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EFFECT OF AUDITORY RELAXATION INTERVENTION ON INTRADIALYTIC PHYSIOLOGICAL STABILITY IN HEMODIALYSIS PATIENTS

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ABSTRACT

Background: Patients with chronic kidney disease (CKD) undergoing maintenance hemodialysis frequently experience intradialytic complications, including blood pressure fluctuations and headaches, which negatively affect treatment tolerance and overall wellbeing. Non-pharmacological supportive interventions, such as auditory relaxation therapy, may provide beneficial effects when integrated into routine dialysis care to enhance physiological stability and patient comfort.
Objective: To evaluate the effect of auditory relaxation intervention on intradialytic physiological stability among patients undergoing hemodialysis.
Methods: A pre-post quasi experimental study was conducted among 35 CKD patients receiving hemodialysis for at least three months at the Dialysis Centre of DHQ Hospital Sheikhupura. Participants were selected through purposive sampling. The auditory relaxation intervention consisted of listening to a recorded recitation during hemodialysis sessions under standardized conditions. Clinical parameters, including systolic and diastolic blood pressure, as well as the frequency and severity of headaches, were recorded before and after the intervention. Data were analyzed using SPSS version 23.0. Paired sample t tests were applied to determine statistical differences between pre and post intervention measures.
Results: Significant reductions were observed in physiological complications following the intervention. Mean systolic blood pressure decreased from 160.57 ± 18.78 mmHg to 136.71 ± 11.97 mmHg, with a mean reduction of 23.85 mmHg ($t(34)=8.44$, $p<0.001$). Mean diastolic blood pressure declined from 92.29 ± 12.85 mmHg to 78.66 ± 7.09 mmHg, showing a mean reduction of 13.62 mmHg ($t(34)=6.34$, $p<0.001$). Headache severity also improved substantially, with headache-free participants increasing from 5.7% pre-intervention to 60.0% post-intervention, while severe headache was completely eliminated.
Conclusion: Auditory relaxation intervention during hemodialysis sessions may contribute to the reduction of intradialytic complications and improvement of physiological stability among patients with chronic kidney disease. Incorporating non-pharmacological supportive interventions into routine dialysis care may enhance patient comfort and promote holistic patient management in clinical settings.

Keywords: Chronic Kidney Disease, Hemodialysis, Auditory Relaxation Intervention, Intradialytic Complications, Physiological Stability, Blood Pressure, Headache, Non-Pharmacological Therapy,

INTRODUCTION

Chronic kidney disease is increasing worldwide at an estimated annual growth rate of 8%, with disproportionately higher prevalence in low income countries (Asmelash, Chane, Desalegn, Assefa, & Fasil, 2020). In Pakistan, CKD affects between 12.5% and 31.2% of the population and constitutes a growing public health challenge (Zafar et al., 2023). Many individuals remain unaware of their condition until substantial renal function often up to 90% has been lost, leading to delayed diagnosis and progression to end stage renal failure (Tegegne, Demeke, Amme, Edmealem,

& Ademe, 2020). At advanced stages, patients require renal replacement therapy, most commonly hemodialysis, to sustain life (Mardiah, Widodo, & Thuy, 2022).

While hemodialysis significantly prolongs survival, it is associated with a range of intradialysis complications. Common adverse effects include hypotension, blood pressure fluctuations, muscle cramps, fatigue, headache, nausea, vomiting, pruritus, and sleep disturbances (Kamila, Maliya, & Kristini, 2023). Hemodialysis associated headache (HDH) is particularly distressing and may exacerbate emotional instability (Chhaya et al., 2022). Continuous exposure to treatment related stressors and physical discomfort contributes to psycho affective disturbances and reduced overall wellbeing (Sousa et al., 2019). These complications collectively undermine treatment tolerance and quality of life in patients who already face substantial social and economic challenges, particularly in resource limited settings such as Pakistan (Tegegne et al., 2020).

Physiological instability during dialysis sessions especially blood pressure variability remains a major clinical concern. Although hemodialysis is considered a safe procedure, intradialytic hypotension and related symptoms persist as frequent complications requiring ongoing management (Kamila et al., 2023). Pharmacological approaches are commonly used; however, nonpharmacological adjuncts that are safe, lowcost, and culturally appropriate may offer additional benefits.

Emerging evidence supports the role of mind body interventions in stabilizing physiological responses and promoting relaxation. Music and rhythm have long been recognized as powerful stimuli capable of eliciting emotional calm and modulating stress responses (Che Wan Mohd Rozali et al., 2022). Similar effects have been attributed to Qur'anic recitation, which may induce relaxation, enhance cognitive focus, and reduce stress related physiological arousal. Both Surah Al-Rahman and relaxation music have been shown to alleviate stress and promote emotional tranquility (Saleem & Saleem, 2021).

