



# Effect of Practicing Meditation Techniques on Vital Signs and Mindfulness Levels among Adolescents with Chronic Kidney Disease Undergoing Hemodialysis

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## ABSTRACT

**Keywords:** Meditation, Vital Signs, Mindfulness, Adolescents with Chronic Kidney Disease, Hemodialysis.



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**Background:** Adolescents with chronic kidney disease undergoing hemodialysis experience significant physiological instability and psychological distress, including elevated anxiety, depression, blood pressure, and pulse rate. Given the risks of pharmacological interventions in renal impairment, safe non-pharmacological approaches are essential. **Aim:** This study aimed to assess the effects of a regular meditation exercise on vital signs and mindfulness levels in this vulnerable population. **Methodology:** A quasi-experimental research design, the study was conducted in three hemodialysis units located in the Karbala Holy Governorate, Iraq, between the periods of April 14th and August 20th, 2025. A non-probability purposive sample of forty-four patients was selected, the control group, which consists of twenty-two patients, is not subjected to the meditation program, just routine care, while twenty-two patients in the study group are subjected to the practice of meditation techniques. **Results:** The mindfulness meditation intervention significantly improved cardiorespiratory parameters (heart rate and respiration rate) and substantially elevated mindfulness levels in adolescents undergoing hemodialysis. **Conclusion:** The study determined that the structured meditation intervention significantly elevated mindfulness levels and markedly improved specific physiological parameters, particularly heart and respiration rates, in adolescents undergoing hemodialysis. **Recommendations:** The application of meditation techniques in hospitals as a complementary nursing intervention for adolescents suffering from various chronic illnesses. Continuous training and workshops should be provided for nurses and healthcare staff working in hemodialysis units on the principles and techniques of meditation and mindfulness practices.

## 1. INTRODUCTION

Chronic kidney disease (CKD) is a progressive condition characterized by the gradual loss of kidney function over time. Commonly known as chronic renal failure or kidney insufficiency, it is characterized by a sustained decline in kidney function that increases the risk of more severe kidney damage. [1] Chronic renal failure is a disorder characterized by the kidneys' inability to concentrate urine, retain electrolytes, or eliminate waste materials. Similar to adults, renal failure in children can manifest as either an acute or chronic illness. Certain instances of acute renal failure resolve without problems; however, dialysis is required for other pediatric patients. Acute renal failure, if it persists, progresses to chronic renal failure, sometimes referred to as end-stage renal disease (ESRD). [2] End-

stage renal disease (ESRD) is the terminal, irreversible phase of chronic kidney disease, characterized by a significant deterioration in renal function, rendering the kidneys incapable of meeting the body's requirements. [3] Individuals diagnosed with ESKD must select from many options for renal replacement therapy, specifically hemodialysis HD and peritoneal dialysis (PD); these treatments may significantly disrupt the patient's life due to their prolonged length or frequent occurrence, dietary limitations, adjustments to lifestyle, adverse side effects, and potential problems that may arise during the sessions. [4] Adolescents with chronic kidney disease and hemodialysis face serious physical and mental health issues, such as stress, anxiety, depression, high blood pressure, and cardiovascular problems. [5] The management of mental health difficulties in adolescents

with chronic kidney disease requires both pharmaceutical and non-pharmacological approaches. [6] Hemodialysis patients require multiple drugs mostly excreted by the kidneys; thus, introducing more medications to enhance their mental health may result in new health complications. Consequently, it is essential to identify non-pharmacological approaches for managing patients' mental health issues. Non-pharmacological approaches, including Complementary and Alternative Medicine (CAM), can alleviate anxiety and depression. [7] Mindfulness meditation enhances adolescents' self-awareness by training them to observe their thoughts and emotions without judgment. As awareness increases, teens become better at recognizing negative thought patterns and emotional triggers associated with anxiety and depression. [8] Regular mindfulness practice significantly reduces symptoms of anxiety and depression in adolescents by decreasing rumination and emotional reactivity; it also helps break the cycle of negative self-evaluation that often maintains depressive states. [9] Mindfulness-based interventions could be particularly effective for adolescent mental health, offering protective benefits during this vulnerable developmental period. [10] Despite a growing body of evidence supporting meditation's benefits in adult chronic illness populations [11] A significant research gap persists regarding its structured application for adolescents with CKD undergoing hemodialysis, especially in specific cultural and healthcare contexts like Iraq [12]. Previous studies often investigate multi-component interventions or broad mindfulness programs, making it difficult to isolate the effect of core, simple techniques that are most feasible in a busy clinical setting [13]. Furthermore, the unique physiological and developmental vulnerabilities of adolescents within nephrology care require tailored investigation. Therefore, this study aims to address this gap by evaluating the effect of a structured, nurse-facilitated meditation program incorporating mindfulness breathing and guided imagery on both physiological parameters (vital signs) and psychological outcomes (mindfulness levels) among adolescents with CKD undergoing maintenance hemodialysis in Iraq. [11]

