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Araştırma Makalesi / Research Article

Hemodiyaliz Hastalarında Doğa Temelli Ses Uygulamasının Yorgunluk ve Hasta Konforuna Etkisi: Ön Test-Son Test Yarı Deneysel Çalışma

Nature-Based Sounds to Improve Fatigue and Comfort During Hemodialysis: A Pre-Post Test Experimental Study

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ÖZET

Kronik böbrek yetersizliğinin tedavisinde sık kullanılan tedavi seçeneklerinden biri hemodiyalizdir. Fakat hemodiyaliz yorgunluk, hipotansiyon, üremik kaşıntı, deride kuruluk, ağrı, kas krampları, bulantı, kusma, konforda bozulma gibi çeşitli sorunlara neden olmaktadır. Bu çalışmanın amacı, hemodiyaliz sırasında doğa temelli ses uygulamasının hemodiyaliz hastalarının yorgunluk ve hasta konforu üzerindeki etkisini belirlemektir. Bu çalışma ön-son test yarı deneysel bir çalışmadır. Bu çalışma bir devlet hastanesinin hemodiyaliz ünitesinde gerçekleştirilmiştir. En az altı aydır hemodiyaliz tedavisi gören toplam 54 kronik böbrek yetmezliği hastası müdahale (30 hasta) ve kontrol gruplarına (24 hasta) ayrıldı. Veriler hasta bilgi formu, Piper Yorgunluk Ölçeği ve Hemodiyaliz Hasta Konfor Ölçeği kullanılarak toplandı. Doğa temelli ses uygulamasından sonra, Piper yorgunluk ölçeği puanları (6.074 ± 1.1'e karşı 6.947 ± 1.6) anlamlı olarak daha düşükken, hemodiyaliz konfor ölçeği puanları (32.0 ± 2.8'e karşı 29.2 ± 4.3) müdahale grubunda kontrol grubuna göre anlamlı olarak daha yüksekti ($p<0.001$). Doğa temelli ses uygulamasının, hemodiyaliz tedavisi sırasında kronik böbrek yetmezliği olan hastalarda yorgunluğu ve konforu iyileştirdiği bulundu.

Anahtar kelimeler: Doğa sesi, Hasta konforu, Hemodiyaliz, Hemşirelik, Yorgunluk

ABSTRACT

Hemodialysis is one of the most used treatment options in the treatment of chronic renal failure. However, hemodialysis causes various problems such as fatigue, hypotension, uremic itching, dry skin, pain, muscle cramps, nausea, vomiting, and deterioration in comfort. This study aimed to evaluate the effect of nature-based sound application on fatigue and patient comfort during hemodialysis. This was a pre-post test experimental study. This study was conducted in the hemodialysis unit of a public hospital. A total of 54 patients with chronic renal failure receiving hemodialysis treatment for at least six months were divided into the intervention (30 patients) and control groups (24 patients). Data were collected using patient information form, the Piper Fatigue Scale, and Hemodialysis Patient Comfort Scale. After nature-based sound application, scores of Piper fatigue scale (6.074 ± 1.1 vs. 6.947 ± 1.6) were significantly lower, whereas scores of the hemodialysis comfort scale (32.0 ± 2.8 vs 29.2 ± 4.3) were significantly higher in the intervention group than in the control group ($p<0.001$). Patients with chronic kidney failure who receive hemodialysis have been found to benefit from the use of nature-based sound to improve fatigue and comfort.

Keywords: Fatigue, Hemodialysis, Nature-Based Sounds, Nursing, Patient Comfort

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INTRODUCTION

Chronic renal failure is one of the chronic diseases that adversely affects the quality of life of the individual by progressing to renal dysfunction and end-stage renal disease (Charles & Ferris, 2020; Evans et al., 2022). Hemodialysis remains the most commonly utilized treatment for managing chronic renal failure, serving as a critical intervention for the survival of patients with chronic kidney disease. Hemodialysis is an important treatment modality for the survival of patients with chronic kidney disease(Çor & Soysal, 2023; Panthi et al., 2023; Rini, Rahmayani, Sari, & Lestari, 2021). However, hemodialysis causes patients physical, psychological, social, economic, and spiritual problems(Rini et al., 2021).

