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The Effect of Nature-Based Sounds Applied Before Colonoscopy on Patients' Pain, Anxiety, and Embarrassment: A Randomized Controlled Study

Kolonoskopi Öncesi Uygulanan Doğa Temelli Seslerin Hastaların Ağrı, Anksiyete ve Utanma Duygusuna Etkisi: Randomize Kontrollü Bir Çalışma

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ABSTRACT Objective: The study aimed to determine the effect of nature-based sounds before colonoscopy on pain, anxiety, and embarrassment. **Material and Methods:** This randomized-controlled experimental study was conducted with 80 patients in the colonoscopy unit of a university hospital. All patients underwent standard care and intestinal preparation before the colonoscopy. The patients were randomized into 2 groups. The randomization of the study was carried out through the closed envelope method. In addition to routine maintenance before the colonoscopy, 20-minute nature-based sound was applied to the intervention group (n=40). And the control group (n=40) did not receive any intervention other than routine nursing care. The nature-based sounds, which are used in practice and prepared in line with the literature by taking expert opinion in preparation, consist of 4 different sounds. The data were collected using the Descriptive Information Form, Visual Analog Scale, Spielberger State Anxiety Inventory, Colonoscopy Embarrassment Scale, and Physiological Parameters Assessment Form. **Results:** In the in-group and between-group evaluations, the reduction in anxiety, embarrassment and pain severity was statistically significant in the group that listened to nature-based sound (p=0.001). There were statistically significant differences in favor of the nature-based sound group in the between-group and in-group evaluations of physiological parameters (p<0.05). **Conclusion:** This research provides results supporting the use of nature-based sounds before colonoscopy. It is recommended that nature-based sound be included in nursing activities intended for patients undergoing colonoscopy and studies be continued in this field to increase the evidence level of the present study's results.

ÖZET Amaç: Kolonoskopi öncesi uygulanan doğa temelli seslerin ağrı, anksiyete ve utanma duygusu üzerine etkisini belirlemektir. **Gereç ve Yöntemler:** Bu randomize kontrollü deneysel çalışma, bir üniversite hastanesinin kolonoskopi ünitesinde 80 hasta ile yürütüldü. Tüm hastalara kolonoskopi öncesi standart bakım ve bağırsak hazırlığı yapıldı. Hastalar randomize olarak 2 gruba ayrıldı. Çalışmanın randomizasyonu kapalı zarf yöntemi ile gerçekleştirildi. Rutin bakıma ek olarak, müdahale grubuna (n=40) kolonoskopi öncesi 20 dk'lık doğa temelli sesler uygulandı. Kontrol grubuna (n=40) ise rutin hemşirelik bakımı dışında herhangi bir müdahale yapılmadı. Uygulamada kullanılan ve hazırlanmasında uzman görüşü alınarak literatüre uygun olarak hazırlanan doğa kaynaklı sesler 4 farklı sestten oluşmaktadır. Veriler Tanımlayıcı Bilgi Formu, Görsel Analog Ölçeği, Spielberger Durumluk Anksiyete Envanteri, Kolonoskopi Utanç Ölçeği ve Fizyolojik Parametreler Değerlendirme Formu kullanılarak toplandı. **Bulgular:** Grup içi ve gruplar arası değerlendirmelerde, doğa temelli ses dinletilen grupta anksiyete, utanma ve ağrı şiddetinde azalma istatistiksel olarak anlamlıydı (p=0,001). Fizyolojik parametrelerin gruplar arası ve grup içi değerlendirmelerinde, doğa temelli ses grubu lehine istatistiksel olarak anlamlı farklılıklar vardı (p<0,05). **Sonuç:** Bu araştırma, doğa temelli seslerin kolonoskopi işlemi öncesi kullanımını destekleyen sonuçlar sunmaktadır. Kolonoskopi yapılan hastalara yönelik hemşirelik etkinliklerinde doğa temelli seslere yer verilmesi ve bu çalışmanın sonuçlarının kanıt düzeyinin artırılması için bu alanda çalışmaların sürdürülmesi önerilmektedir.