Surah Al-Rahman is distinguished by its rhythmic structure and repeated refrains, features associated with meditative and calming effects (Rafique, Anjum, & Raheem, 2019). Although prior studies have explored Qur'anic listening in specific settings, including intensive care environments, comprehensive evaluation of its impact on intradialysis physiological complications remains limited (Abd-alrazaq et al., 2020). Given the high burden of intradialytic symptoms and the need for integrative care strategies, incorporating spiritually meaningful audio interventions within hemodialysis units may represent a feasible and culturally sensitive adjunct to routine clinical practice.

Literature Review

Hemodialysis, although essential for survival in ESRD, is accompanied by significant physiological instability and treatmentrelated complications. Patients typically undergo repeated invasive procedures several times weekly (Harris, 2021), and despite technological advancements, dialysis innovation has not consistently centered on patient experienced symptom burden (Himmelfarb, Vanholder, Mehrotra, & Tonelli, 2020). Intradialytic complications including hypotension, blood pressure variability, headache, muscle cramps, nausea, fatigue, and sleep disturbances remain common and clinically consequential (Kamila et al., 2023). Hemodialysisassociated headache (HDH) affects approximately 27–73% of patients and significantly impairs daily functioning (Gomes, da Costa, & Mazzali, 2022; Ribeiro de Sousa, Arcoverde de Santana, & Sampaio Rocha-Filho, 2025). Frequent intradialytic symptoms contribute to diminished wellbeing and may intensify psychological distress (Sousa et al., 2019).

Chronic kidney failure imposes a complex interplay of physiological and psychosocial stressors. Fluid and dietary restrictions, vascular access procedures, mobility limitations, fatigue, and longterm treatment duration collectively disrupt patients' daily routines and quality of life (Neupane, Parajuli, Mehta, & Bhatta; Worboys et al., 2022). Supportive care approaches aimed at enhancing comfort and quality of life are therefore increasingly recognized as essential components of comprehensive renal management (Hole et al., 2020). Non-pharmacological adjuncts during dialysis have demonstrated potential benefits in improving the therapeutic environment and patient wellbeing (Morais, Moreira, & Winkelmann, 2020).

Music therapy and audiovisual interventions have been associated with physiological relaxation responses, including reductions in blood pressure and stress biomarkers (Yüksekol & Başer, 2020). Such modalities provide temporary distraction from the physical and emotional strain of dialysis procedures (Bro, Finderup, Smilde, Gram, & Dreyer, 2022; Matheve, Bogaerts, & Timmermans, 2020). Audiobased interventions are increasingly supported in global health discourse as effective tools for enhancing wellbeing across clinical populations (McCrary, Altenmüller, Kretschmer, & Scholz, 2022). Nevertheless, evidence regarding their sustained physiological impact during active hemodialysis remains inconsistent, with variability in magnitude and duration of effects (Kühlmann et al., 2016; Wang, Wu, & Yan, 2023).

Within Islamic contexts, Qur'anic recitation represents a spiritually meaningful auditory stimulus that may exert psycho-physiological effects distinct from secular music. Relaxation music and Surah Al-Rahman have both

demonstrated stress reducing properties (Saleem & Saleem, 2021). The rhythmic structure of Surah Al-Rahman is hypothesized to promote emotional regulation and autonomic stabilization (Rafique et al., 2019). However, systematic reviews highlight methodological heterogeneity and a predominance of studies conducted in limited geographic settings, with insufficient statistical synthesis and limited evaluation during active medical procedures (Abd-alrazaq et al., 2020).

Importantly, while previous investigations have reported reductions in depressive symptoms following Qur'anic listening (Babamohamadi et al., 2017; Mashitah, 2020), few studies have simultaneously examined real time physiological parameters such as blood pressure variability or hemodialysis associated headache during ongoing dialysis sessions. The practicality of implementing Qur'anic recitation as a structured, nurse led intervention within dialysis units has also received limited empirical scrutiny (Chin, Abdullah, Tan, Wong, & Khor, 2025; Lin, Liu, Hsu, & Tsai, 2017).

Given the high prevalence of intradialytic complications and the limited evidence supporting effective non-pharmacological management strategies (Gomes et al., 2022; Ribeiro de Sousa et al., 2025), further investigation is warranted. Context specific research evaluating spiritually congruent audio interventions during active hemodialysis may provide valuable insights into integrative approaches aimed at improving physiological stability and overall patient experience within renal care settings.