Fatigue is a complex problem that is common in patients with chronic renal failure and involves physical, psychological, and emotional problems(Bossola, Hedayati, Brys, & Gregg, 2023; Parker Gregg, Bossola, Ostrosky-Frid, & Susan Hedayati, 2021). Although fatigue may be disease-related, it is also frequently observed after hemodialysis treatment. In the literature, the prevalence of fatigue after dialysis is reported to be 85% (Bossola et al., 2018; Bossola, Monteburini, et al., 2023). The fatigue that occurs with the start of a dialysis session increases gradually during hemodialysis (Brys et al., 2020). This symptom decreases patients' physical, psychological, and social comfort, reducing their overall quality of life. For example, in a study examining the relationship between itching, fatigue, and quality of life in hemodialysis patients, it was found that pruritus increased fatigue and negatively affected quality of life(Pehlivan Köksal, Tezel, & Nural, 2024). In addition, it has been reported that the symptoms seen in hemodialysis patients affect the comfort level and quality of life of individuals, and patients with effective symptom control experience a sense of relief(Gülay, Özdemir Eler, Ökdem, & Akgün Çıtak, 2020).

In the literature, there are studies examining the effect of non-pharmacological applications such as back massage, hand-foot massage, footbath, aromatherapy, exercise, reiki, and acupressure in the management of fatigue and patient's comfort (Ahmady, Rezaei, & Khatony, 2019; Bagheri-Nesami, Shorofi, Nikkhah, Espahbodi, & Ghaderi Koolaee, 2016; Çeçen & Lafcı, 2021; Güler, Şahan, Ülker, & Sipahioğlu, 2024; Hassanzadeh, Kiani, Bouya, & Zarei, 2018; Karadag & Samancioglu Baglama, 2019; Malini et al., 2022; Unal & Balci Akpinar, 2016; Yeşil Bayülgen & Gün, 2023). One of these applications, nature-based sounds is one of the music-based non-pharmacological methods used in recent years to manage some symptoms in patients (Akarsu, Koç, & Ertuğ, 2019). Music-based practices have been reported to be an effective approach in the management of symptoms such as pain and anxiety in patients with chronic renal failure (Burrai et al., 2020; Burrai, Micheluzzi, Zito, Pietro, & Sisti, 2014; Wu, Ji, Yao, Wang, & Jiang, 2021).

Although the effects of music therapy on symptoms in hemodialysis patients have been extensively studied, no research has specifically investigated the impact of nature-based sounds on fatigue and comfort in this population. Furthermore, it remains uncertain whether nature-based sounds can offer similar benefits in symptom management. This study aims to address this gap by evaluating the effects of listening to nature-based sounds during hemodialysis on fatigue and patient comfort, thereby contributing to the development of innovative non-pharmacological care strategies for hemodialysis patients.

This study aimed to determine the effect of listening to nature-based sounds during hemodialysis on fatigue and patient comfort. The following hypotheses were tested for this study:

H_1: Nature-based sound application is effective in improving fatigue during hemodialysis in patients with chronic kidney failure.

H_2: Nature-based sound application is effective in improving comfort during hemodialysis in patients with chronic kidney failure.

METHODS

Study Design, Participants and Setting

This study was carried out as a single-blind parallel group, a pre-post test randomized controlled trial with an interventional design incorporating pre-test and post-test assessments. This study has been registered at ClinicalTrials.gov, and its trial number was NCT06165211.

The study sample consisted of patients receiving treatment in the Hemodialysis Unit of Bartın State Hospital. Research data were collected between September 2022 and February 2023. The inclusion criteria were; over 18 years of age, receiving hemodialysis treatment for at least six months, having no hearing and speech impairments no cognitive disability, and having vital signs within normal values.

Participants who did not listen to the nature-based audio application for 30 minutes were determined as the criterion for exclusion from the sample. The sample size calculation was performed based on a similar study on this subject (Haghi, Zadeh, & Vafayee, 2019). Based on calculations with a 5% margin of error ($\alpha = 0.05$) and 80% power ($1-\beta = 0.80$), the sample size required for a one-sample t-test ($d = 0.34$) was determined to be 28 for both the intervention and control groups using Power analysis (G*Power 3.1.9.2). Considering the losses during the research process, 30 participants were included in both groups. However, there was a total of 63 patients receiving hemodialysis treatment. Therefore, although it was calculated how many people would be included in the sample, since the total number of patients receiving treatment in the hemodialysis unit was 63, participants who met the inclusion criteria and agreed to participate in the study were included in the study. No sampling method was used as in similar studies in the literature (Kuzay & İlçe, 2023). The 54 patients who met the inclusion criteria and agreed to participate in the study were given a pseudonym and randomized to the intervention and control groups (https://www.randomizer.org/) using the tool on the "Research Randomizer" website. A total of 54 patients, 30 in the intervention group and 24 in the control group, constituted the research sample (Figure 1 flow diagram of the study).