Keywords: Nature-based sound; anxiety; pain; embarrassment; nursing; colonoscopy

Anahtar Kelimeler: Doğa temelli ses; anksiyete; ağrı; utanma; hemşirelik; kolonoskopi

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Colonoscopy is an endoscopic examination method used in the diagnosis, treatment, and follow-up of colon diseases and in patients who need colorectal cancer screening.^{1,2} Colonoscopy is considered the gold standard for detecting and removing polyps and adenomas in the colorectum. However, colonoscopy is regarded to be a rather invasive procedure. And patients often view it as uncomfortable and painful.^{3,4} It can lead to embarrassment, fear, anxiety, and pain due to physical and emotional discomfort in patients before and during the procedure.^{5,6} Embarrassment can cause physiological changes in an individual, such as increased blood pressure, accelerated heartbeat, palpitations, muscle tension, sweating, and increased respiratory rate due to the activation of the autonomic nervous system. Therefore, stress and avoidance may occur regarding the colonoscopy procedure due to embarrassment.^{3,7} In fact, a positive relationship is reported between the embarrassment or pain during colonoscopy and the reluctance to participate in colorectal cancer screening.⁸ In addition, a high level of anxiety toward the colonoscopy can make the procedure more difficult and painful, increase the need for sedative and analgesic drugs, and lead to inadequate examination and low patient satisfaction.⁹ Therefore, nurses should manage the patients' feelings that reduce their satisfaction with the colonoscopy to improve the procedure's acceptability, reliability, and applicability.^{10,11}

Today, sedated colonoscopy is used to increase patient satisfaction and procedure success as well as to reduce anxiety and pain.^{9,10} However, the procedure has potential cardiopulmonary complication risks due to excessive sedation, such as hypoxemia, hypoventilation, aspiration pneumonia, pulmonary embolism, and myocardial infarction. In addition, an anesthesiologist is needed to administer sedation drugs during the colonoscopy procedure.¹ And all such situations increase the cost of the procedure and negatively affect the patient's level of tolerating the procedure.¹²

Since colonoscopy is a beneficial procedure in diagnosis and treatment, cost-effective and non-invasive nonpharmacological methods are recommended to ensure patient satisfaction and alleviate the negative emotions experienced by patients.^{1,3,10,11}

These methods include applications such as aromatherapy, hypnosis, acupuncture, and music listening.^{3,13}

Music listening is a simple, effective, inexpensive, and safe nonpharmacological method used to manage pain and anxiety both in surgical and medical treatments.^{1,9,10} Music functions as a distractor and engages the mind with something pleasant; it can distract one's attention from a negative experience, replacing it with positive thoughts.^{3,4} Music intervention is known to reduce the anxiety level, pain severity, and physiological response of the body to stress by providing relaxation.^{9,14,15} Some authors have recommended the use of instrumental, nature-based music in music interventions to enable patients to focus on the music pieces rather than the meaning of their lyrics.¹⁶⁻¹⁹ For this purpose, sounds with natural origins have been used to reduce or control anxiety and pain in treating certain diseases since 1984.¹⁶

Ever since human beings existed, they have had experiences with the sounds of nature at every stage of life. It is stated that these sounds have a positive and therapeutic effect on the human organism, accelerating healing. Sounds from nature cause physiological and psychological reactions in the human body, just like music.¹⁸ They cause a general relaxation by affecting the autonomic nervous system and create anxiolytic effect by speeding up and slowing down some brain waves.¹⁷ They also reduce anxiety by increasing the pressure on neurotransmitters in the brain. Thus, while accelerating the recovery, it can cause relaxation and comfort in patients.¹⁸

When the literature was reviewed, various studies investigating the effect of listening to music on colonoscopy-related pain and anxiety were found.^{1,5,9,10,15,20,21} However, there are also studies investigating the effectiveness of the nature-based sounds in the fields such as bronchoscopy, gynecological examination, angiography, cardiac surgical intensive care and heart failure.^{16-19,22,23} Nevertheless, although there are studies reporting that the embarrassment experienced by patients prevents the control of colonoscopy-related anxiety and pain and adversely affects the patient comfort, no specific research has been found evaluating the effect of nature-

based sounds on embarrassment.^{2,7} The effect of nature-based sound is reported to be not specific to a particular geography, to be able to appeal to all cultures, and to create positive emotional effects in patients by reflecting the well-being of the natural environment.¹⁶ However, no peculiar studies have been found showing its effect on colonoscopy-related anxiety, pain, and embarrassment. Therefore, the present study is considered original.

