Chronic kidney disease, Hemodialysis, Mindfulness-based stress reduction, blood pressure.
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INTRODUCTION

Chronic kidney disease (CKD), a persistent decline in kidney function, is recognized as a growing public health concern. Over 840 million people worldwide have chronic kidney disease (CKD), with a prevalence of 10–15%, according to the Global Burden of Disease Study (Jager et al., 2019). Based on Sullivan et al. (2020), diabetes and hypertension are the two primary causes of CKD and risk factors for the development of both CKD and CVD. In accordance with Mark et al. (2025), 11·5% (8·4–14·5) of cardiovascular fatalities were caused by impaired renal function as a risk factor. High systolic blood pressure, body mass index, and fasting plasma glucose were the main risk factors for CKD DALYs. Persistent hypertension can contribute to the progression of Chronic Kidney Disease, while declining Estimated Glomerular Filtration Rate (eGFR) may hinder adequate blood pressure regulation (Ku Eugene et al., 2019). Furthermore, chronic kidney disease is linked to persistent inflammation, oxidative stress, and vascular impairment, which increase the risk of various vascular complications (Satapathy et al., 2025). Elattaby et. Aal., (2023) and Vongchaiudomchoke et al., (2023) has demonstrated that for patients with MHD, the risk of hospitalization or death within six months' increases by 20% for every 10 mmHg increase in blood pressure during dialysis. IDH significantly lowers the 2-year survival rate for patients whose pre-dialysis systolic blood pressure (SBP) was less than 120 mmHg. As a result, improving the prognosis and quality of life for dialysis patients requires efficient management of IDH. According to reports, long-term mindfulness practice particularly deep meditation can trigger the release of serotonin and endorphins from the autonomic nervous system. Blood pressure eventually

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drops because of this, which also lowers cortisol levels and sets off noradrenergic and parasympathetic reactions Intarakamhang et al., (2020). Based on available data, by Wu et. al., (2024) mindfulness meditation could be used in conjunction with or instead of conventional techniques to lower blood pressure in hypertensive patients. However, dialysis patients face significant physiological changes (such as blood pressure fluctuations and fluid adjustments) and psychological stress (such as anxiety and loneliness) during the dialysis process, in addition to long-term blood pressure control problems, unlike patients with general hypertension. Alhawatmeh et al., (2020) found the use of mindfulness meditation in this population may improve the comfort and efficacy of the dialysis procedure by reducing immediate discomfort and assisting in blood pressure regulation. Patients can improve their quality of life, strengthen their resilience, and better manage physical and mental stress by practicing it while receiving dialysis. The integration of shared decision-making and patient-centred care strategies can strengthen the ability of patients with Chronic Kidney Disease to participate actively in their healthcare management and develop treatment goals tailored to their individual needs (Saranya & Priyadarsini, 2024). There is, however, a dearth of research on the application of mindfulness practices to manage blood pressure in dialysis patients. In order to close the current research gap and offer a solid scientific foundation for clinical practice, the current study investigates the effects of a mindfulness-based stress reduction intervention in conjunction with standard treatment on blood pressure in haemodialysis patients.

METHODOLOGY

The study evaluated the impact of a mindfulness-based intervention on blood pressure in patients receiving hemodialysis using a quantitative interventional approach and a quasi-experimental pre-test–post-test control group design. Ten patients, or 10% of the estimated main sample size of 100, were conveniently chosen from the dialysis unit of Saveetha Medical College and Hospital in Chennai for a pilot study. There were five experimental and five control groups. Patients between the ages of 18 and 75 who are diagnosed with chronic kidney disease, were receiving maintenance hemodialysis for at least a year, had been diagnosed with hypertension before dialysis, were taking standard antihypertensive medication, and met the requirements for intradialytic hypertension were eligible to participate; those with mental illnesses or comorbidities that interfered with cooperation were not. The Institutional Ethics Committee granted ethical approval (Ref. No: 001/10/2024/IEC/SMCH), and informed consent was obtained. A semi-structured questionnaire was utilized to gather baseline clinical and demographic information. Before dialysis, at 30-minute intervals during dialysis, and after the session, blood pressure was taken on the non-fistula arm using a calibrated mercury sphygmomanometer. In addition to routine care and standard antihypertensive medication, the experimental group received an eight-week Mindfulness-Based Stress Reduction (MBSR) program that included body scans, mindfulness breathing, and awareness of sounds and thoughts. SPSS version 16.0 was used to analyze the data; independent sample t-tests and chi-square tests were used to compare baseline characteristics, independent t-tests were used to compare differences between groups, and repeated measures ANOVA was used to compare intra-group changes. P-values less than 0.05 were regarded as statistically significant.