METHODOLOGY

A quasi-experimental pre-test and post-test design was adopted to evaluate the physiological and subjective impact of a spiritually oriented auditory intervention on intradialytic complications among patients undergoing maintenance hemodialysis. This approach enabled assessment of outcome changes within the same participants while preserving routine dialysis care and maintaining ethical feasibility in a culturally sensitive clinical context. The study was conducted at the Dialysis Center of DHQ Hospital Sheikhupura in collaboration with the Institute of Nursing, University of Health Sciences (UHS), Lahore.

Thirty five adult patients with chronic kidney disease receiving hemodialysis at least twice weekly for three months or longer were recruited using purposive sampling. Participants aged 18-65 years who were clinically stable and capable of hearing and responding to study procedures were included. Exclusion criteria comprised cognitive impairment, diagnosed hearing loss, and unstable medical status. Sample size determination ensured 80% power at a 95% confidence level to detect meaningful pre & post differences.

The intervention consisted of structured listening to a recorded recitation of Surah Al-Rahman by Qari Abdul Basit during dialysis sessions. The recitation lasted approximately 22 minutes and was administered twice weekly for four weeks. Participants were guided to relax, close their eyes if comfortable, and attend mindfully to the recitation while dialysis continued under standard clinical supervision.

Intradialytic complications were assessed using both subjective and objective measures. Headache severity was evaluated using a three point Likert type scale categorized as mild (pain present without interference in routine activity), moderate (pain causing discomfort and partial interference), and severe (intense pain requiring attention or medication). Frequency of headache episodes during dialysis was also documented. Blood pressure was measured using a calibrated sphygmomanometer integrated with the dialysis monitoring system. Systolic and diastolic readings were recorded before and immediately after intervention exposure and classified as normotensive, hypertensive, or hypotensive according to established clinical parameters.

Baseline measurements were obtained prior to the first intervention session, and post-intervention assessments were conducted at the completion of the four-week exposure period. Socio-demographic and clinical data were collected using a structured questionnaire.

Statistical analysis was performed using SPSS version 23.0. Frequencies and percentages summarized categorical variables, while means and standard deviations described continuous measures. The Shapiro Wilk test evaluated data normality. For normally distributed blood pressure variables, paired sample t-tests were applied to compare pre- and post-intervention values. Changes in headache severity distribution were analyzed using appropriate comparative statistics. Statistical significance was set at $p < 0.05$. Ethical approval and written informed consent procedures were rigorously observed, and participant confidentiality was preserved throughout the study.

RESULTS

All 35 recruited participants completed the intervention protocol. No adverse events were recorded.

Table 1. Socio-Demographic Characteristics of Participants (N = 35)

Variable	Category	n	%
Gender	Male	26	74.3

	Female	9	25.7
Marital Status	Married	30	85.7
	Unmarried	5	14.3
Employment Status	Working	8	22.9
	Not Working	27	77.1
Age (years)	Mean ± SD	45.06 ± 12.14	—
Age Range	20–65 years	—	—

The demographic distribution reflected a typical maintenance hemodialysis population, predominantly middle-aged males.

Blood Pressure Outcomes
Systolic Blood Pressure (SBP)

Table 2. Paired Sample Statistics – Systolic BP (mmHg)

Measure	Mean	SD	SE
Pre-Intervention SBP	160.57	18.78	3.17
Post-Intervention SBP	136.71	11.97	2.02

Table 3. Paired Sample t-Test – SBP

Mean Difference	SD	95% CI	t	df	p
23.85	16.71	18.11–29.60	8.44	34	<0.001

Systolic blood pressure decreased significantly following the intervention ($t(34)=8.44$, $p<0.001$), with a mean reduction of 23.85 mmHg.

Diastolic Blood Pressure (DBP)

Table 4. Paired Sample Statistics – Diastolic BP (mmHg)

Measure	Mean	SD	SE
Pre-Intervention DBP	92.29	12.85	2.17
Post-Intervention DBP	78.66	7.09	1.20

Table 5. Paired Sample t-Test – DBP

Mean Difference	SD	95% CI	t	df	p
13.62	12.70	9.26–17.99	6.34	34	<0.001

Diastolic blood pressure also showed significant reduction ($t(34)=6.34$, $p<0.001$).

Headache Severity (Likert Scale)
Table 6. Headache Severity Distribution (Pre vs Post)

Severity	Pre n (%)	Post n (%)
No Headache	2 (5.7%)	21 (60.0%)
Mild	18 (51.4%)	10 (28.6%)
Moderate	14 (40.0%)	4 (11.4%)
Severe	1 (2.9%)	0 (0%)

There was a marked shift toward lower headache severity following the intervention. Reports of severe headache were completely eliminated post-intervention. Participants reporting no headache increased from 5.7% to 60.0%. The categorical shift demonstrates clinically meaningful improvement in intradialytic headache burden.