The study aimed to determine the effect of nature-based sounds applied before colonoscopy on pain, anxiety, and embarrassment.

MATERIAL AND METHODS

STUDY DESIGN AND SETTING

This randomized-controlled research was conducted in the endoscopy unit of a university hospital. Before the study, ethical approval from the Atatürk University Faculty of Medicine Clinical Research Ethics Committee (date: October 10, 2020, decision no: B.30.2.ATA.0.01.00/404) as well as written and verbal permission from all patients participating in the study were received. In the study, the Helsinki Declaration was adhered to.

PARTICIPANTS

Before starting the study, the sample size was calculated using the G*Power (Version 3.1.9.4) (Heinrich Heine Üniversitesi Düsseldorf, Almanya) software. In the analysis performed based on an effect size of 0.888 calculated in a reference study, the sample size was determined as 56 individuals in total (intervention: 28, control group: 28) with a confidence interval of 90% ($\beta=0.10$) and an error margin of 5% ($\alpha=0.05$).²⁴ Between November 12, 2020 and January 5, 2021, during which the study was carried out, 116 patients were reached. The study was completed with 80 (intervention group: 40, control group: 40) patients. The randomization of the study was carried out through the closed envelope method. Envelopes with “intervention group” or “control group” written in them were prepared by a researcher who was not involved in the study. The envelopes were the same as each other. They were numbered consecutively. After each patient was evaluated according to the criteria for admission to the study, a person not involved in the study opened an envelope for those meeting the criteria. A total of 80 patients were assigned to the intervention and control groups according to the envelopes drawn randomly (Figure 1).²⁵ As the re-

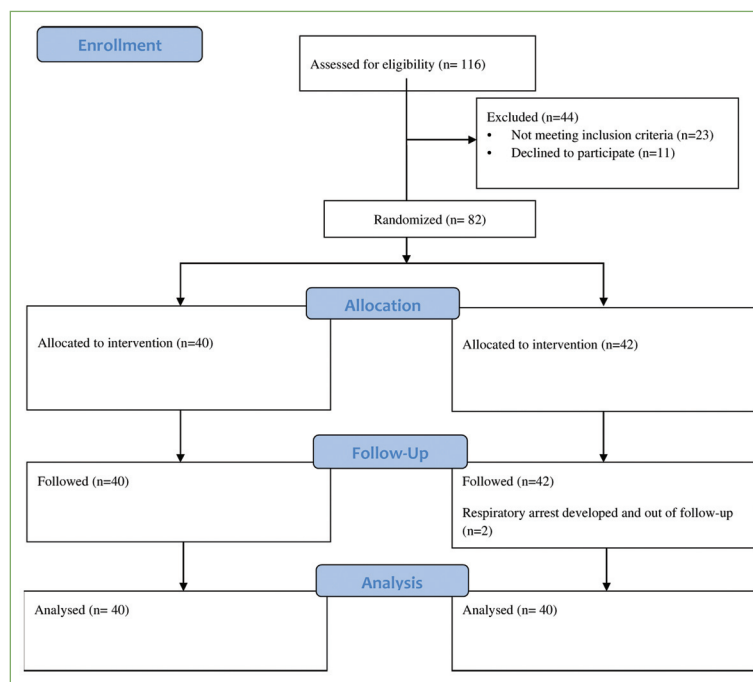


FIGURE 1: CONSORT flow diagram for study participants.

researcher was required to conduct the research herself, she applied the nature-based sound and measurement tools alone. No participant, research, and application blinding were carried out. After the data collection was completed, the patient data in the intervention and control groups were coded as groups 1 and 2 in the SPSS 23.0 (SPSS Inc, Chicago, Illinois) program. No information was given to the statistics consultant to ensure outcome assessment blinding.