## 2. METHODOLOGY

A quasi-experimental design study was conducted on all adolescents with chronic kidney disease undergoing hemodialysis in three hemodialysis units located in the Karbala H Al-Hindiya General Hospital in the Holy Governorate, Iraq: Karbala Teaching Hospital for Children and Imam Al-Hasan Al-Mujtaba Teaching Hospital. A non-probability purposive sample selection process to choose 44 adolescents for this study in addition to the 6 patients in the pilot study. The participants were randomly divided into two halves by the lottery method; half of these adolescents will participate in the meditation program, making up the "study group," and the other half of the adolescents will serve as a control group. The data have been collected by using the self-report method to answer the questionnaire. The questionnaire consisted of three parts; the first was concerned with the adolescents' demographic data includes age, sex types, educational level, residency, duration of hemodialysis sessions (hours),

duration of hemodialysis (years), number of dialysis sessions per week, and adolescent ranking in the family. The second part consists of Vital signs, including blood pressure, heart rate, body temperature, and respiratory rate, were recorded before and after the meditation intervention. Measurements were taken 30 minutes into the hemodialysis session to ensure patient stability, as initial treatment phases often involve transient hemodynamic and anxiety-related fluctuations. The third part consists of Child and adolescent mindfulness measure (CAMM). This scale was adapted from Sadik et al. (14) to evaluate mindfulness in children and adolescents. It comprises ten questions. Initially, invert all scores by substituting 0 for 4, 1 for 3, 3 for 1, and 4 for 0 (2 and 6 remain unchanged). The Questionnaire and the Program's Validity: A panel of eleven experts evaluated the content validity of both the meditation program and the study instruments. Seven experts from the University of Baghdad's Faculty of Nursing. The meditation intervention was administered across three structured 35-minute sessions, conducted either individually or in small groups due to patient scheduling constraints and dialysis allocation challenges. Sessions were held in a quiet, dedicated room equipped with a television and padded chairs to ensure comfort. Each session employed a consistent pedagogical approach, beginning with an explanation of the technique's rationale and potential benefits. The core content included guided imagery and mindfulness breathing exercises. Instructional methods comprised lectures, role-playing, demonstration, and participant redemonstration. After completing the three meditation program sessions, participants are instructed to continue practicing the meditation intervention during their hemodialysis sessions over an eight-week period.

## 3. RESULTS

Table -1 illustrates the socio-demographic characteristics of the adolescents with chronic kidney disease undergoing hemodialysis, which included 22 participants in both the study and control groups. The age of participants ranged from 10 to 18 years, with the majority falling in the 16–18 years category in both the study group (40.9%) and the control group (45.5%), and the mean age was comparable between groups:  $14.73 \pm 2.34$  years for the study group and  $14.91 \pm 2.39$  years for the control group. Male participants were predominant in both the study (54.5%) and control group (59.1%). Most participants had basic literacy skills (reading and writing) in both the study (54.5%) and control (50.0%) group. The majority of participants in both the study (68.2%) and control (63.6%) group were on hemodialysis for over two years. The majority of participants in both groups underwent hemodialysis three times per week (95.5% in the study group and 90.9% in the control group). Regarding hemodialysis session duration, four hours was the most common, comprising 86.4% of the study group and 90.9% of the control group. Rank of adolescent in the family was similarly distributed, with half of the participants in each group being second. Most participants resided in urban areas (63.6% of the study group and 72.7% of the control group). Statistical analysis using chi-square tests indicated no significant differences between the study and control