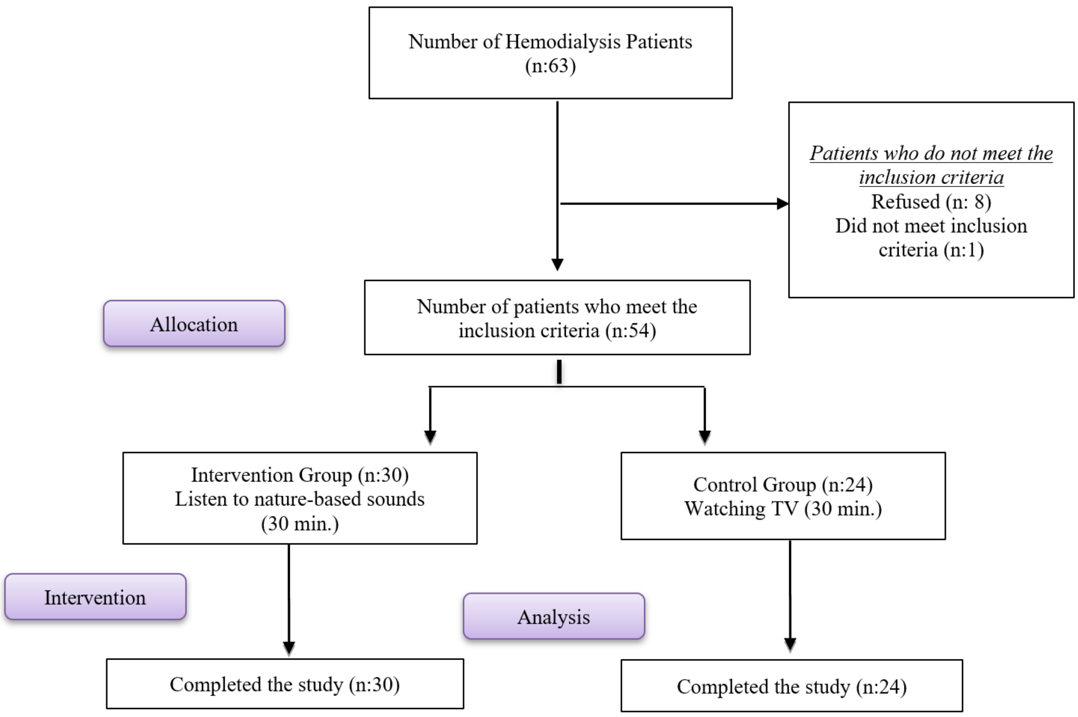

Figure 1. Flow diagram of the study.

Data Collection

All patients were evaluated during a single hemodialysis session. Before the application, data were collected from patients who came on different days and hours so that the patients assigned to the intervention and control groups would not see each other. Before the application, the purpose of the study was explained to the patients, their written verbal consent was obtained, and the pre-tests were completed. For nature-based sound, the sounds of bird songs and leaves rustling in the wind recommended for fatigue were selected after consulting a music therapist. As suggested in the literature, nature-based sound was played to the patients for 30 minutes with over-the-head headphones and MP3(Kim & Jeong, 2021). After the conclusion of the hemodialysis session, the researcher administered the Piper Fatigue Scale and Hemodialysis Comfort Scale to the patients.

Interventions

After the hemodialysis session started, MP3 players and over the head headphones were provided to the intervention group and nature-based sounds (the sounds of bird songs and leaves rustling in the wind) were played for 30 minutes (to minimize the effect of surrounding noise). Standard care of the hemodialysis unit was provided to the control group. The control group was allowed to watch the T.V. program of their choice from the bedside T.V. unit during hemodialysis.

Data collection

The data were collected by the researcher in the Hemodialysis Unit of Bartın State Hospital by face-to-face interview while the patients were undergoing hemodialysis between September 2022 and March 2023. Patients were assigned to the intervention and control groups based on their dialysis schedules. Specifically, patients attending dialysis sessions on Monday, Tuesday, and Saturday (morning and afternoon) constituted the control group, while those attending on Wednesday, Thursday, and Friday (morning and afternoon) formed the intervention group. Patient Identification Form and pre-test (Piper Fatigue Scale and Hemodialysis Comfort Scale) were administered to the patients before the hemodialysis session. For the intervention group, in addition to these assessments, nature-based sounds were played through headphones for 30 minutes starting from the one hour of the dialysis session. Post-tests were administered immediately after the end of the hemodialysis session.