INCLUSION AND EXCLUSION CRITERIA

The study's inclusion criteria were being over 18 years of age, being able to communicate verbally, having a colonoscopy for the first time, being conscious, having no complications during and after the procedure, and having no neurological and psychiatric diagnoses. The patients with abnormal changes in their vital signs during and after the procedure to the extent that they required medical intervention were excluded from the study.

INSTRUMENTS AND MEASUREMENTS

The nature-based sounds used in the application was prepared according to the literature by receiving an expert opinion (2 experts interested in music therapy, 2 experts with a doctorate degree with previous studies on listening to music, 1 expert working on nature-based sounds). It consisted of four different sounds, including bird, waterfall, forest, and drizzle sounds.¹⁶⁻¹⁸ In addition, in the specified order, nature-based sounds were applied to all patients in the same order and for the same duration. The researcher combined those sounds using a computer program to create a nature-based sounds that will last 20 minutes (5 minutes of each nature-based sound). Nature-based sounds are combined with soft and rhythmic piano accompaniment. Preliminary application was made on 16 patients who were not included in the study and who were going to undergo colonoscopy procedure before the study. The nature-based sounds were then uploaded to the researcher's phone in a computer environment.

A data collection form containing 10 questions to identify the sociodemographic characteristics of the patients was used to collect the study data.

The Status Anxiety Inventory Questionnaire, developed by Spielberg et al. and adapted to Turkish

society by Öner and Le Compte, was used to determine the anxiety levels of the patients.^{26,27} The State Anxiety Inventory Questionnaire is a 4-point Likert scale designed to assess the anxiety levels of the patients with 20 questions. For each item, participants are required to tick one of the following options determining the intensity of behaviors and emotions: "Not at all", "Somewhat", "Moderately", and "Very much." The total score obtained from the scale ranges from 20-80. High scores indicate high levels of anxiety, and low scores indicate low levels of anxiety.

The Visual Analog Scale (VAS), which was developed by Cline et al. and whose Turkish validity and reliability studies were carried out, was used to assess the patients' pain severity related to the colonoscopy procedure.^{28,29} The scale consists of a 10 cm long horizontal line. The value of each item ranges from zero to 10 and is determined by measuring the distance between the leftmost end of the scale and the marked point. Higher values indicate increased severity of pain.

The scale used to assess the patients' colonoscopy-related embarrassment, which was developed by Mitchell et al. and whose Turkish validity and reliability studies were conducted by Köroğlu, examines the patients' reasons for getting embarrassed with 15 questions.^{30,31} For the statements in each item, the participants tick the response most appropriate to their thoughts on a scale ranging from 1-4 (I don't agree at all=1, I don't agree=2, I agree=3, I totally agree=4). The lowest total score that can be obtained from the scale is 15, and the highest is 60. A higher score indicates a higher level of embarrassment. The physiological parameters form was used to assess the physiological reflection of the feelings experienced by patients undergoing colonoscopy (systolic/diastolic blood pressure, pulse rate, respiratory rate, and peripheral oxygen saturation).

PROCEDURE

All patients underwent standard care and intestinal preparation before the colonoscopy. This preparation consisted of a diet starting 3 days before the colonoscopy and a liquid diet with an intestinal cleansing agent (monobasic/dibasic sodium phos-

phate and sennoside A+B calcium) in the evening before the procedure. On the morning of colonoscopy, all patients were taken to the colonoscopy unit to obtain their written consent for the procedure and make the necessary preparations for conscious sedation. The intervention and data collection were carried out by the same researcher. The face-to-face interview method was used to collect the data. In order to collect data, the researcher was present in the colonoscopy unit between 08:00 and 15:00 in general, in a way to coincide with 1 hour before each patient's entry into the colonoscopy procedure. First, the researcher introduced herself to the patients who met the study's inclusion criteria about an hour before the procedure. Then, she invited patients to participate in the study without providing detailed information about the study. To determine the group of each patient who volunteered to participate, a person who was not involved in the study randomly drew an envelope. Intervention and control group patients were informed about the study in detail, and their verbal and written consent was received. The Descriptive Characteristics Form, State Anxiety Inventory, VAS, and Colonoscopy Embarrassment Scale were applied to the patients in both groups. The basal values determined by evaluating the physiological parameters of the patients were recorded.