RESULTS AND DISCUSSION

Section A: Demographic and clinical Characteristics of the experimental and control group patients

Majority of patients (50%) were between the ages of 40 and 50, followed by those between the ages of 51 and 60 (30%), and those under 40 (20%). In terms of gender, 40% of participants were women and 60% of participants were men. Thirty percent of the participants had a professional degree or were graduates, twenty percent had finished high school, ten percent had studied up to the intermediate or diploma level, twenty percent had only completed primary or middle school, and twenty percent were illiterate. Twenty percent were clerks, twenty percent were skilled workers, ten percent were technicians, ten percent were professionals, ten percent were plant/machine operators, ten percent were agricultural workers, ten percent were elementary school workers, and ten percent were unemployed.

Only 60% of participants were in the lowest income group (≤₹7,315–21,913) and 40% were in the lower-middle income group (₹21,914–59,251). Fifty percent of the patients were part of nuclear families, thirty percent were part of joint families, and twenty percent were part of extended families. In terms of marital status, 10% of respondents were single, divorced, or widowed, whereas 70% were married. Regarding where they lived, half (50%) of the participants were from cities, while the other half were from rural areas.

Type II diabetes mellitus accounted for 40% of the patients' renal failure, with hypertension coming in second (0%). Ten percent of cases had other causes, such as polycystic kidney disease, while twenty percent had kidney disease. Half of the patients (50%) had been receiving dialysis for one to five years, 30% for more than ten years, and 20% for six to ten years. In the same way, 40% of participants said they had been ill for 6–10 years, 30% for 1–5 years, and 30% for more than 10 years.

Hypertension was the leading cause of renal failure (50%) and was followed by kidney disease (20%), type II diabetes mellitus (20%), and other causes (10%). Of the patients, half (50%) had been receiving dialysis for one to five years, thirty percent for over ten years, and twenty percent for six to ten years. Thirty percent had been ill for more than ten years, thirty percent for one to five years, and forty percent for six to ten years. Dialysis was performed three times a week for the majority (60%) and twice a week for 40%. Half (50%) had an AV fistula, and 50% used a central venous catheter in terms of vascular access.

Regarding hemodialysis sessions, 40% of patients received dialysis twice a week, while the majority (60%) received

dialysis three times a week. Thirty percent of the patients had a central venous catheter (CVC), and fifty percent had an AV fistula.

Section B: Table 1: Effect of MBSR on Systolic and Diastolic Blood Pressure among Experimental and Control Group (n=10)

Group	BP Measure	Pre-test Mean ± SD	Post-test Mean ± SD	*t* value	*p* value
Experimental (MBSR)	SBP (mmHg)	145.2 ± 4.2	142.8 ± 3.9	2.61	0.02*
	DBP (mmHg)	94.5 ± 3.3	93.6 ± 3.7	1.21	0.22 (NS)
Control	SBP (mmHg)	144.8 ± 4.0	145.6 ± 4.3	0.88	0.38 (NS)
	DBP (mmHg)	94.2 ± 3.5	95.1 ± 3.0	1.02	0.31 (NS)

The results of the paired t-test for the experimental and control groups' systolic and diastolic blood pressure are shown in Table 1. The mean systolic pressure of those who received the intervention dropped from 145.2 ± 4.2 to 142.8 ± 3.9 (t = 2.61, p = 0.02), a significant decrease. However, there was no statistically significant change in the mean diastolic pressure, which decreased from 94.5 ± 3.3 to 93.6 ± 3.7 (t = 1.21, p = 0.22). On the other hand, the diastolic pressure (94.2 ± 3.5 to 95.1 ± 3.0; t = 1.02, p = 0.31) and systolic pressure (144.8 ± 4.0 to 145.6 ± 4.3; t = 0.88, p = 0.38) increased slightly but not significantly in the control group. Overall, these findings show that although MBSR had no statistically significant impact on diastolic blood pressure, it did significantly lower systolic blood pressure.

A systematic review of randomized controlled trials investigating the effect of MBSR on blood pressure in people with hypertension or elevated readings was conducted by Solano Lopez (2018). Five studies were included in the review, which concluded that MBSR is a useful behavioural strategy that supports lifestyle modifications and lowers blood pressure. These results are consistent with a meta-analysis conducted by Lee et al. (2020), which showed that MBSR interventions significantly decreased hypertensive patients' systolic blood pressure. In a similar vein, Chen et al. (2024) verified that mindfulness-based techniques successfully reduce stress and enhance blood pressure control in hypertensive patients.

Table 2 : Comparsion of systolic and diastolic blood pressure between the intervention and control groups over each 30 minutes.