Data Collection Tools

Descriptive Information Form: This form comprises 15 questions formulated in accordance with existing literature. It is divided into two sections, encompassing sociodemographic characteristics and disease-related information (Ahmady et al., 2019; Bagheri-Nesami et al., 2016; Çeçen & Lafcı, 2021; Hassanzadeh et al., 2018; Karadag & Samancioglu Baglama, 2019; Malini et al., 2022; Unal & Balci Akpinar, 2016).

Piper Fatigue Scale (PFS): The Piper Fatigue Scale (PFS) was developed by Piper et al. in 1998. The Turkish validity and reliability of the scale were established, with a Cronbach's alpha coefficient of 0.89. The scale comprises four subscales and a total of 22 items distributed across behavioral (six items), affect (five items), affective (five items), and cognitive (six items) domains. Subscale scores and overall fatigue scores were derived from these items, with an additional five items used in the score calculations. Three open-ended questions were asked to elucidate the underlying causes of fatigue. To calculate the scores, the average score was determined by summing all 22 item scores and dividing by the total number of items (Can et al., 2004).

Hemodialysis Comfort Scale (HDCS): The hemodialysis comfort scale was developed by Orak et al. to determine the comfort level of patients receiving hemodialysis treatment. Comprising nine items, the scale encompasses two subdimensions: relaxation and coping. The total score and subdimension evaluations were determined by calculating the mean score. The scale demonstrated a Cronbach's alpha value of 0.87, indicating high internal consistency. Higher scores reflect greater levels of comfort (Orak, Cınar, & Kartal, 2017).

Ethical considerations

Ethical permission was obtained from the Ethics Committee Permission from Bartın University Social and Human Sciences Ethics Committee (Protocol no: 2021-SBB-0439) to conduct the study. Institutional permission was also obtained from the Bartın Provincial Health Directorate (No: 2200029978). The patients were informed about the project's purpose, that the data would be used for scientific purposes, and that participation in the project was voluntary, and verbal and written informed consent was obtained from the participants. We affirm that the study adheres to the principles outlined in the Helsinki Declaration.

Data analysis

In the statistical analysis phase of the study, the score points of all dimensions of the hemodialysis comfort scale and Piper fatigue scale applied to the participants before and after the hemodialysis procedure were calculated. "Shapiro-Wilk" test was used for normality analysis. Since the data were not suitable for normal distribution, nonparametric tests were applied. Intergroup comparisons of the characteristics of the intervention and control groups were analyzed with the "Chi-Square Independence Test," "Fisher's Test," "Mann-Whitney-U Test," and "Wilcoxon paired samples test". Statistical findings of the study are presented as n (Number of observations), Mean (Average), S.D. (Standard Deviation), and p (Significance value). The statistical significance level was considered as "$p<0.05$" in all calculations and interpretations. Statistical analysis of the data was performed using the IBM SPSS 27 statistical package program.

RESULTS

The mean age of the participants in the study was 54.3 years (SD=2.98) for the intervention group and 56.0 years (SD=2.72) for the control group ($p>0.05$). Table 1 shows the comparison results of the characteristics of the participants in the intervention and control groups. When these results are examined, there is no statistically significant relationship between gender, marital status, education level, income level, occupational groups, with whom they live, hemodialysis diagnosis, presence of a different chronic disease, regular exercise, smoking status, and alcohol consumption status of the individuals in the intervention and control groups ($p>0.05$).

Table 2 shows the results of intragroup and intergroup comparisons of behavioral, affective, sensory, and cognitive scores of the PFS (Piper Fatigue Scale) before and after hemodialysis of the participants in the intervention and control groups.

When the intragroup comparison results of the individuals in the control group were examined, a statistically significant difference was found between the behavioral, affective, sensory, and cognitive scores of the PFS before and after hemodialysis ($p<0.05$). When these differences were examined, individuals in the control group had significantly higher PFS and behavioral, affective, sensory, and cognitive scores after hemodialysis than before.