Approximately 30 minutes before the colonoscopy procedure, patients in both groups were taken to a separate room containing a stretcher for them to recline on. In the intervention group, after the patient lay on the stretcher, the researcher opened the nature-based sounds on the android phone and placed the phone at the patient's bedside. Patients were asked to close their eyes, rest and follow the sound flow while listening to the nature-based sounds. In contrast, the patients in the control group were ensured to recline on a stretcher and rest for 20 minutes. The State Anxiety Inventory, VAS, Colonoscopy Embarrassment Scale, and Physiological Parameters Form were applied to the patients just before entering the colonoscopy procedure. Then the patients were transferred to the procedure room. And they were administered a minimal standard sedative dose (Propofol) and an anticholinergic (hyoscine-N-butylbromide) drug. All examination were performed by a

specialist gastroenterologist using a colonoscope with similar characteristics. The physiological parameters of the patients were evaluated right after the procedure finished. After the patient rested for 30 minutes, the State Anxiety Inventory, VAS, and Physiological Parameters Form were applied, and the answers were recorded.

Approximately 140 minutes were allocated to the data collection process, which comprised the procedures of applying nature-based sound/waiting for 20 minutes and applying measurement tools before and after colonoscopy.

DATA ANALYSIS

The data were transferred to the SPSS 23.0 (SPSS Inc, Chicago, Illinois) software. While assessing the descriptive characteristics data, frequency distribution (number, percentage) was given for categorical variables and descriptive statistics (mean, standard deviation) for numerical variables. While comparing the descriptive characteristics of the groups, qualitative data were assessed through a chi-square test and quantitative data in independent groups were evaluated through a t-test. In intergroup comparisons of mean scale scores, the t-test was used in independent groups. In addition, paired t-test was used to examine the difference between 2 intragroup measurements, and the Repeated Measures ANOVA test was used to assess the difference between more than 2 measurements. The statistical significance value was accepted to be $p < 0.05$.

RESULTS

SAMPLE DEMOGRAPHICS

No significant difference was found between the 2 groups with respect to their gender, educational and marital status, occupation, income, age, body mass index, and having non-formal information about colonoscopy ($p > 0.05$) (Table 1).

COMPARISON OF ANXIETY, PAIN, AND EMBARRASSMENT

Intergroup and intragroup comparisons of anxiety, pain, and embarrassment were carried out (Table 2). The anxiety level of the intervention group, which

TABLE 1: Sample characteristic.

Variables		Groups				p value
		Intervention (n=40)		Control (n=40)		
		n	%	n	%	
Gender	Female	20	50.0	19	47.5	p=0.823
	Male	20	50.0	21	52.5	
Marital status	Single	7	17.5	5	12.5	p=0.531
	Married	33	82.5	35	87.5	
Educational status	Literate	2	5.0	8	20.0	p=0.222
	Primary school graduate	20	50.0	18	45.0	
	Secondary school graduate	3	7.5	5	12.5	
	High school graduate	5	12.5	3	7.50	
	Bachelor's degree	10	25.0	6	15.0	
Occupation	Housewife	16	40.0	15	37.5	p=0.253
	Worker	1	2.5	3	7.5	
	Officer	5	12.5	4	10.0	
	Farmer	4	10.0	10	25.0	
	Retired	14	35.0	8	20.0	
Presence of chronic diseases	None	18	45.0	20	50.0	p=0.654
	Present	22	55.0	20	50.0	
Income status	Low	1	2.5	5	12.5	p=0.177
	Moderate	27	67.5	27	67.5	
	Good	12	30.0	8	20.0	
Previous surgery history	None	14	35.0	16	40.0	p=0.644
	Present	26	65.0	24	60.0	
Having non-formal information about colonoscopy	None	27	67.5	27	67.5	p=1.000
	Present	13	32.5	13	32.5	
		$\bar{X}\pm SD$		$\bar{X}\pm SD$		
Age		46.28±13.70		45.60±14.99		p=0.834
Body mass index (kg/square meter)		27.23±4.15		27.17±5.49		p=0.951