groups across all socio-demographic variables ( $p > 0.05$ ), suggesting that the groups were homogeneous at baseline. Table -2 presents a comparison of adolescents' physiological measurements (vital signs) between the study and control groups before and after the intervention. In the study group, there was a notable decrease in heart rate (from  $99.5 \pm 7.6$  to  $81.3 \pm 6.8$  beats/min) and respiration rate (from  $29.4 \pm 2.2$  to  $20.9 \pm 1.8$  cycles/min) after the intervention, which was statistically significant ( $t = 4.12, p = 0.000$  \*\* and  $t = 3.98, p = 0.000$  \*\*, respectively). In contrast, temperature showed a slight decrease in the study group ( $37.3 \pm 0.4$  to  $37.2 \pm 0.3^\circ\text{C}$ ), but this change was not statistically significant ( $t = 0.85, p = 0.404$ ). Blood pressure measurements both systolic and diastolic remained relatively stable in both groups, with no significant differences observed ( $p > 0.05$ ). In the control group, minor changes occurred in heart rate and respiration rate, but these changes were not statistically significant and were substantially smaller in magnitude compared to the study group.

Table (3) presents the effect sizes (Cohen's d) for changes in physiological measurements following the intervention. The analysis reveals large effect sizes for heart rate and respiration rate (exceeding 1.0), indicating substantial reductions. In contrast, temperature and blood pressure showed only small to negligible effects. This pattern of results confirms the intervention had a strong, yet specific, impact on cardiorespiratory measures rather than a generalized effect on all vital signs.

Table (4) presents the overall mindfulness levels of adolescents according to the CAMM before the meditation intervention in both the study and control groups. The majority of participants in both groups scored at a low level (90.9% in the study group and 86.4% in the control group). A small proportion of participants fell into the moderate category (9.1% in the study group and 13.6% in the control group), and no participants in either group scored at a high level. The mean total CAMM score was similar between groups, with  $21.17 \pm 3.52$  in the study group and  $21.45 \pm 4.11$  in the control group.

Table (5) presents the overall mindfulness levels of adolescents according to CAMM after the meditation intervention in both study and control groups. In the study group, the majority of participants (86.4%,  $n=19$ ) achieved a high level of mindfulness, while 9.1% ( $n=2$ ) were at a moderate level, and only 4.5% ( $n=1$ ) remained at a low level. The mean total score for the study group was  $37.97 \pm 8.13$ , reflecting a marked improvement compared to pre-test scores. Conversely, the control group largely remained at a low mindfulness level, with 86.4% ( $n=19$ ) scoring low, 13.6% ( $n=3$ ) at moderate, and none at a high level, with a mean total score of  $21.94 \pm 4.12$ .

Table (6) presents the statistical comparison of overall adolescents' mindfulness scores according to CAMM between the study and control groups at pre-test. The mean total score for the study group was  $21.17 \pm 3.52$ , while the control group scored  $21.45 \pm 4.11$ . An independent t-test indicated no significant difference between the two groups ( $t = -0.492, p = 0.625$ ), with a very small effect size ( $\eta^2 = 0.006$ ).

#### 4. GENERAL REQUIREMENTS

##### Tables and Figures

##### A. Tables

**Table 1.** Distribution of Study Sample by their Socio-demographic Variables (SDVs)

SDVs	Category	Study Group (n=22)	Control Group (n=22)	$\chi^2$	P-value
Age	10-<12	4 (18.2%)	4 (18.2%)	0.26	0.794
	12-<14	4 (18.2%)	3 (13.6%)		
	14-<16	5 (22.7%)	5 (22.7%)		
	16-18	9 (40.9%)	10 (45.5%)		
	M ± SD	14.73 ± 2.34	14.91 ± 2.39		
Sex	Male	12 (54.5%)	13 (59.1%)	0.10	0.752
	Female	10 (45.5%)	9 (40.9%)		
Educational Level	Read & write	12 (54.5%)	11 (50.0%)	1.123	0.842
	Elementary	4 (18.2%)	5 (22.7%)		
	Intermediate	4 (18.2%)	3 (13.6%)		
	Secondary	2 (9.1%)	3 (13.6%)		
Duration of Haemodialysis (Years)	< 1 year	3 (13.6%)	3 (13.6%)	0.14	0.932
	1-2 years	4 (18.2%)	5 (22.7%)		
	> 2 years	15 (68.2%)	14 (63.6%)		
No. of Haemodialysis/Week	2 sessions	1 (4.5%)	2 (9.1%)	0.081	0.922
	3 sessions	21 (95.5%)	20 (90.9%)		
Duration of HD Session	3 hours	3 (13.6%)	2 (9.1%)	0.392	0.640
	4 hours	19 (86.4%)	20 (90.9%)		
Rank in the Family	First	5 (22.7%)	4 (18.2%)	0.18	0.914
	Second	11 (50.0%)	11 (50.0%)		
	Third & above	6 (27.3%)	7 (31.8%)		
Residence	Urban	14 (63.6%)	16 (72.7%)	0.10	0.752
	Rural	8 (36.4%)	6 (27.3%)		

No. Number; %= Percentage; M = Mean; SD = standard deviation.