When the intragroup comparison results of the individuals in the intervention group were examined, a statistically significant difference was found between the behavioral, affective, emotional, sensory, and cognitive scores of the PFS before and after hemodialysis ($p<0.05$). When these differences were examined, the behavioral, affective, sensory, and cognitive scores of the individuals in the intervention group were significantly lower after hemodialysis. There is a statistically significant difference between the PMS scores of the intervention and control groups before hemodialysis ($p<0.05$). When this difference was examined, the individuals in the intervention group had significantly higher PMI scores before hemodialysis. In addition, according to the findings, there was a statistically significant difference between the intervention and control groups' behavioral, affective, sensory, and cognitive scores before hemodialysis (p>0.05). There is no statistically significant difference between the behavioral and PFS scores of the intervention and control groups after hemodialysis (p>0.05). In addition, there is a statistically significant difference between the intervention and control groups' affect, sensory, and cognitive scores after hemodialysis (p<0.05). When these differences are examined, the individuals' affective, sensory, and cognitive scores in the intervention group after hemodialysis are significantly lower than in the control group.

Table 1. Characteristics of the participants in the intervention and control groups

Variable	Control (n=24)		Intervention (n=30)		Test Statistic	p
	n	%	n	%		
Gender						
Male	8	33.33	10	33.33	<0.001	1.000^{p}
Female	16	66.67	20	66.67		
Marital status						
Single	3	12.50	6	20.00		
Married	19	79.17	19	63.33	1.680	0.432^{f}
Widow	2	8.33	5	16.67		
Level of education						
Primary School	18	75.00	19	63.33		
High School	6	25.00	9	30.00	2.736	0.255^{f}
University	0	-	2	6.67		
Occupation						
Housewife	16	66.67	19	63.33		
Worker	2	8.33	6	20.00		
Officer	2	8.33	3	10.00	3.471	0.482^{f}
Retired	3	12.50	2	6.67		
Not working	1	4.17	0	-		
Level of income						
Bad	5	20.83	3	10.00		
Middle	16	66.67	17	56.67	3.844	0.146^{f}
Well	3	12.50	10	33.33		

Time of diagnosis of CRF						
6-12 months	8	33.33	9	30.00		
1-5 years	9	37.50	12	40.00	0.072	0.965P
More than 5 years	7	29.17	9	30.00		
Hemodialysis time						
6-12 months	9	37.50	10	33.33		
1-5 years	9	37.50	12	40.00	0.102	0.951P
More than 5 years	6	25.00	8	26.67		
Do you have any other chronic diseases?						
Chronic heart failure	2	8.33	2	6.67		
Diabetes	0	-	7	23.33		
Hypertension	7	29.17	3	10.00		
No	9	37.50	13	43.33	14.297	0.513P
CHF+DM+HT	4	16.67	5	16.67		
DM+HT	2	8.33	0	-		
Regular exercise						
Yes	6	25.00	4	13.33	0.311	0.228f
No	18	75.00	26	86.67		
Smoking						
Yes	4	16.67	5	16.67		
No	20	83.33	24	80.00	1.194	0.551f
Dropped out	0	-	1	3.33		
Drinking alcohol						
No	23	95.83	28	93.33	1.000	0.585f
Dropped out	1	4.17	2	6.67		
Age (mean/ SD)	56	13.34	54.4	16.34	-0.810	0.418
How many times a week do you receive hemodialysis?	2.417	0.504	2.467	0.571	0.459	0.646

n: Number of observations CHF: Chronic heart failure CRF: chronic renal failure DM: Diabetes HT: Hypertension SD: Standard deviation f: Fisher Exact test p: Pearson's correlation test

Table 2. Comparisons of Participants' Dimensions of the Piper Fatigue Scale

Subdimension	Control (n=24)				Intervention (n=30)				Comparisons between groups	
	Mean	SD	Min	Max	*Mean*	SD	Min	Max	*U*	p
PFS (before)	6.235	1.540	1.00	8.59	6.842	0.991	4.18	8.09	2.073	**0.038**
PFS (after)	6.947	1.622	1.86	9.05	6.074	1.108	3.77	7.82	-3.021	0.003
Within group comparison	W= 3.645 p<**0.001**				W=-4.744 p<**0.001**				r: 0.215	
Behavioral (before)	6.410	1.975	1.00	10.00	6.978	1.876	2.17	8.50	1.779	0.075
Behavioral (after)	6.979	1.995	1.50	10.00	6.217	1.860	1.50	8.50	-1.467	0.142
Within group comparison	W= 3.112 p=**0.002**				W=-4.605 **p<0.001**					
Emotion (before)	6.992	1.677	1.00	10.00	7.487	1.023	5.40	9.80	1.440	0.150
Emotion (after)	7.608	1.722	1.80	10.00	6.607	1.000	4.80	9.40	-3.216	**0.001**
Within group comparison	W= 3.053 p=**0.002**				W=-4.658 **p<0.001**					
Sensory (before)	6.342	1.491	1.00	8.20	7.027	1.114	4.20	8.80	1.807	0.071
Sensory (after)	7.075	1.590	2.00	9.60	6.187	1.225	3.80	8.40	-2.715	**0.007**
Within group comparison	W= 3.596 p<**0.001**				W=-4.774 p<**0.001**					
Cognitive (before)	5.340	1.521	1.00	7.67	6.017	1.087	3.33	7.67	1.648	0.099
Cognitive (after)	6.257	1.728	2.17	8.50	5.394	1.095	2.67	7.00	-2.388	**0.017**
Within group comparison	W= 3.889 p<**0.001**				W=-4.077 p<**0.001**					