p: Chi-square test; t-test; NS: Non significant; SD: Standard deviation.

TABLE 2: Intergroup and intragroup comparison of anxiety, pain, and embarrassment.

	Anxiety			Pain			Embarrassment		
	Intervention ($\bar{X}\pm SD$)	Control ($\bar{X}\pm SD$)	P ^a	Intervention ($\bar{X}\pm SD$)	Control ($\bar{X}\pm SD$)	P ^a	Intervention ($\bar{X}\pm SD$)	Control ($\bar{X}\pm SD$)	P ^a
T ₀	43.75±10.62	38.95±8.95	***p=0.032	1.13±1.70	0.68±1.29	NS=0.186	36.35±10.10	37.83±11.75	NS=0.549
T ₁	38.93±8.96	40.53±9.35	NS=0.437	0.50±1.06	1.03±1.48	NS=0.072	33.18±9.41	38.50±11.37	***p=0.025
T ₃	34.68±8.83	35.53±7.20	NS=0.638	2.23±2.11	3.38±2.62	***p=0.033			
P ^c	**p=0.000	*p=0.010		**p=0.000	**p=0.000	P ^b	**p=0.000	NS=0.249	

a: Student's t-test; b: Paired t-test; c: Repeated measurements ANOVA tests; *p<0.01; **p≤0.001; ***p<0.05; SD: Standard deviation; NS: Non significant.

was initially (T₀= Baseline) higher than the control group, decreased at the immediately before colonoscopy (T₁) and minutes after completion of colonoscopy (T₃) measurements. In contrast, the anxiety level of the control group increased at the T₁ measurement. On the other hand, at the T₃ measure-

ment of the control group, the anxiety level of the patients was higher than the intervention group, and the intragroup differences were significant at levels of p<0.01, p≤0.001. There was no significant difference between the groups in terms of pain level at T₀ and T₁ measurements (p>0.05). However, at the T₁ mea-

TABLE 3: Intergroup and intragroup comparison of physiological parameters (intervention n=40; control n=40).

	SBP		DBP		Heart rate		Respiratory rate	
	Intervention (X±SD)	Control (X±SD)	Intervention (X±SD)	Control (X±SD)	Intervention (X±SD)	Control (X±SD)	Intervention (X±SD)	Control (X±SD)
T ₀	133.83±19.30	125.93±17.05	81.85±10.06	76.90±11.06	94.03±17.59	90.08±16.15	15.23±3.77	16.40±2.54
T ₁	129.18±16.53	130.10±17.43	78.45±8.82	80.70±11.42	87.83±14.75	89.20±15.41	17.25±2.72	17.58±1.50
T ₂	116.03±13.65	110.00±17.02	74.35±9.85	71.50±13.68	94.03±16.57	90.13±14.38	16.43±3.07	17.90±1.81
T ₃	123.40±12.27	119.05±12.68	78.18±9.39	76.58±9.01	91.93±13.40	87.13±12.10	16.40±3.36	17.58±1.34
P ^b	**p=0.000	**p=0.000	**p=0.003	*p=0.001	**p=0.000	NS=0.050	**p=0.000	**p=0.003
P ⁱ								
T ₀		NS=0.056		***p=0.040		NS=0.299		NS=0.107
T ₁		NS=0.808		NS=0.327		NS=0.685		NS=0.511
T ₂		NS=0.085		NS=0.288		NS=0.264		***p=0.011
T ₃		NS=0.123		NS=0.439		NS=0.097		***p=0.045

a: Student's t-test; b: Repeated measurements ANOVA tests; SBP: Systolic blood pressure (mmHg); DBP: Diastolic blood pressure (mmHg); SD: Standard deviation; *p<0.01; **p<0.001; ***p<0.005; NS: Non significant.