Time Point	Measure	Intervention (Mean ± SD)	Control (Mean ± SD)	*t* value	*p* value
Pre-dialysis	SBP	141.2 ± 15.4	139.5 ± 14.8	0.31	0.76 (NS)
	DBP	72.0 ± 10.5	73.1 ± 11.0	0.28	0.78 (NS)
30 min	SBP	145.8 ± 15.9	152.6 ± 16.5	1.21	0.23 (NS)
	DBP	74.1 ± 10.7	77.9 ± 11.2	1.02	0.31 (NS)
1 hour	SBP	150.5 ± 16.2	162.4 ± 17.1	2.15	0.04*
	DBP	76.8 ± 9.8	82.3 ± 10.4	1.87	0.07 (NS)
1.5 hours	SBP	152.0 ± 16.8	168.5 ± 17.9	2.68	0.01*
	DBP	78.5 ± 10.1	85.6 ± 10.9	2.14	0.04*
2 hours	SBP	153.2 ± 17.9	174.6 ± 18.3	3.25	0.003*
	DBP	79.1 ± 10.2	88.2 ± 11.5	2.41	0.02*
2.5 hours	SBP	150.6 ± 17.5	179.1 ± 19.1	3.98	<0.001*
	DBP	80.2 ± 10.4	93.5 ± 11.8	3.15	0.004*
3 hours	SBP	146.8 ± 18.1	185.2 ± 19.2	4.85	<0.001*
	DBP	81.3 ± 9.9	98.5 ± 11.7	3.92	<0.001*
3.5 hours	SBP	144.2 ± 17.9	188.3 ± 20.1	5.21	<0.001*
	DBP	80.9 ± 10.0	104.2 ± 12.0	4.62	<0.001*
Post-dialysis (4h)	SBP	142.0 ± 17.3	191.5 ± 20.0	5.72	<0.001*
	DBP	80.2 ± 10.1	107.6 ± 12.4	4.85	<0.001*

***-significant, NS- Non significant**

Systolic and diastolic blood pressure readings taken at 30-minute intervals throughout the four-hour dialysis sessions in both groups are compared in Table 2. Pre-dialysis SBP and DBP were similar across groups at baseline, with no discernible variations. The control group's blood pressure slightly increased at 30 minutes, but the difference was not statistically significant. By the first hour, the control group's systolic pressure had significantly ($p < 0.05$) increased in comparison to the intervention group, but the diastolic values had only slightly increased. The control group's diastolic and systolic pressures were noticeably higher at 90 minutes. Differences became more noticeable after two hours, with both SBP and DBP increasing statistically significantly ($p < 0.05$) and reaching highly significant elevations ($p < 0.01$). The control group's blood pressure continued to rise steadily during the last two hours of dialysis, while the intervention group's readings remained comparatively stable. The control group's systolic and diastolic pressures were nearly 50 mmHg and 27 mmHg higher than the intervention group's by the end of dialysis. These results show that, in contrast to the control group's noticeable increase in intradialytic hypertension, the mindfulness intervention was successful in bringing blood pressure under control during dialysis.

Similarly, Buchanan et al. (2022) reported similar effects, demonstrating that stress-reduction interventions reduced blood pressure variability during hemodialysis. Significant differences in pulse rate, SBP, DBP, pulse pressure, and MAP were observed between pre-dialysis and post-dialysis time points ($p<0.05$) in another study by Wu et al. (2025). In particular, blood pressure indicators were significantly lower at each post-dialysis time point than they were prior to dialysis, and the reduction in blood pressure increased with the length of dialysis. This suggests that patients receiving hemodialysis can benefit from mindfulness meditation interventions that lower blood pressure levels and improve blood pressure fluctuations during the process.

Section C: Association of Demographic Variables with Post-Test Blood Pressure values of Experimental Group.

Most patients were above 45 years (60%), and they had higher mean SBP (145.0 ± 4.0 mmHg) and DBP (94.5 ± 3.2 mmHg) compared to younger patients (142.1 ± 3.5 mmHg, 93.2 ± 2.9 mmHg). This association was significant ($p = 0.02$). Similarly, males (60%) showed higher post-test SBP (144.6 ± 4.1 mmHg) and DBP (94.4 ± 3.4 mmHg) than females (142.8 ± 3.8 mmHg, 93.1 ± 3.1 mmHg), with significant association ($p = 0.04$). Other variables such as education, occupation, income, family type, marital status, and residence showed minor differences in post-test blood pressure values but did not demonstrate statistically significant associations ($p > 0.05$).

The relationship between post-test SBP and DBP and clinical variables. Displays The patients in this group had the highest mean SBP (145.1 ± 4.0 mmHg) and DBP (94.8 ± 3.1 mmHg), and hypertension was the primary cause of renal failure (50%). The cause of renal failure and post-test blood pressure were found to be significantly correlated ($p = 0.01$). Thirty percent of patients had CKD for more than ten years, and forty percent had it for six to ten years. When compared to those with 1–5 years of duration, these groups displayed higher mean SBP and DBP. The length of illness and post-test blood pressure were found to be significantly correlated ($p = 0.02$). Other factors like vascular access site, frequency of haemodialysis sessions, and dialysis duration did not significantly correlate with post-test SBP and DBP ($p > 0.05$).

CONCLUSION

MBSR has been found to improve blood pressure outcomes for haemodialysis patients. Additionally, a small sample was used in this pilot study. As a result, the study focused on blood pressure outcome measures. According to the study's findings, MBSR may be a suitable adjunctive treatment for people with high blood pressure and may enhance their quality of life.

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