PFS (Piper Fatigue Scale) SD: Standard deviation Min: Minimum Maks: Maximum W: Wilcoxon paired samples test
U: Mann Whitney U test, r: effect size

Table 3 shows the results of intragroup and intergroup comparisons of the participants in the intervention and control groups in terms of overcoming and relaxation scores of the hemodialysis comfort scale before and after hemodialysis.

When the intragroup comparison results of the individuals in the control group were examined, a statistically significant difference was found between the pre and post-hemodialysis HCS, overcoming, and relaxation scores (p<0.05). According to these results, the participants in the control group had significantly lower HCS, coping, and relaxation scores after hemodialysis than before hemodialysis. When the intragroup comparison results of the individuals in the intervention group were examined, a statistically significant difference was found between the scores of HCS, coping, and relaxation before and after hemodialysis (p<0.05). According to these differences, the participants in the intervention group had significantly higher HCS and coping scores after hemodialysis than before hemodialysis. According to the findings, a statistically significant difference exists between the coping scores of the individuals in the intervention and control groups measured before hemodialysis (p<0.05). According to this result, individuals in the intervention group had significantly lower coping scores before hemodialysis. In addition, there was no statistically significant difference between the hemodialysis comfort and relaxation scores of the individuals in the intervention and control groups measured before hemodialysis (p>0.05).

Table 3. Comparisons of Participants' Dimensions of Hemodialysis Comfort Scale

Subdimension	Control (n=24)				Intervention (n=30)				Comparisons between groups	
	Mean	SD	Min	Maks	*Mean*	SD	Min	Maks	*U*	p
HCS (before)	31.000	3.923	26.00	44.00	29.233	2.582	25.00	35.00	-1.798	0.072
HCS (after)	29.208	4.344	23.00	44.00	32.033	2.895	27.00	40.00	3.306	**0.001**
Within group comparison	W=-2.881 p=**0.004**				W= 4.224 p<**0.001**				r: 0.193	
Overcome (before)	16.292	3.839	12.00	30.00	14.400	2.594	10.00	20.00	-2.112	**0.035**
Overcome (after)	14.750	4.067	10.00	30.00	17.200	2.797	12.00	25.00	3.369	**0.001**
Within group comparison	W=-2.776 p=**0.006**				W= 4.224 p=**0.004**					
Relaxation (before)	14.708	0.690	13.00	15.00	14.833	0.913	10.00	15.00	1.593	0.111
Relaxation (after)	14.458	1.062	11.00	15.00	14.833	0.913	10.00	15.00	2.238	**0.025**
Within group comparison	W=-1.732 p=0.083				W= 1 p=1.000					

HCS (Haemodialysis comfort scale) SD: Standard deviation Min: Minimum Maks: Maximum
W: Wilcoxon paired samples test U: Mann Whitney U test, r: effect size

When the findings are examined, there is a statistically significant difference between the hemodialysis comfort, coping, and relaxation scores of the individuals in the intervention and control groups measured after hemodialysis (p<0.05). When these differences are examined, the hemodialysis comfort, coping, and relaxation scores of the individuals in the intervention group measured after hemodialysis are significantly higher than the control group.

DISCUSSION

Hemodialysis is one of the most frequently used methods in the treatment of patients with chronic renal failure. However, hemodialysis causes various side effects in patients (Sondergaard, 2020). This study aimed to determine the impact of nature-based sound on fatigue and patient comfort during hemodialysis sessions. Current study found that the application of nature-based sound was an effective intervention to reduce fatigue and increase comfort during hemodialysis. It is reported that musical sounds have positive effects on the nervous system. In literature, studies are reporting positive effects of different music genres on pain, anxiety, depression, and blood pressure in hemodialysis patients (Burrai et al., 2020; Hagemann, Martin, & Neme, 2019; Imani, Jalali, Salari, & Abbasi, 2021; Inayama et al., 2022; Kim & Jeong, 2021; Wu et al., 2021). The positive effects of nature sound on human health have been explained in different theoretical frameworks. The Attention Restoration Theory (ART) suggests that exposure to nature helps improve mental fatigue and reduces anxiety, while the Stress Recovery Theory posits that nature facilitates physiological recovery by activating the parasympathetic nervous system, contributing to a reduction in stress levels (Gould Van Praag et al., 2017). These theoretical perspectives may help explain the beneficial impact of nature-based sound interventions in the study.