surement, while the pain level of the intervention group decreased, the pain level of the control group increased. The pain level of the intervention group was lower than the control group at the T₃ measurement, and the difference between the groups was significant at the level of p<0.05. The difference between the measurements of both groups showed a statistical significance at the level of p≤0.001. While embarrassment levels did not show any significant difference between the groups at the T₀, the embarrassment level of the intervention group showed a significant intergroup and intragroup difference in decreasing direction at the T₁ measurement (p<0.05).

COMPARISON OF PHYSIOLOGICAL PARAMETERS

Intergroup and intragroup comparisons of the physiological parameters of the patients undergoing colonoscopy were carried out (Table 3). The systolic blood pressure value of the intervention group, which was T₀ higher than the control group, decreased at the T₁ and immediately after colonoscopy (T₂) measurements. In contrast, the anxiety level of the control group increased at the T₁ measurement. On the other hand, at the T₂ measurement of the control group, the systolic blood pressure value was higher than the intervention group, and the intragroup differences were significant at the level of p<0.001. The diastolic blood pressure value at the T₀ measurement was higher in the intervention group than in the control group, and the intergroup difference was significant (p<0.05). However, at the T₁ measurement, while the intervention group's diastolic blood pressure value decreased, the control group's diastolic blood pressure value increased. In both groups, the diastolic blood pressure value was lower at the T₂ measurement, and the intragroup differences were significant at p<0.01 and p≤0.001 levels. No significant differences were found in the intergroup pulse rate comparison at all measurements (p>0.05). The intervention group pulse rate was determined to show a significant intragroup difference in the decreasing direction at the measurements of T₁ and T₃ (p≤0.001). In the intergroup comparison, the respiratory rate was determined to be lower in the intervention group at the T₂ and T₃ measurements, and the difference between the groups was found to be significant (p<0.05). In the intragroup assessment, the respiratory rate, which increased at the T₁ measurement in both groups, changed in the decreasing direction at the T₂ and T₃ measurements in the intervention group and in the increasing direction at the T₂ measurement in the control group. In the intragroup comparison, respiratory rates were found to show significant differences at levels of p<0.01 and p≤0.001 between measurements.

DISCUSSION

Study findings have shown that the nature-based sounds applied before colonoscopy reduces anxiety and embarrassment as well as pain severity, positively affecting the physiological parameters.

One of the critical findings of this study was that the pain and anxiety levels, which were initially higher in the intervention group than in the control group, decreased at the T₁ and T₃ measurements in the intervention group and increased at the T₁ measurement in the control group. Another important finding was that the pain and anxiety levels of the control group patients were high at the T₃ measurement compared to the intervention group. This finding supports the previous study findings showing that music therapy/music listening before the colonoscopy procedure is effective on anxiety and pain.^{9,10,15,32} On the other hand, similar findings in other published studies conducted with different patient groups confirm that such interventions reduce anxiety and pain severity in patients.^{16-19,22} Akarsu et al. had patients listen to nature-based sounds for 30 minutes before percutaneous coronary intervention and found that the pain and anxiety scores of the intervention group were significantly lower than the control group both immediately after the procedure and 30 minutes after the procedure.¹⁷ Diette et al. provided strong evidence to the literature that watching a colorful meadow mural while listening to the sound of a babbling stream during and after bronchoscopy significantly reduced reporting of pain in patients.²² In relation to the literature, these results show that nature-based sounds listened to before colonoscopy can be effective on patient anxiety and pain as a nonpharmacological method that starts before the procedure and continues afterward.