**Table 2.** Comparison of Adolescents' Physiological Parameters (Vital Signs) Before and After the Intervention

Item	Study Group Pre-test (Mean ± SD)	Study Group Post-test (Mean ± SD)	Control Group Pre-test (Mean ± SD)	Control Group Post-test (Mean ± SD)	t-value	P-value
Temperature (°C)	37.3 ± 0.4	37.2 ± 0.3	37.6 ± 0.5	37.3 ± 0.4	0.85	0.404
Heart rate (beats/min)	99.5 ± 7.6	81.3 ± 6.8	98.8 ± 8.1	98.5 ± 7.9	4.12	0.00**
Respiration (cycles/min)	29.4 ± 2.2	20.9 ± 1.8	28.9 ± 2.4	29.1 ± 2.0	3.98	0.00**

Systolic BP (mmHg)	129.3 ± 8.5	128.1 ± 7.9	129.5 ± 7.8	129.8 ± 8.2	0.65	0.51
Diastolic BP (mmHg)	89.2 ± 6.2	87.5 ± 5.4	88.0 ± 5.9	86.8 ± 6.1	0.72	0.47

Note: \*t-value from paired t-test;  $p < 0.05$  is significant; \*\* $p < 0.01$  is highly significant; SD= standard deviation.

**Table 3.** Effect Size (Cohen's  $d$ ) for Change from Pre-test to Post- test

Variable	Mean Difference	SD Pooled	Cohen's $d$	Interpretation
Temperature (°C)	-0.4	2.0	0.20	Small effect
Heart Rate (beats/min)	-8.2	7.2	1.14	Large effect
Respiration (cycles/min)	-8.5	2.0	1.25	Large effect
Systolic BP (mmHg)	+1.6	8.2	0.20	Small effect
Diastolic BP (mmHg)	-0.5	5.8	0.09	Negligible effect

**Table 4.** Overall Adolescents' Mindfulness According to CAMM Before Meditation Techniques in Study-control Groups

Weighted Level	Study Group			Control Group		
	No.	%	M ± SD	No.	%	M ± SD
Low	20	90.9	21.17 ± 3.52	19	86.4	21.45 ± 4.11
Moderate	2	9.1		3	13.6	
High	0	0.0		0	0.0	
Total	22	100		22	100	

M: Mean for total score, SD: Standard Deviation for total score (Low = 10 – 23.33, Moderate= 23.34 – 36.66, High = 36.67 – 50)

**Table 5.** Overall Adolescents' Mindfulness after Meditation Techniques in Study-control Groups.

Weighted Level	Study Group			Control Group		
	No.	%	M ± SD	No.	%	M ± SD
Low	1	4.5	37.97 ± 8.13	19	86.4	21.94 ± 4.12
Moderate	2	9.1		3	13.6	
High	19	86.4		0	0.0	
Total	22	100		22	100	

M: Mean for total score, SD: Standard Deviation for total score (Low = 10 – 23.33, Moderate = 23.34 – 36.66, High = 36.67 – 50)

**Table 6.** Statistical Variations in Adolescents' Mindfulness According to CAMM between Study and Control Groups (Pre-test)

Groups	Mean ± SD	t (df=42)	$\eta^2$	Sig (p-value)
Study	21.17 ± 3.52	-0.492	0.006	0.625
Control	21.45 ± 4.11			

level at 0.05. M: Mean, SD: Standard deviation, t: t-test, d.f: Degree of freedom,  $\eta^2$ = Eta squared; Sig: Significance level at 0.05.