The results of the studies examining the effect of music on fatigue in hemodialysis patients in the literature were similar to our study. The study by Eroğlu et al. (2022) found that classical music and relaxation exercise twice a week for eight weeks decreased the severity of fatigue in the fourth week compared to the control group (Eroglu & Gok Metin, 2022). Another study, 12 sessions of classical and modern music were played for a month and found to be effective in improving fatigue (Haghi et al., 2019). The results were similar in studies examining music's effect on fatigue in different patient groups. Music therapy was found to reduce fatigue in studies examining the effect of music on fatigue in different oncology patient groups (Alcântara-Silva et al., 2018; Miladinia et al., 2024; Reimnitz & Silverman, 2020). Another group of patients with heart failure, performed nature sounds and Benson relaxation exercises for 20 minutes in the morning and evening for three days and found a significant difference in their fatigue levels compared to the control group (Seifi, Najafi Ghezeljeh, & Haghani, 2018). In a recent meta-analysis, the effect of nature sounds on health was examined. While the majority of the fifteen study outcomes in this meta-analysis examined the effect of nature sounds on anxiety, stress, emotional and cognitive functions, only one study examined its effect on fatigue (Zhu et al., 2024). According to these results, it can be reported that nature-based sounds, similar to music-based practices, have a positive effect on emotional, cognitive and physiological healing. In our study, it can be reported that nature-based sounds are particularly effective in providing emotional and cognitive relaxation and are effective in reducing the severity of fatigue. Also, in theories explaining the restorative effect of nature on healing, it is stated that nature improves physical, mental and emotional well-being as a whole (Kaplan, 1995).

Comfort is negatively affected in hemodialysis patients due to disease and treatment-related reasons. Nurses can improve patient comfort with appropriate interventions (Güler, Şahan, Ülker, & Sipahioğlu, 2023). According to this study results, listening to nature-based sounds during hemodialysis increased the comfort of patients. Although there are no studies in the literature examining the effect of nature-based sound or music application on comfort, there are studies examining the effect of foot bath, aromatherapy, reiki different applications on comfort (Güler et al., 2023; Ozen et al., 2022; Yeşil Bayülgen & Gün, 2023). The effect of music applications on patient comfort was examined in different patient groups. It was found that 20 minutes of music application during cystoscopy had no effect on patient comfort (Durgun & Yaman Aktaş, 2023). There was a significant improvement in the comfort of patients who played Ajam Ashiran maqam of Turkish Classical Music for 30 minutes during colonoscopy (Çelebi, Yılmaz, Şahin, & Baydur, 2020). Music was played for 45 minutes before the upper gastroscopy procedure, positively affecting the patient's comfort (Aksu, 2023). When the effect of music therapy on comfort in different patient groups is examined, it can be thought that the duration of listening to music, the type of music and the way of application have an effect on improving comfort. The method of our study is similar to those of these studies, in which music is played with overhead headphones, which effectively improves patient comfort.

This study has limitations. The fact that the nature sound application was only applied for 30 minutes in a single session and repeated measurements were not made constitutes an essential limitation in evaluating the effectiveness of the application. Similar studies in the literature show that music applied at different intervals such as eight weeks, 12 sessions, three days a week (Eroglu & Gok Metin, 2022; Haghi et al., 2019;

Seifi et al., 2018). Current study found that listening to nature sounds increased the fatigue and comfort of hemodialysis patients. However, these results cannot be generalized to all hemodialysis patients, and studies with high evidence power are needed.