The second important finding of this study was that the embarrassment of the intervention group patients was lower than the control group patients at the T₁ measurement and showed a significant intergroup and intergroup difference in the decreasing direction compared to the initial measurement ($p < 0.05$). Many studies in the literature indicate that interferences with the patients' privacy can cause embarrassment and in turn anxiety.^{5,6} Aktas et al. revealed that 50% of women got embarrassed during a gynecological examination and nature-based sounds could reduce anxiety along with this feeling.¹⁸ The literature and the present study's findings suggest that nature-based sounds can be included in evidence-based nursing initiatives for the management of colonoscopy-related embarrassment.

Physiological parameters indicate the objective reflections of feelings subjectively evaluated by the patients. In this context, another important finding of this study is the amount of change in the physiological parameters in consecutive measurements. For instance, the intervention group patients' systolic/diastolic blood pressure, pulse, and respiratory rate changed in the decreasing direction. In the control group, however, this change was in the increasing direction, especially just before the colonoscopy procedure. A limited number of experimental studies in the literature, conducted in fields other than colonoscopy, have reported a recovery in the physiological parameters of the patients after receiving nature-based sounds.^{16,33} Aghaie et al. report that nature-based sound is an effective method to reduce the potential negative hemodynamic responses caused by anxiety and agitation during separation from mechanical ventilation in coronary artery bypass graft patients.²³ Like those of the other studies in the literature, the present study's findings are essential in terms of showing that nature-based sounds can be one of the applicable methods with a positive emotional and physiological effect in ensuring comfort in colonoscopy patients.

STRENGTHS AND LIMITATIONS

The strength of this study is that it is the first study to evaluate the effect of nature-based sounds on anxiety, pain, and embarrassment in patients undergoing colonoscopy. Moreover, evaluating the effect of the nature-based sounds on embarrassment using the embarrassment scale specific to the colonoscopy increases the study's strength. However, there are some limitations that must be taken into account while interpreting the study findings. The study sample was made up of Turkish patients who applied to the endoscopy unit of a university hospital in the eastern region of Türkiye to have a colonoscopy procedure for various reasons. Although this study reveals that nature-based sounds reduce anxiety, pain, and embarrassment, these findings cannot be generalized to all patients undergoing colonoscopy. Another limitation of the study was that the participants and researchers could not be blinded to the study because the same researcher both applied the nature-based sounds and

collected data through face-to-face interviews with patients without the help of a second researcher. In addition, the concepts of embarrassment, anxiety, and pain are subjective. Although the objective physiological reflections of these feelings were also tried to be reflected in the study, there might be different psychospiritual parameters affecting patients' feelings.

CONCLUSION

Study results have shown that the nature-based sound applied before colonoscopy reduces anxiety and embarrassment as well as pain severity in patients, positively affecting their vital signs. It is recommended that nature-based sound be included in nursing activities intended for patients undergoing colonoscopy and studies be continued in this field to increase the evidence level of the present study's results.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that pro-

vides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Gülden Küçükakça Çelik, Dürdane Plabıyık Yılmaz, Nadiye Özer, Semra Erdağı Oral; **Design:** Gülden Küçükakça Çelik, Dürdane Plabıyık Yılmaz, Nadiye Özer, Semra Erdağı Oral; **Control/Supervision:** Nadiye Özer, Gülden Küçükakça Çelik, Dürdane Plabıyık Yılmaz; **Data Collection and/or Processing:** Gülden Küçükakça Çelik, Dürdane Plabıyık Yılmaz, Nadiye Özer; **Analysis and/or Interpretation:** Gülden Küçükakça Çelik, Nadiye Özer, Semra Erdağı Oral; **Literature Review:** Gülden Küçükakça Çelik, Dürdane Plabıyık Yılmaz, Semra Erdağı Oral; **Writing the Article:** Gülden Küçükakça Çelik, Dürdane Plabıyık Yılmaz, Nadiye Özer, Semra Erdağı Oral; **Critical Review:** Gülden Küçükakça Çelik, Nadiye Özer; **References and Fundings:** Dürdane Plabıyık Yılmaz; **Materials:** Dürdane Plabıyık Yılmaz.

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