## 5. DISCUSSION

### Discussion of the socio-demographic characteristics of the study samples.

mean age of participants in the study group was  $14.73 \pm 2.34$  years, with the largest proportion falling within the 16-18 age bracket (40.9%). This demographic finding is consistent with the authors [14]. Their research included thirty-two adolescents with a mean age of  $13.9 \pm 2.0$  years. Males dominated both the study (54.5%) and control (59.1%) groups in this study. This result is consistent with the authors [15], where 60% of the children were boys, and the authors [16] which mentioned that more than half of the participants in hospitalization were male. The study found that 54.5% of study participants and 50.0% of control participants had elementary education. This supports the authors [17], who observed that dialysis patients had more school absenteeism and inferior academic performance than their healthy peers and those with pre-dialysis CKD. Other study by the authors [18] discovered that 69% of teenagers attended elementary school. Most study participants (68.2%) and control participants (63.6%) had been undergoing hemodialysis for more than two years. The results match [19], who found that 42% of teenagers had been on hemodialysis for over four years. 95.5% of study participants and 90.9% of control participants performed hemodialysis three times a week. This supports the authors [20] found that nearly two-thirds of the children evaluated had three weekly hemodialysis treatments. The current study found that 50% of adolescents in each group were second in family rank. Similarly, other authors [21] revealed that only 42.5% of respondents were ranked as the second child in the family. The study demonstrated that 63.6% of participants lived in urban area. Research by other authors [22,23] in Iraq confirms that over half of the population (56.0%) lives in urban areas.

### 2. Discussion of physiological parameters (vital signs) for the study sample

The findings of this study demonstrate a differential impact of the meditation intervention on various physiological parameters following the meditation intervention. As shown in Table 3-4, large effect sizes (Cohen's  $d > 1.0$ ) were observed for heart rate (HR), and respiration rate (RR) is consistent with findings reported in numerous studies demonstrating that meditation practices significantly attenuate these autonomic parameters. For example, [24] a systematic review concluded that integrated yoga and meditation interventions consistently lead to a lower resting heart rate and that paced breathing techniques are a key pathway for acute autonomic modulation. Similarly, contemporary study of the author [25]. that research on mindfulness-based practices. For instance, an 8-week Mindfulness-Based Stress Reduction (MBSR) program was shown to significantly decrease respiration rate compared to a control group, demonstrating a measurable effect (Cohen's  $*d = -0.41$ ).

### 3. Discussion of the effect of the meditation intervention on mindfulness level:

Findings demonstrated that there was a highly significant increase in mindfulness of adolescents, with the mean score rising from  $21.17 \pm 3.52$  at pre-test to  $37.97 \pm 8.13$  at post-test. The paired t-test confirmed this improvement was

statistically significant ( $t = 12.48, p < 0.001$ ), with a substantial effect size (Cohen's  $d = 1.90$ ). These findings are in the same lines as Basma R. Abdel Sadik's [26,27] studies, whose aim was to evaluate the effect of the meditation technique on the psychological and physical body change in children with chronic kidney disease on hemodialysis. A purposive sample of (47) children undergoing hemodialysis therapy used the Child and Adolescent Mindfulness Measure tool. The study revealed that the majority of the studied children had a low level of mindfulness at the pre-application meditation technique, while more than two-thirds of them had a high level of mindfulness at the post-application meditation technique. The researcher contends that the increase in adolescent mindfulness is not coincidental. The increase is probably because meditation is introspective, which fits with teenagers' need to learn more about themselves. In short, meditation provides them a structured way to look at and understand how their identity is changing.

## 6. CONCLUSIONS

In conclusion, the implemented meditation program proved to be a safe, feasible, and effective non-pharmacological intervention. It successfully addressed both physiological instability and psychological distress. Physiologically, the intervention led to statistically significant improvements in key cardiorespiratory parameters. Specifically, participants in the study group exhibited a substantial reduction in heart rate and respiration rate post-intervention, with large effect sizes confirming the strength of this effect. This indicates that meditation can effectively modulate autonomic nervous system activity, promoting a state of physiological calm during hemodialysis sessions. Psychologically, the intervention resulted in a marked and highly significant enhancement of mindfulness levels. The majority of adolescents in the study group progressed from low to high levels of mindfulness, as measured by the CAMM.

## RECOMMENDATIONS

Based on the results of the study, the researcher recommended the application of meditation techniques in hospitals and hemodialysis centers as a complementary nursing intervention for adolescents suffering from a chronic illness. Carry out longitudinal studies to evaluate the long-term effects of continuous meditation practice on anxiety, depression, mindfulness, and physiological parameter outcomes in this patient population across several years.

## AUTHORS' DECLARATION:

We confirm that all the Figures and Tables in the manuscript belong to the current study.

## CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this study.

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