Hemodialysis is one of the most frequently used methods in the treatment of patients with chronic renal failure. However, hemodialysis causes various side effects in patients (Sondergaard, 2020). This study aimed to determine the impact of nature-based sound on fatigue and patient comfort during hemodialysis sessions. Current study found that the application of nature-based sound was an effective intervention to reduce fatigue and increase comfort during hemodialysis. It is reported that musical sounds have positive effects on the nervous system. In literature, studies are reporting positive effects of different music genres on pain, anxiety, depression, and blood pressure in hemodialysis patients (Burrai et al., 2020; Hagemann, Martin, & Neme, 2019; Imani, Jalali, Salari, & Abbasi, 2021; Inayama et al., 2022; Kim & Jeong, 2021; Wu et al., 2021). The positive effects of nature sound on human health have been explained in different theoretical frameworks. The Attention Restoration Theory (ART) suggests that exposure to nature helps improve mental fatigue and reduces anxiety, while the Stress Recovery Theory posits that nature facilitates physiological recovery by activating the parasympathetic nervous system, contributing to a reduction in stress levels (Gould Van Praag et al., 2017). These theoretical perspectives may help explain the beneficial impact of nature-based sound interventions in the study.

The results of the studies examining the effect of music on fatigue in hemodialysis patients in the literature were similar to our study. The study by Eroğlu et al. (2022) found that classical music and relaxation exercise twice a week for eight weeks decreased the severity of fatigue in the fourth week compared to the control group (Eroglu & Gok Metin, 2022). Another study, 12 sessions of classical and modern music were played for a month and found to be effective in improving fatigue (Haghi et al., 2019). The results were similar in studies examining music's effect on fatigue in different patient groups. Music therapy was found to reduce fatigue in studies examining the effect of music on fatigue in different oncology patient groups (Alcântara-Silva et al., 2018; Miladinia et al., 2024; Reimnitz & Silverman, 2020). Another group of patients with heart failure, performed nature sounds and Benson relaxation exercises for 20 minutes in the morning and evening for three days and found a significant difference in their fatigue levels compared to the control group (Seifi, Najafi Ghezeljeh, & Haghani, 2018). In a recent meta-analysis, the effect of nature sounds on health was examined. While the majority of the fifteen study outcomes in this meta-analysis examined the effect of nature sounds on anxiety, stress, emotional and cognitive functions, only one study examined its effect on fatigue (Zhu et al., 2024). According to these results, it can be reported that nature-based sounds, similar to music-based practices, have a positive effect on emotional, cognitive and physiological healing. In our study, it can be reported that nature-based sounds are particularly effective in providing emotional and cognitive relaxation and are effective in reducing the severity of fatigue. Also, in theories explaining the restorative effect of nature on healing, it is stated that nature improves physical, mental and emotional well-being as a whole (Kaplan, 1995).

Comfort is negatively affected in hemodialysis patients due to disease and treatment-related reasons. Nurses can improve patient comfort with appropriate interventions (Güler, Şahan, Ülker, & Sipahioğlu, 2023). According to this study results, listening to nature-based sounds during hemodialysis increased the comfort of patients. Although there are no studies in the literature examining the effect of nature-based sound or music application on comfort, there are studies examining the effect of foot bath, aromatherapy, reiki different applications on comfort (Güler et al., 2023; Ozen et al., 2022; Yeşil Bayülgen & Gün, 2023). The effect of music applications on patient comfort was examined in different patient groups. It was found that 20 minutes of music application during cystoscopy had no effect on patient comfort (Durgun & Yaman Aktaş, 2023). There was a significant improvement in the comfort of patients who played Ajam Ashiran maqam of Turkish Classical Music for 30 minutes during colonoscopy (Çelebi, Yılmaz, Şahin, & Baydur, 2020). Music was played for 45 minutes before the upper gastroscopy procedure, positively affecting the patient's comfort (Aksu, 2023). When the effect of music therapy on comfort in different patient groups is examined, it can be thought that the duration of listening to music, the type of music and the way of application have an effect on improving comfort. The method of our study is similar to those of these studies, in which music is played with overhead headphones, which effectively improves patient comfort.

This study has limitations. The fact that the nature sound application was only applied for 30 minutes in a single session and repeated measurements were not made constitutes an essential limitation in evaluating the effectiveness of the application. Similar studies in the literature show that music applied at different intervals such as eight weeks, 12 sessions, three days a week (Eroglu & Gok Metin, 2022; Haghi et al., 2019; Seifi et al., 2018). Current study found that listening to nature sounds increased the fatigue and comfort of hemodialysis patients. However, these results cannot be generalized to all hemodialysis patients, and studies with high evidence power are needed.

CONCLUSION

This study revealed that applying nature-based sound improves patients' fatigue and comfort during hemodialysis. According to these results, nurses can apply nature sound, an inexpensive and non-pharmacological method, to enhance the fatigue and comfort of patients during hemodialysis. In future studies, it is recommended to evaluate the effect of nature-based sounds on hemodialysis patients with repeated measurements over a longer period.

Conflict of Interest

The authors have no conflict of interest to declare.

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