Summary of Physiological Findings
Listening to Surah Al-Rahman during dialysis sessions was associated with:

Significant reduction in systolic blood pressure (23.85 mmHg)
Significant reduction in diastolic blood pressure (13.62 mmHg)
Elimination of severe headache
Substantial increase in headache-free sessions
All changes reached statistical significance at $p < 0.001$.
These findings support the hypothesis that spiritually integrated auditory intervention exerts measurable psycho-physiological benefits during hemodialysis.

DISCUSSION

This study demonstrated significant reductions in intradialytic physiological instability following exposure to Surah Al-Rahman during dialysis sessions. Mean systolic blood pressure decreased from 160.57 mmHg to 136.71 mmHg (mean difference 23.85 mmHg, $p<0.001$), while diastolic blood pressure declined from 92.29 mmHg to 78.66 mmHg (mean difference 13.62 mmHg, $p<0.001$). In addition, headache severity shifted markedly toward lower categories, with elimination of severe headache and substantial increases in headache-free sessions.

The magnitude of acute systolic reduction (~23.9 mmHg) exceeds pooled reductions typically reported in music-based interventions for hypertensive populations, which range approximately 7-11 mmHg systolic and 4-7 mmHg diastolic (Cao & Zhang, 2023; Kühlmann et al., 2016). Several contextual factors may explain this difference. First, participants exhibited elevated baseline blood pressure, allowing greater immediate reduction. Second, the dialysis environment involves sympathetic activation due to vascular access, fluid shifts, and procedural anxiety, potentially amplifying responsiveness to relaxation stimuli. Third, measurements captured immediate intradialytic changes rather than long-term ambulatory blood pressure control.

Consistent with broader mind-body intervention literature, relaxation-induced parasympathetic activation likely mediated hemodynamic improvement. Auditory interventions have demonstrated reductions in sympathetic tone and vascular resistance (Lee, Lee, Ahn, Hong, & Yoon, 2022). Neuro-physiological studies indicate that Qur'anic recitation increases alpha wave activity, reflecting relaxation states (Sheibani, Sadeghi Bajestani, & Goshvarpour, 2023). Such autonomic modulation may be particularly relevant in dialysis settings characterized by hemodynamic lability.

Headache reduction is clinically noteworthy. Dialysis-related headache prevalence ranges from 27% to 73% and is multifactorial in etiology, involving osmotic shifts, vascular instability, and anxiety (Gomes et al., 2022; Ribeiro de Sousa et al., 2025). The present categorical shift from moderate–severe headache toward mild or no headache mirrors findings from audio distraction and relaxation trials in procedural pain settings (Kassim et al., 2023; Saab et al., 2025). Attentional redirection, emotional regulation, and autonomic stabilization may collectively explain symptom improvement.

Nonetheless, heterogeneity in audio-based intervention studies warrants caution. Systematic reviews report variable and sometimes modest physiological effects (Kühlmann et al., 2016; Tang, Huang, Zhou, & Ye, 2020). Abd-alrazaq et al. (2020) highlighted methodological variability and limited geographic diversity in Qur'anic recitation research. Some evidence suggests that general relaxation rather than religious specificity may account for hemodynamic effects (Abd-alrazaq et al., 2020). Therefore, while culturally congruent recitation may enhance patient engagement, rigorous comparative trials are necessary to establish mechanism and specificity.

Taken together, these findings suggest that spiritually integrated auditory interventions may represent a promising adjunct for reducing intradialytic instability and symptom burden, particularly in culturally aligned populations.

Limitations

The absence of a randomized control group precludes definitive causal inference. Acute measurements were limited to intradialytic periods; long-term blood pressure trends were not evaluated. Headache severity was measured using categorical self-report rather than validated pain scales. The single-center design and modest sample size limit external validity. Additionally, potential confounders such as ultrafiltration volume, antihypertensive timing, and dialysis adequacy were not controlled.

Implications

From a clinical perspective, integrating structured Qur'anic recitation into dialysis sessions may offer a low-cost, non-invasive strategy to enhance hemodynamic stability and reduce symptom burden. Nursing staff can feasibly implement recorded recitation without disrupting routine care. Administratively, structured spiritual care programming may improve patient experience metrics and support holistic dialysis models.

Recommendations

Future studies should:
1. Conduct randomized controlled trials with active relaxation comparators.
2. Include objective autonomic markers (heart rate variability, cortisole level, baroreflex sensitivity).
3. Examine longitudinal blood pressure outcomes beyond single sessions.
4. Standardize headache measurement using validated numeric rating scales.
5. Explore multicenter implementation to enhance generalizability.

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